Revised Roadmap for the UN Decade of Ocean Science for Sustainable Development

Updated Version 2.0
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Roadmap for the UN Decade of Ocean Science for Sustainable Development

1 Introduction

1.1 Background

At the seventy-second session of the United Nations General Assembly (UNGA), within Part XI of the Omnibus Resolution for Oceans and the law of the sea (RES 72/73) relating to "Marine science", the UNGA decided (paragraph 292) to proclaim

> *the United Nations Decade of Ocean Science for Sustainable Development for the 10-year period beginning on 1 January 2021, within existing structures and available resources, and called upon the Intergovernmental Oceanographic Commission to prepare an implementation plan for the Decade in consultation with Member States, specialized agencies, funds, programmes and bodies of the United Nations, as well as other intergovernmental organizations, non-governmental organizations and relevant stakeholders.*

Further, the UNGA:

293. Requested that the Intergovernmental Oceanographic Commission provide information on the development of the implementation plan and regularly consult with, and report to, Member States on the United Nations Decade of Ocean Science and its implementation;

294. Invited the Secretary-General to inform the General Assembly about the implementation of the United Nations Decade of Ocean Science through his report on oceans and the law of the sea, on the basis of information to be provided by the Intergovernmental Oceanographic Commission;

295. Invited UN-Oceans and its participants to collaborate with the Intergovernmental Oceanographic Commission on the United Nations Decade of Ocean Science.

The UNGA Decision was the culmination of two years of preparatory work by the Intergovernmental Oceanographic Commission of UNESCO (IOC), during which Member States and many other interested parties were consulted on the concept and potential value of a Decade of Ocean Science. A proposal was drafted for consideration by IOC Member States (IOC/INF-1341, 2 February 2017) and a revised version (IOC/INF-1341 REV) was presented to the twenty-ninth session the Assembly of the IOC and subsequently endorsed by the IOC Assembly (IOC Resolution XXIX-1). In addition, recognising the cross-cutting role of ocean science in Sustainable Development Goal 14 of the 2030 Agenda, the

Decade[1] proposal was registered by IOC as a voluntary commitment to the UN Conference to Support the Implementation of Sustainable Development Goal 14, 5–9 June 2017, New York.

The endorsement by the UN General Assembly of the Decade of Ocean Science implies an acknowledgement by the global community of the importance, need for and role of ocean science, data and information exchange for sustainable development, and that science can play an important role in helping the ocean support the 2030 Agenda. The Decade requires response and delivery from the scientific community as a whole, as well as from the IOC and other UN bodies, working in close contact with governments, industry and business, as well as the civil society.

Annex 1 "Context within the UN System" contains further information on the UN context within which the UN Decade of Ocean Science for Sustainable Development will be developed and implemented.

1.2 The Decade Roadmap

As stated in the UNGA Decision, the Decade will require an Implementation Plan that will be developed during the period 2018-2020. This document, "Roadmap for the UN Decade of Ocean Science for Sustainable Development", provides an initial guide for the steps and processes needed to develop an Implementation Plan for the Decade. The Roadmap will serve as a guiding framework to the Executive Planning Group described in section 3.1.1. The single aim of this document is the Implementation Plan. The Roadmap contains the tentative Decade strategy and an outline of what is required to achieve a draft Implementation Plan by the first quarter of 2020. Consistent with the discussions and consultation prior to the UNGA proclamation, it is assumed that the Implementation Plan includes plans for research and technical infrastructure (a Science Plan); plans for engagement and communication; a plan for capacity development, training and education; and a plan for resource mobilisation (a Decade business plan).

The Roadmap recapitulates the goals and objectives of the Decade and the expected outcomes and benefits (section 2 Strategic Approach for the Decade). Section 3 "Preparation Phase" outlines the key milestones and consultations that will be part of the preparation of the Plan. The annexes introduce an outline for the Implementation Plan and the elements that are anticipated to be part of that Plan.

The term "Sustainable Development" in the title of the Decade provides the overarching context: sustainable development of the ocean, seas and coasts. Wherever "ocean" appears alone in this Roadmap, it should be read as ocean, seas, and coasts. Similarly, when referring to the term 'sustainable development agenda', it will usually imply reference not only to the policy setting as framed within the 2030 Agenda (in particular Sustainable Development Goal 14 and other Goals where the ocean may play a role), but also the Sendai Framework on Disaster Risk Reduction, the SAMOA Pathway for Small Island Developing States, the UNFCCC Paris Agreement, and other provisions and instruments under the United Nations Convention on the Law of the Sea relevant to ocean sustainability.

[1] Hereafter, "the Decade" is used as shorthand for the UN Decade of Ocean Science for Sustainable Development

Ocean Science should be interpreted broadly in this Roadmap and includes social sciences and human dimensions; the infrastructure that supports ocean science (observations, data systems); the application of those sciences for societal benefit, including transfer and applications in regions that are lacking science capacity; and the science-policy/user interface. The integration of traditional knowledge in ocean research will also be promoted in the context of the Decade.

This Roadmap does not contain references to the documents that informed the proposal for the Decade. The 1st version of the Roadmap (Version 1.0, 6/02/2018) was reviewed by IOC Member States, UN-Oceans Members and benefited from inputs by the informal planning group established by the IOC Chair. These collective inputs are reflected as far as possible in the present version. A summary of inputs received form Member States and UN partners is presented in Annex 7.

All background documents are available at : https://en.unesco.org/ocean-decade.

1.3 Why a Decade of Ocean Science?

The main motivation for the proposed UN Decade of Ocean Sciences for Sustainable Development is to support efforts to reverse the cycle of decline in ocean health and create improved conditions for sustainable development of the ocean, seas and coasts.

The marine realm is the largest component of the Earth's system that stabilizes climate and supports life on Earth and human well-being. However, the First World Ocean Assessment released in 2016 notes the cycle of decline in the ocean health, with changes and losses in the structure, function and benefits obtained from marine systems. Productive habitats from coastlines (mangroves), coastal shallows (corals and seagrass), open ocean and deep seas (ocean benthos) are being lost, eroded, or undermined as a result of extractive and non-extractive activities at local and global scales. In addition, the impact of multiple stressors on the ocean is projected to increase as the human population grows towards an expected 9 billion by 2050. Action needs to be taken.

The Decade is needed to enable Member States and stakeholders to formulate and implement adaptation strategies and policies.

Over the coming decades, a changing climate, growing global population, rising food prices, and environmental stressors will have significant yet highly uncertain impacts on food security and human welfare. Adaptation strategies and science-informed policy responses to global change are urgently needed.

The Decade is needed to encourage the science community, the public, and the policy makers to think beyond business as usual and aspire for real change, whether that be in the level of knowledge of the ocean that is currently produced, or in the way we manage cooperation and partnerships in support of sustainable development and healthy ocean.

The Agenda 2030 adopted by all nations offers a concerted framework of action to set the ocean on a path to sustainability whilst also highlighting the universal dimension of the ocean in promoting other societal goals, such as gender, equity, sustainable economic development, food security or climate change, amongst a few. These critically important goals are very science intensive by nature, and to deliver the science required, a new transformative approach is needed. Underpinning these global goals, scientific

understanding of the ocean response to pressures and management action is fundamental for sustainable management. Ocean observations and research are also essential to predict the consequences of change, design mitigation and guide adaptation to cope with the many ways the ocean affects human lives and infrastructure at different spatial and temporal scales.

TO ENABLE ACTION AT ALL LEVELS

Whilst the knowledge we need is available for guiding the first steps to be taken in terms of removing, adapting to or mitigating recognised impacts, the Decade would establish still missing or strengthen existing but weak links of science to marine applications of direct societal benefit, such as adaptation to climate change or marine spatial planning. It could also provide the scientific basis for further defining the concept of sustainability in the context of the marine environment, through enhanced and focussed research bringing social and natural science together, and improved communication.

The Decade intends to bring out an increased understanding of the need to take urgent actions to maintain a life-supporting ocean and ensure adequate protection and adaptive management of the marine environment. This enhanced understanding, based on effective communication of scientific knowledge, is a prerequisite for generating commitments among governments and other stakeholders, and for creating a new level of awareness in the public about the state and future of the ocean. This understanding may also trigger and guide substantial technological developments and related transfer of marine technology, including modelling tools, new forecasting capabilities, through sustained cooperation, and new partnerships, also stimulating capacity building.

The Decade can catalyze major investments in ocean science, as well as stimulate research agenda at the national level, by aligning science priorities with national commitments towards the sustainable development agenda.

As demonstrated by other initiatives such as the International Polar Year or International Year of the Ocean, which resulted in sustained investment in ocean research in some nations, the Decade may provide a framework for stimulating support for ocean-related activities at local, national and global level, in governments, the public, civil society and scientific communities. The national governments may provide additional resources for research and infrastructure, while local governments could support local awareness creating actions. Aligning national science agenda with the sustainable agenda of nations can also provide another incentive.

The Decade should provide an unifying framework to the UN-wide system for seeking science-based solutions to the 2030 Agenda priority issues.

At the international level, ocean governance responsibilities are distributed across a number of UN bodies and programmes. Most of these are part of UN-Oceans, the inter-agency coordination mechanism on ocean affairs. Within their sectoral mandate, all UN partners have a need for ocean science, data and information, and supporting infrastructure to inform the implementation of their respective programmes. For example, the Decade can provide opportunity to raise awareness and promote development of science-based solutions to improve fisheries management, which will in turn support delivery of the SDG 2030 agenda. Scientific inquiry into the continued development and

growth of aquaculture is another key area, as well as defining the ocean carrying capacity so specific economic activities.

The Decade is also needed to raise awareness on the truly global dimension of the ocean, demonstrating that its well-being affects people globally and locally, at sea, on the coast, and inland. In its design, activities and communication, the Decade should articulate those inter-relationships and linkages through the production of relevant knowledge that emphasize the fundamental contribution of the ocean to global sustainability from a social, environmental and economic perspective. It should also demonstrate to nations how ocean science can provide support to their ocean management issues and bring economic benefits.

Patterns of consumption and production drive the generation of waste and pollutants that reach the ocean and impact ecosystems, species and ultimately people. The ocean drives change and variability in the climate system, influencing rainfall and desertification even far from coasts. Large populations across the globe are vulnerable to hazards associated with the marine environment (e.g. tropical cyclones, tsunamis) or dependent on rainfall patterns driven by the oceans (e.g. the monsoon in the Indian sub-continent). Loss of access to and/or shortage of seafood can trigger nutritional crisis, leading to migration of affected populations within and across continents.

Scientific cooperation can help to reduce critical tensions in the society and the Decade should therefore be instrumental in promoting peaceful use of the ocean and fostering cooperation across nations on ocean matters.

The ocean also influences global and regional stability, as disputes amongst nations related to maritime territories and boundaries have emerged, leading to conflicts, diplomatic crisis and loss of access to marine resources, hence impacting social and economic development.

The ocean business community has a vital role in ensuring the sustainable development of the ocean and coasts and should be engaged proactively in the work of the Decade.

The private sector is primary user of the Ocean, with many businesses such as shipping, offshore oil and gas, fisheries, tourism, seabed mining, ports and renewable energy directly dependent upon marine space and resources. Other sectors are dependent on these direct ocean industries, e.g. shipbuilding, marine technology, seafood producers, and also marine classifications societies, insurers, financiers and lawyers, who provide services that enable ocean economic activity. Given the importance of reliable data and information to support ocean economic operations, the private sector could assist in identifying user needs and help forge new public-private partnerships in ocean research aimed at supporting sustainable approaches. Through subsequent investment in R&D, the private sector is also well placed to develop and implement solutions in response to society's increasing demands that the marine ecosystem use be sustainable, the industry accountable and the impacts be reduced.

Similarly, because of the role of Non-Governmental Organisation (NGOs) in the sustainable management of marine resources whereby these often act as a link between local communities and government bodies, the academic community or industry, these should be engaged in the activities of the Decade. They may also have an important role in pioneering participatory research and development on the topics defined by the Decade and can also be a major conduit for communicating

the objectives of the Decade and promoting the engagement of stakeholders, as well as act as a vehicle to deliver capacity development within their constituency.

The Decade will stimulate action over the next ten years in areas of critical importance for the five Ps of the 2030 Agenda, namely: Planet, People, Prosperity, Peace and Partnership. The Decade programme should offer to network all communities, from local, national, regional to global.

TO ADDRESS KNOWLEDGE GAPS THOUGH INTEGRATED RESEARCH

The Decade should aim to address identified knowledge gaps and strengthen the conduct of the World Ocean Assessment as well as other global and regional assessments, by providing a coordinated framework for formulating research questions, conducting collaborative and integrated research across scientific fields (both natural, economic and social sciences), collecting and disseminating data according to international standards, and building technical capacity. The Decade is also needed to address disparities across ocean basins in terms of existing knowledge and capacities.

When it comes to 71% of our planet, several gaps in our knowledge remains despite great advancements in the last fifty years of ocean research and observations. As stated by the World Ocean Assessment (WOA-I), many areas require further investigation to fully comprehend the role of the ocean in the earth system. Our knowledge of human interaction with the ocean is also very partial in terms of the ways in which we benefit from it. It is not yet possible to place a value on the ecosystem services derived from the ocean. There are many gaps in the information needed for such a valuation exercise. Information on the effects of changes in the ways in which the planetary ecosystem works needs to be collected and evaluated, in order to define sustainable management options.

TO BUILD CAPACITIES TO ACT WORLDWIDE

The Decade will initiate a coordinated framework responding to regionally driven priorities to improve the scientific knowledge base through capacity development for the nations, regions and groups that are presently limited in capacity and capability, especially SIDS and LDCs.

The First World Ocean Assessment also concludes that "*major disparities exist in the capacities around the world to undertake the marine scientific research necessary for proper management of human activities that can affect the marine environment".* These conditions are an impediment to nations as some of them lack the basic infrastructures and knowledge to use the ocean in a sustainable manner. This is not only relevant to the developing nations. The Global Ocean Science Report found that Ocean Science accounts for only between 0,04% and 4% of total research and development expenditures worldwide. New cooperation and partnership to facilitate access to data, equipment and know-how will be key. But the Decade will go beyond scientific capacity development; it will aim to create a new awareness at the policy and civil society level through ocean literacy. Gender balance will also be at the core of the Decade activities. As noted by the Global Ocean Science Report, female scientists represent on average 38% of marine scientists. Therefore, the Decade can be used to promote gender balance across the whole value chain, i.e. from research to the development of products to inform policy.

TO UNLOCK AND SHARE NNOVATION POTENTIALS

Enhanced international and interdisciplinary scientific collaboration paired with technology transfer and an international framework to fill these technological and knowledge gaps are required. Therefore unlocking the innovation potential from the ocean should be an important thrust of the Decade, with a view to support sustainable growth of the ocean economy and linking it with the infrastructure on land.

Nations around the world are increasing investment in ocean observations and research, as reflected in the improving data coverage, growing number of marine scientists, research and education institutions, and significant infrastructure enhancements. Most of developed and some developing countries are rapidly expanding and networking data streams on oceans, climate and human activity, to deliver near real-time and delay-mode data and information on ocean status, enabling weather and climate services, disaster risk reduction, and science-based ecosystem management. Further advances in observation technology, trans-ocean and regional communication systems are notable and can make data visible and accessible to allow decision-makers to optimize extractive and non-extractive activities and minimise risks. However, gaps in human and institutional capacities and lack of resources still prevent many, especially less-developed countries, from taking advantage of what is on offer for enhancing action. In many regions, national ocean research policies as well as scientific advisory mechanisms that could define a pathway to support such development are still missing, while acquisition of sufficient credible scientific data and information still requires major investment.

1.4 IOC's role in the Decade

Since its creation in 1960, the IOC has provided a global intergovernmental forum for promoting international cooperation and coordinating programmes in research, services and capacity-building, to support Member States efforts in the sustainable use of the marine environment. Because of the nature of its work, its contributions to UN frameworks and collaboration with other UN and non-UN partners and its convening capacity to bring together scientists and government representatives, the IOC is a 'natural convener' to coordinate the preparation of the Decade.

The UNGA has entrusted this work to the Commission, positioning de-facto IOC Governing bodies as the prime intergovernmental forum for designing a robust, inclusive and transformative process to deliver the Decade. Through its coordinating role, the IOC will need to engage with Member States of other UN organizations (e.g. UN, FAO, ISA, IMO…), Secretariat of UN bodies and Intergovernmental Organizations, Non-governmental organisations, academic and research networks, industry and businesses, amongst others. In doing so, it will ensure transparency and effectiveness, and will report its progress to IOC Governing bodies as well as to the UNGA.
In addition to the coordination work, the IOC will also contribute substantially to the design of the Implementation Plan through its own programmes in ocean sciences, observation and services, coastal hazards, and capacity development in accordance with its role as the custodian agency for SDG target 14.a related to the advancement of scientific knowledge and the development of research capacity.

2 Strategic Approach for the Decade

2.1 Framing the contribution of the Decade to societal outcomes

Today, there is an unprecedented confluence of human interest on the ocean, manifesting economically, environmentally, and morally. If the societal benefits of the sustainable use of the ocean are to be accrued through achievement of the SDGs targets as well as other frameworks, it is important to define a number of outcomes that the Decade will address over the course of its implementation.

This section of the Roadmap introduces a set of outcomes considered to be highly transformative, because they are expected to trigger environmental, societal, and policy changes. It also provides a non-exhaustive description on how the Decade might contribute to their realization. Reference is also made to relevant international agreements related to the sustainable development agenda.

The main principle is that the Decade will address both deep disciplinary understanding of ocean processes and solution-oriented research to generate new knowledge. This knowledge will support societal actors in reducing pressures on the ocean, preserving and restoring ocean ecosystems and safeguarding ocean-related prosperity for generations to come. The Decade should turn the scientific knowledge and understanding into effective actions supporting improved ocean management, stewardship and sustainable development.

SOCIETAL OUTCOMES

1. A clean ocean whereby sources of pollution are identified, quantified and reduced and pollutants removed from the ocean;

Our rapidly growing, affluent, and more technologically advanced society is increasingly impacting its local and, subsequently, the global environment, leading to pollution by both chemical and physical wastes. Through the Decade, integrated research will be fostered to assess the human and environmental risks of ongoing and future types of ocean pollution, to generate new ideas to reduce the ocean pressures by promoting recycling, improved waste management and related incentives, and by strengthening the governance regimes to encourage more sustainable production and consumption. The most challenging ocean pollutants include: atmospheric carbon dioxide, which is the main cause of the climate change with ocean warming, ocean acidification, and sea-level rise; agricultural fertilizers, which lead to increased primary production but result in ocean deoxygenation; untreated waste water; invasive species; and micro- and macro-plastics.

This outcome is supported by:
SDG 14.1 – Pollution, SDG 3 –Health and wellbeing, SDG 6 – Sanitation, SDG 15 – Land, SDG 11 – Urbanisation, SDG 12 – Consumption, SIDS Samoa Pathways

2. A healthy and resilient ocean whereby marine ecosystems are mapped and protected, multiple impacts, including climate change, are measured and reduced, and provision of ocean ecosystem services is maintained

Marine ecosystem degradation has greatly accelerated during the last five decades due to the multitude of stressors affecting the ocean. To support the conservation and protection of ocean

ecosystems, the Decade will promote inter-disciplinary research aimed at elucidating impacts of cumulative stressors on the ocean, its seas, ecosystems and resources, hence providing more complete information to fill gaps, and specify actions, which can improve the situation and reverse the degradation. Improved appreciation of the economic and societal value of ocean ecosystems will also be key to stimulate the development of marine spatial planning, marine protected areas, and other ecosystem-based management approaches. Supplementing and completing the science base with holistic mapping of the ocean, in all its dimensions, will also be needed for adaptive management approach towards good ocean stewardship. All nations will benefit in a healthy and resilient ocean and by preserving its capacity to deliver food, income, support transportation and many other elements of sustainable development.

This outcome is supported by:
SDG 14.2 – Marine and coastal ecosystems, SDG 1 – Poverty, SDG 13 –Climate Change, SDG 7 – Renewable energy, SDG 16 – Effective institutions, UNFCCC Paris Agreement, SIDS Samoa Pathways

3. A predicted ocean whereby society has the capacity to understand current and future ocean conditions, forecast their change and impact on human wellbeing and livelihoods

The vast volume of the ocean and its complex coastlines are neither adequately observed nor fully understood. In particular, the deep sea is a frontier of ocean sciences. Under the Decade, sustained and systematic ocean observations can be expanded to all ocean basins and depths to document ocean change, initialize ocean system models and provide critical information for improved ocean understanding. Such information is increasingly needed by nations and the ocean business community operating within or beyond national jurisdictions. Improved access to understanding ocean present and future conditions will be a pre-requisite to the development of sustainable ocean economic policies and ecosystem-based management and will lead to more efficient shipping, mitigate storm damage and flooding of coastal cities, sustain healthy fisheries, protect coral reefs and other key marine ecosystems from degradation, and improve climate forecasting, amongst a few. The Decade will also build on advances in ocean robotics and the combination of remote and in situ ocean observations which offer new opportunities and will reduce operational costs; it will also promote free and open data sharing and multi-stakeholder contributions by governments (rich and poor), the private sector and citizens.

This outcome is supported by :
SDG14.a, SDG 8 – Blue economy, SIDS Samoa Pathways, SDG 9 – Technology Innovation

4. A safe ocean whereby human communities are protected from ocean hazards and where the safety of operations at sea and on the coast is ensured

Ocean hazards such as storm surges, tsunamis, harmful algal blooms, or coastline erosion can be devastating for coastal communities. The rush for coastal recreation and economic expansion in the maritime domain has increased access to the sea to a multitude of users, producing newly built infrastructures that are increasingly vulnerable to ocean extreme events. Climate change impacts on the ocean will have profound implications for all human societies and most of our activities. The Decade will promote research aimed at reducing and minimizing impacts of various changes (risk reduction) through adaptation and mitigation, at assessing social and physical vulnerability and help clarify interactions between natural and man-induced changes. It will also support the development of integrated multi-hazard warning systems in all basins hence contributing to enhanced preparedness

and awareness of society with regards to ocean risks. This could trigger the introduction and use of new technologies through private-public partnerships. Community resilience and adaptive capacity, with elevated education and awareness as regards the use of observations and data, will also contribute to reduced impacts and improved efficiency of early warning systems for natural and man-made hazards.

This outcome is supported by:
SDG 13 – Climate Change, SDG 11 –Resilient Coastal cities, SENDAI, UNFCCC Paris Agreement, SIDS Samoa Pathways

5. A sustainably harvested and productive ocean ensuring the provision of food supply and alternative livelihoods

Society now depends on the ocean more than at any time before. It is a vital source of nourishment, supporting directly the livelihood of about 500 million people, especially in the poorest nations, and, indirectly, the global population. Ocean economies are among the most rapidly growing and promising in the world, providing benefits to many sectors of great economic value, such as fisheries, biotechnologies, energy production, tourism and transport, and many others. The Decade should create a better understanding of the interactions and interdependencies of the environmental conditions and processes, the use of resources and the economy. A major task in context of the development of the ocean economy will be in documenting the potential impacts from environmental changes on the established and emerging maritime industries and their ability to generate growth, especially for LDCs and SIDS. Defining safe and sustainable thresholds for economic operations in the ocean will help policy-makers and stakeholders in implementing a truly sustainable blue economy. New research should develop and flesh out sustainable blue-green growth agendas and link it to efforts in ecosystem protection.

This outcome is supported by :
SDG 14.4, 14.6, SDG 1 – Reduce poverty; SDG 8 – Economic growth; SDG 2 – Food security; SIDS Samoa Pathway

6. A transparent and accessible ocean whereby all nations, stakeholders and citizens have access to ocean data and information, technologies and have the capacities to inform their decisions

The achievement of the above outcomes very much depends on global capacity building and resource-sharing between countries at different levels of wealth and development. The enormous need for more ocean information at the scientific, governmental, private sector, and public levels demands a step-change in ocean education at all levels. New technology, and the digital revolution are transforming the ocean sciences; these will be harnessed to deliver data and information to all stakeholders. Science-policy interface for oceans should be enhanced as well. Open access to ocean information, increased interactions between the academic and societal actor communities, and ocean literacy for all should capacitate all citizens and stakeholders to have a more responsible and informed behaviour towards the ocean and its resources. Innovative capacity development schemes between south–south and north–south ocean actors as well as courses for ocean professionals will be key in raising ocean awareness and promote better solutions.

This outcome is supported by:
SDG 14.a, SDG 16 – Peaceful and inclusive society, SDG 4 – Education, SDG 5 – Gender equality, SDG 10 -

2.2 Structuring the Decade: A two-way process

The Decade offers the ocean community a once-in-a-life-time opportunity to join efforts, mobilize resources, create partnerships with private sector and public at large, and engage governments in moving towards an Ocean We Need for the Future We Want.

Many contributions towards achieving these outcomes were widely captured in the commitments made in the course of the UN Ocean Conference, the "Our Ocean" Conferences, the World Ocean Summits, and several other meetings. These commitments and the corresponding communities and networks that existed well before the Conferences or were formed more recently constitute potential building blocks for the Decade. However, too many uncoordinated projects working in too many directions will be unable to achieve the required results, unless a structured approach is proposed.

Building on the several decades of international cooperation in ocean research and observations, and also on the current momentum and commitments, it is desirable to specify a number of higher level scientific and technological breakthroughs, or R&D Priority Areas for the Decade that are necessary for the achievement of societal outcomes identified above.

The Decade objectives and R&D Priority Areas would be **defined globally,** and the activities will be guided by them. Once these objectives and outcomes are identified and agreed, preferably as early as possible**, a bottom-up process** would be enabled so as to allow for the regional or even local definition of these outcomes and objectives, with the formulation of scientific products, activities and partnerships that could be proposed in the context of the Decade (e.g., see section 4.3.4 on regional workshops). If basins, regions, or subregions would wish to undertake an activity under the banner of the Decade, through the Decade, an endorsement would be provided of a level of program activity that may give some governments an inspiration to fund the activity.

In this context, efforts will be made to actively linking, supporting and networking common initiatives in different nations and regions, hence allowing these to be more effective and improve international cooperation. The coordination of the Decade should work towards common objectives and standards so that locally generated knowledge can be reported and used globally. The Decade will also give particular consideration to gender equity and geographical balance in its process.

The approach will be transformative. The vision of the Decade, ***Ocean science for the future we want***, captures this transformative aspect.

The ocean science community should strategically think beyond business as usual and aspire for real change, whether that be in the level of knowledge of the ocean, or in the way we manage cooperation and partnerships in support of sustainable development and healthy ocean. The focus will be on the scientific basis that is currently inadequate to support the sustainable development agenda in almost all ocean aspects.

The preliminary overarching goals and more specific objectives and R&D Priority Areas are proposed in sections 2.3- 2.5. These will be further refined through consultations, expert and stakeholder inputs.

2.3 Overarching Goals

The following over-arching goals provided the high-level motivation for the proclamation of a UN Decade of Ocean Science for Sustainable Development:

Goal 1: To generate the scientific knowledge and underpinning infrastructure and partnerships needed for sustainable development of the ocean.

Goal 2: To provide ocean science, data and information to inform policies for a well-functioning ocean in support of all Sustainable Development Goals of Agenda 2030.

The contribution of the Decade to all Sustainable Development Goals is described in details in the following section.

2.4 Strategic objectives

The following six Strategic Objectives are aimed at carrying out lasting impacts at the policy and societal level. The two overarching Goals and the six Objectives are focused on change: how we go from the state of Ocean Science and its use and impact in 2020 to the desired state in 2030. The objectives should be realistic, measurable and achievable and, if achieved, result in outcomes and benefits that are tangible and significant – they should make a difference and result in real value for the stakeholders and have impact at the science-policy interface. Through the planning process, these objectives, actions and benefits will be refined and contextualised, and actions that are providing the most important benefits will be prioritised within the implementation plan.

The first three objectives define the scientific basis for the ocean we need:

(I) To generate knowledge of the ocean system, its role in the earth and climate system, including the human component, its biodiversity and the seabed, to support sustainable management;

(II) To develop and provide access to a comprehensive evidence base and capacities for ecosystem-based management that will improve ocean health and support a blue economy; Emphasis will be given to research on socio-economic aspects of sustainable use of the ocean, and as well as understanding and managing the effects of cumulative stressors.

(III) To save lives and reduce risks from extreme events and ocean-related hazards through an accelerated program of research and development supporting integrated multi-hazard early warning systems, accompanied by improved community preparedness and awareness;

The following three cross-cutting objectives enable and support the first three objectives:

(IV) To enhance ocean observing networks, data systems and other infrastructure, and their supporting cooperation and partnerships to service the demands of all nations by 2030;

(V) To transform the scientific and technical capacity of the ocean stakeholders, especially for SIDS and LDCs, through greater access to and more informed use of scientific knowledge and accelerated transfer of marine technology, training and education, and increased ocean

literacy so that all can participate in, and benefit from, developments in ocean science and technology and its application for sustainable economic development, food production, ocean management, assessments, and responses to climate change;

(VI) To enhance cooperation, coordination, and communication between stakeholders, including the private sector, in ocean science, with immediate delivery of new and existing knowledge to policy and decision-makers in the context of the 2030 Agenda, and beyond.

The objectives are interdisciplinary and universal, reflecting the crosscutting nature of ocean science. They will support nations, whether coastal or land-locked, to achieve all Sustainable Development Goals of the Agenda 2030, which benefit from improved knowledge of the ocean, and more particularly SDG14 and other SDGs that have an explicit ocean dimension, for example SDG 2 on food security, SDG 8 on economic growth, SDG 12 on sustainable consumption, or SDG 13 on climate, amongst others. Annex 3 contains a more detailed elaboration for each objective and examples of actions and the potential benefits that will accrue.

2.5 Priority Research and Development Areas

The six strategic objectives are general. Decisive and fast progress in a number of thematic areas is necessary to achieve them. These initial priority areas of research and development are outlined below. There is no particular priority order of them. They are interconnected but allow focussed design and planning. Once the progress in these areas is achieved and is communicated to potential beneficiaries, it will stimulate the variety of ways for sustainable use of the ocean.

R&D Priority Area 1: Comprehensive map (digital atlas) of the ocean

This Area goes well beyond the domain of ocean bottom topography but its importance can be best illustrated by the huge deficiency of current global ocean depth maps. Current satellite mapping of the ocean renders a resolution between 2 to 5 km. But the present coverage of the ocean at such resolutions is scarcely over 5 percent. The current map of the ocean does not represent therefore many important underwater features. If a parallel to the land surface is evoked, the equivalent resolution of terrestrial maps would level out almost all prominent topographic features. Single averaged flattened pixels will be replacing the Eiffel Tower, the Shanghai skyline, the Capitol Building in Washington, DC, and many other landmarks shaping our world image. Such objects would not be simply visible on current maps. With the current level of knowledge, the recent searches of missing aircraft simply did not know the true initial depth of water they were supposed to operate in.

Current efforts under IHO and IOC to map the world ocean could accomplish this task and should be incorporated in the UN Ocean Decade. But, mapping the ocean should include much more than the depth measurements. It includes parameters of the physical, biological, chemical, and geological environments, ecosystems, cultural objects, boundaries, resources, etc. The shipping and transport community, weather and ocean forecasters, fishing industries, marine resource managers, coastal cities and communities vulnerable to sea level rise, tsunami, and tropical cyclones, are all dependent upon accurate ocean maps. Maritime spatial planning is a way of putting many interdependent maritime activities on a single map. Similar dimension exists in the coastal zone management. Today, the science capability of analysis and predictability is greater than the resolution of ocean maps. An atlas of ocean information is necessary in order to address the prevailing and future societal pressures on the ocean. Designing such a digital georeferenced atlas of the ocean is therefore a necessary and

innovative undertaking that requires consolidation of existing knowledge, review of requirements, potentially new research and development, and comprehensive assemblage.

R&D Priority Area 2: A comprehensive ocean observing system

One cannot manage what one cannot measure. Ocean observations are the key to understanding weather, climate, and the future state of marine ecosystems and resources. Today's Global Ocean Observation System (GOOS) is competent when it comes to physical state variables in the upper two kilometres of the water column and at the surface. It is expanding to include additional measurements in the deeper ocean, and in the domains of biogeochemistry, biology and ecosystems. GOOS is generally a shared undertaking but only a handful of nations contribute, while all nations, even landlocked, benefit from the products. Member States need to engage further to construct and sustain a global ocean observing system that covers all the world's major ocean basins. This system should be routinely maintained, collected in a uniform and common standard of foundational or basic data, with information gathered made freely available to all, and should be readily adaptive to both emerging circumstances and priorities as well as to local or regional needs in addition to basic parameters. All the ocean sciences and their applications would benefit from additional coverage in density of observations and parameters, and in particular, in the Southern Ocean and the Arctic that are currently remarkably under-observed. Efforts will focus on expending observations to the deep ocean in all ocean basins so as to be able to characterize its physical state, biogeochemistry and ecosystems, and detect changes. Partnerships with industry will be required to promote data sharing and guiding the development of new technologies. The Decade should produce a regime of international cooperation that completely monitors the major ocean basins of the world, at all depths, blending into the Global Ocean Observing System, and maintained by the nations of the basin region, among others. It should synergistically use in-situ and remotely sensed observations and strongly benefit from emerging observing technologies. These requirements for observations have been known for a long time but GOOS remains grossly underinvested. The Decade should create conditions for involvement of down-stream beneficiaries of the ocean observations. Their input would provide a very useful feedback on the quality and quantity of the observations information provided and their interest in obtaining the data should create a "pull" and resource base for expanding and sustaining the ocean observations. The current ocean observing community should then reach out to a much wider consortium of stakeholders, which would turn GOOS into a "system of systems".

R&D Priority Area 3: A quantitative understanding of ocean ecosystems and their functioning as the basis for their management and adaptation

The Census of Marine Life produced an inventory of species in the ocean, enhancing remarkably the scientific knowledge on what lived, lives, and will live in the ocean. This work is successfully continuing under the IOC Ocean Biogeographic Information System (OBIS). The biological component of GOOS in approaching the pilot phase. The Decade should build on these foundations with a view to develop capacity for imaging in near real-time the life in the ocean by applying emerging technologies that will become mature and routine during the Decade, such as Environmental DNA sampling, or eDNA. From viruses and plasmids to whales, and their interaction on each other, the new state of genetic science will reveal much of what has not been able to be measured or understood in the past. Increasingly, tools are available to replace the laboratory bound analysis with deployable laboratories that produce the resulting information, rather than simply collecting the sample. A combination of methods exist to produce an ongoing measurement of micro- to the macro- and mega-sized components of the marine ecosystem inventory and assess its health. The new technologies will be able to help the

researchers to better understand the functioning of deep-sea ecosystems, measure the cumulative impacts of ocean stressors and define the carrying capacity of ocean ecosystem to sustain human impacts and economic development. For the first time in history this opens a possibility to meaningfully predict the evolution of ocean ecosystems, using biogeochemical and ecosystem models that are verified against a bulk of standardised *in situ* eDNA and other observations. This also offers potential to guide the adaptation of certain valuable ecosystems (not only individual species), e.g. some coral reef ecosystems to new climatic and environmental conditions, with aggravating ocean acidification and loss of oxygen. The science-based management of ecosystems, with adequate monitoring activities and meaningful prediction capacities will be a crucial help in making fisheries and aquaculture more sustainable.

R&D Priority Area 4: Data and information portal

The interrelationships of the subjects presented above are apparent. With a comprehensive map, the most important areas for detailed observations can be determined, including the location of complex ecosystems, which could be monitored at the appropriate scale, and measured with deployed tools. Providing an open access, well maintained data portal for all and to make this information globally available will allow advances across scientific disciplines as well as enable scientific exploration within and among the data alone, in some cases making discoveries without having to collect a single new measurement. Social science is necessary to enable the fullest understanding of society's needs, as well as informing society at a meaningful scale, and at a meaningful level. Scientific papers should not be the measure of success of the Decade. Impact to society, appropriately measured against clear objectives, should be the measure of success. The private sector should be a beneficiary and contributor to the data system. Ocean economy requires data and information and preserving the ocean health requires open access to most of the data, to ensure efficiency of activities and, importantly, transparency. New data and information technologies should be employed talking the oceanography into the world of Big Data. The vibrant community of IT companies is willing to technologically support the required research and development. At the same time, the ability of all, including developing countries to be a meaningful part and a beneficiary of the data system, and the observance of the necessary data standards and data interoperability will have to be ensured through well-established and mandated mechanisms such as the IOC International Ocean Data and Information Exchange Programme (IODE).

R&D Priority Area 5: Ocean dimension in an integrated multihazard warning system

Currently, there are a number of unconnected warning systems for ocean-related hazards. Some of them are operational, e.g. for tsunami, some are incomplete, e.g. for storm surges, and some emerging, e.g. harmful algal blooms. Widely recognized and reflected in the Sendai Framework for Disaster Risk Reduction is the need to strengthen and harmonize the warning system. An effective warning system has to be based on the knowledge of risks and corresponding emergency planning and warnings. The affected communities need to be prepared to appropriately act on a warning. The hazard has to be detected, followed and/or forecast. The warning then need to be generated and timely, fully, and correctly reacted on. This combination of actions and responsibilities necessarily involves more than one responsible agency. Experience shows a strong advantage of developing multihazard warning systems (MHWS) able to act on more than one type of risk. During the Decade, a concerted effort should be made to incorporate ocean components into emerging or existing MHWSs and, as well, to more effectively use the ocean information for warnings of ocean-related hazards at a variety of time scales, from immediate threats, such as tropical storms, to long-term high-

impact events like droughts, heat waves, forest fires, floods, etc. Until now, humankind largely reacts too late on such hazards. There is significant progress in saving lives, but economic and infrastructural losses from natural disasters remain overwhelming and often strongly affect the capacity of a country or a region to recover after a natural hazard event.

The ocean-related warning systems, especially the one for tsunami, still require major methodological development. Most importantly, the system needs to strengthen and upscale the preparedness of communities at risk. This quality of the system needs to be addressed during the Decade through involvement of appropriate governmental authorities and international mechanisms.

R&D Priority Area 6: Ocean in earth-system observation, research and prediction, with engagement of social and human sciences and economic valuation

Ocean science is a part of the Earth-system science. GOOS is a contributor to the Global Climate Observing System and, more widely, a part of the planet observing system. To study and predict the future state of the ocean, one needs to incorporate it into various types of Earth-system models. As time range of the prediction lengthens, more complexity is usually required to exploit the predictability of the interacting components of the Earth system. Industries, society changes, economy – all need to be eventually included in the observations and predictive modelling scope. This emerging science needs a strong ocean component.

In addition, there exists an untapped potential in oceanographic observation and modelling capacity that can help to improve a number of important services to humanity. This area of societal benefit includes many types and ranges of weather predictions, climate information services, various thematic assessments, and ocean space and resources management. Activities in the coastal zones and operations at sea are becoming more and more regulated and interdependent. They require real-time decision making and anticipatory planning. Ocean modelling and prediction capacity that could meet such emerging requirements does not currently exist. Therefore, the Decade might engage at present unconnected modelling groups and industries into a design of a future multi-scale ocean observation and prediction system. Social science studies, e.g. development of ethical principles of ocean stewardship, and short- and long-term economic analyses of the ocean sustainability and the role of ocean science in it are urgently required. Quantitative assessments of tangible benefits and appreciation of intangible assets related to the ocean may be an additional catalyst to act stronger on land-based sources of pollution or unsustainable ways of fishing and aquaculture. They could also help in protection of underwater cultural heritage.

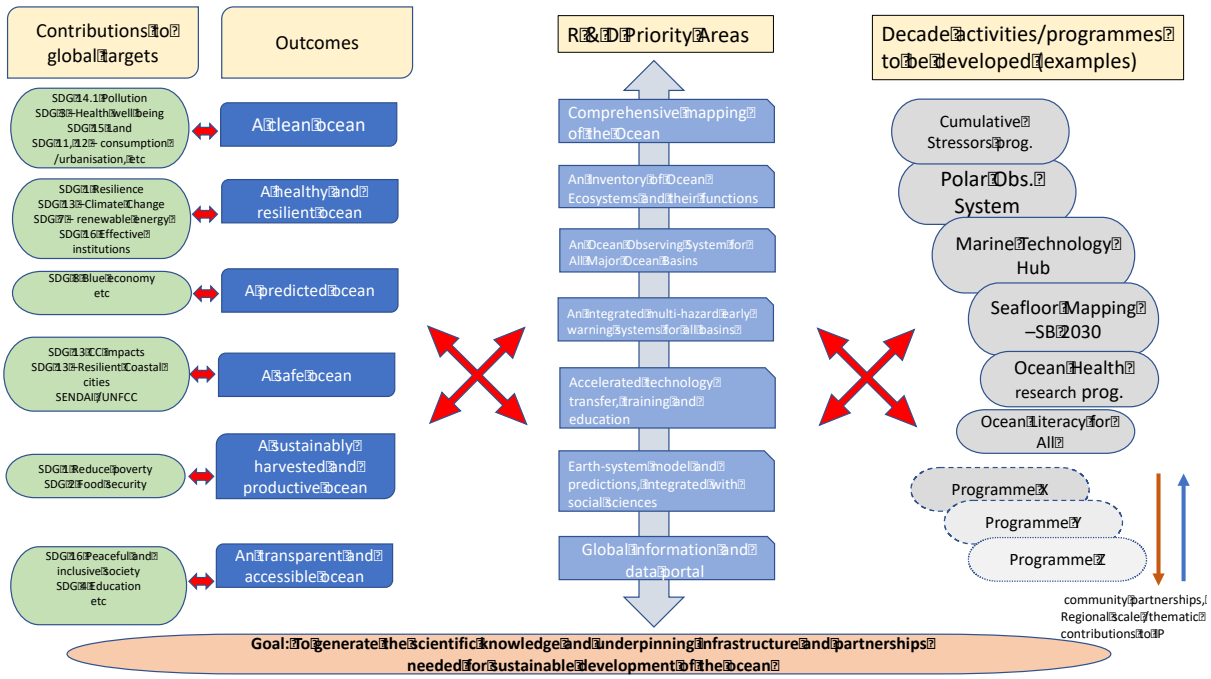
R&D Priority Area 7: Capacity building and accelerated technology transfer, training and education, ocean literacy

All above R&D areas are intended to move forward the cutting-edge of ocean science. They will augment the ocean science capacity and make it fit for the purpose of informing and even guiding the sustainable development. The enabling elements for the progress are human potential, infrastructure, cooperation, resources and adequate social conditions of successful research and development. IOC has started and will keep assessing the capacity of ocean science through the Global Ocean Science Report process. At present the oceanographic capacities are highly uneven in the world, not only in terms of ability to contribute to the research but also in terms of ability to benefit from the scientific knowledge and technology. (Ocean data and information are defined here as elements of ocean technology.) Based on ethical considerations and also on the principle of common but differentiated

responsibilities, all countries and communities should be able to benefit from the ocean life-supporting services, which requires capacity to act in a scientifically sound way. The Decade should strengthen the existing capacity development, training and education work and set in motion the transfer of marine technology (TMT) mechanisms. Infrastructure, training and teaching materials exist in many organizations. Their potential will be better sustained and potentially multiplied once the TMT Clearing House is put in place linking supply and demand in capacity development, training and education. One outcome of the Decade should be a major step forward in the ocean literacy towards various categories of people. The motivation for the Decade itself comes from the seven principles of ocean literacy, especially from the realization of the role of ocean for people and planet and from the understanding that the ocean is largely underexplored. A vigorous ocean literacy program of activities has to be designed. The major target audiences have to be school students, which requires including of ocean literacy in the school curriculum, decision makers including governmental authorities, and the public at large.

INTEGRATION ACROSS RESEARCH AREAS

The activities under the priority Research and Development Areas will be interrelated; for example, the production of a map of the ocean will inform the forecast models of an integrated multi-hazard early warning system, which is accessible via a global ocean data portal, which is reporting the sensing from the deployed enhanced observing system, enabled because of the map. The interrelationships are infinite. The figure below provides a non-exhaustive view to illustrate how the outcomes may support societal needs described above, whilst framing the generation of new science activities as well as alignment of existing partnerships.



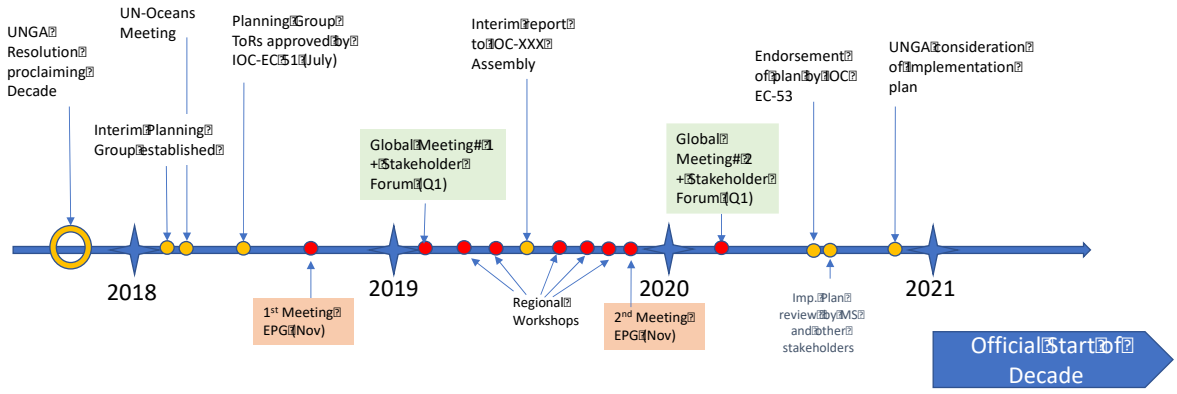
The breakthroughs in the priority R&D areas need to be proactively designed. Once the above ideas start approaching fruition, they will enable a large variety of societal benefits, helping to protect and maintain the ocean health and abundance, support the growth of sustainable ocean-based ("blue")

economy. For that the scientific and technological advances must be designed in close collaboration with their beneficiaries and stakeholders and, as well, the advances and related emerging opportunities have to be widely communicated and promoted.

3 Preparation Phase

The aims of the Preparation Phase are to:

1. develop and agree governance arrangement, for both the planning phase and for the Decade *per se*;
2. outline the form and structure for the Decade
3. engage and consult relevant communities concerning preparations for the Decade
4. develop a resource mobilisation (business plan) for the Decade
5. communicate the purpose and expected results of the Decade to all stakeholders
6. draft an Implementation Plan for the Decade



Preparation phase

Figure 1. Key steps for the Preparation Phase

Figure 1 shows schematically the different high-level activities and milestones in the development of an Implementation Plan and establishment of the Decade. The governing body meetings of the IOC are critical since the UN has given IOC the lead responsibility for preparing the Implementation Plan. The Implementation Plan is likely to include a Science Plan (and project Research Plans), an Engagement and Communication Plan, a Resource/business Plan, and a Capacity Development, Training and Education Plan.

The UNGA Resolution invited the Secretary-General of the UN to inform the General Assembly about progress toward implementation of the Decade, based on advice provided by the IOC. The 53rd Session of the IOC Executive Council would be asked to approve the Implementation Plan, including the structural and governance arrangements contained therein, which would be noted by the UNGA.

This Phase will be supported through two interlinked mechanisms, namely an Executive Planning Group (EPG) composed of appointed experts, and a Stakeholder Forum (SF), composed of institutional members representing various interest groups, which are introduced below.

3.1 Governance and structural arrangements

3.1.1 IOC Governing bodies

IOC Member States will be invited to approve terms of reference of the Planning Group (July 2018);

- IOC Member States will consider an interim report of the Planning Group in June 2019;
- A review phase between January and April 2020 whereby all Member States (IOC and UN Member States, and other key stakeholders) will be invited to provide comments on the draft Implementation Plan;
- The IOC Executive Council at its 52nd session (June/July 2020) will be invited to endorse the Implementation Plan prior to it being made available to the UNGA in the second half of 2020.

3.1.2 Executive Planning Group (EPG)

An Executive Planning Group will be established by the IOC to serve as an expert advisory body to the IOC governing bodies to support the development of an Implementation Plan for the Decade and the delivery of other activities needed to establish the Decade. It will set priorities for the different stakeholders to contribute to the Decade.

Terms of reference of the EPG are presented to the 51st session of the IOC Executive Council as document IOC/EC-LI/2 Annex 4. A wide call for nominations disseminated across relevant networks and partners will be launched shortly after the IOC Executive Council. A Selection Panel, convened by the IOC Chair and composed of the IOC elected officers will be tasked with selecting members of the Executive Planning Group. The IOC Executive Secretary will coordinate the work of the Planning Group to ensure the continuity of the preparatory activities.

3.1.3 Stakeholder Forum

The UNGA called upon the IOC to prepare an Implementation Plan for the Decade *"in consultation with Member States, specialized agencies, funds, programmes and bodies of the United Nations, as well as other intergovernmental organizations, non-governmental organizations and relevant stakeholders".*

A Stakeholder Forum will act as a consultative body to the IOC governing bodies and aims to engage a wide range of relevant stakeholders. The Stakeholder Forum would be composed of representative of institutions with a stake in ocean sustainability and ocean science. The Stakeholder Forum will act as both contributor and end-user of the Decade's Implementation Plan and will provide inputs through the expertise, knowledge, data, information and capacity-building experience of its members on the work carried out by the EPG.

The Stakeholder Forum will meet twice in the course of the preparation Phase. Representatives of the EPG will be invited to the meeting to share information, inter-act and receive inputs on the elements of the Implementation Plan. The modalities of work and are presented in Annex 4.

UN partners will contribute to the design of the Decade through this Stakeholder Forum as well as through UN-Oceans which will act as a platform to interact with and coordinate inputs from UN agencies.

3.1.4 Interim Planning Group

Given the tight outline highlighted by Figure 1, an Ad Hoc or Interim Planning Group has been established, under the Chair of IOC, and acting within the scope of decisions already agreed by Member States. The composition of this Ad hoc/Interim Planning Group will be at the discretion of the Chair of IOC.

The Interim Planning Group provides advice to the Chair and IOC Secretariat, on the governance arrangements, the engagement and communication strategy, and the framing of the Decade objectives and outcomes.

The term of the Interim Planning Group will end once the formal EPG is established.

The modalities of work are presented in Annex 5.

3.1.5 Reporting process

IOC will receive regular reports from the Executive Planning Group on the Decade preparations and provide input for the report of the Secretary- General on oceans and the law of the sea to the UNGA (73th and 74th sessions) and/or provide information to the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea, in the context of its agenda item on "Inter-agency cooperation and coordination". Regular reporting to IOC Member States on the preparation of the Implementation Plan will be essential through IOC governing bodies meetings but also through circular letters, and the recently established IOC Newsletter.

IOC will also ensure that regular information on the preparatory activities of the Decade are provided to UN-Oceans.

3.1.6. National coordination mechanism (preparatory phase)

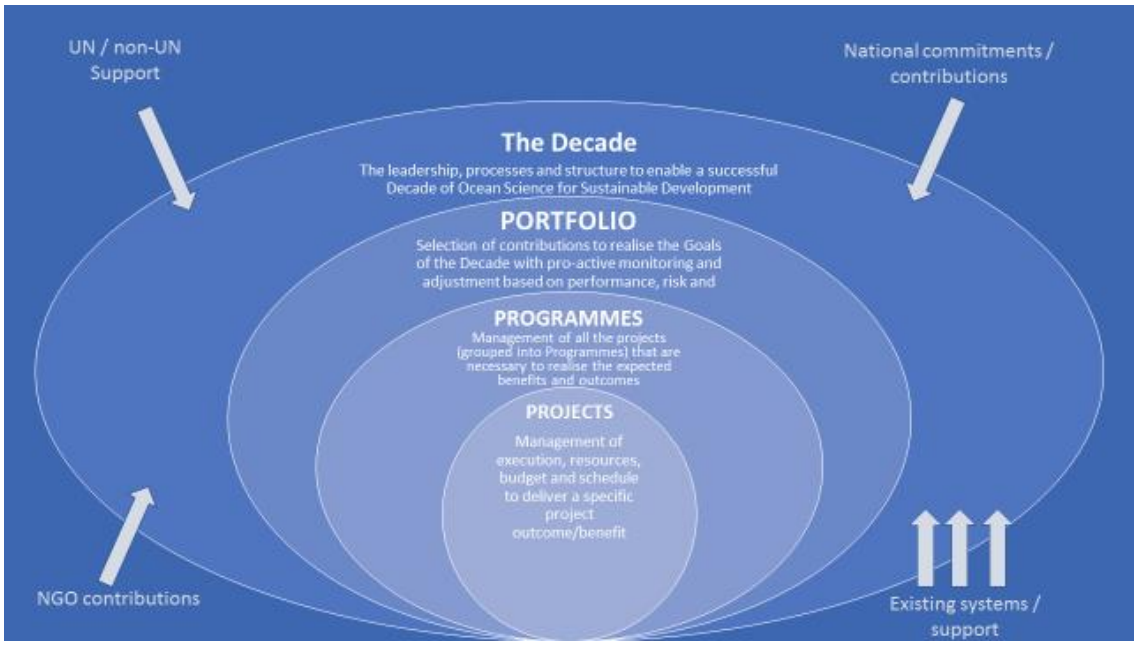
At national level, the Decade should generate substantial government and societal interest in the conduct and dissemination of ocean science. Building on the existing IOC national coordination mechanism, the creation of national committees should be encouraged for the purpose of stimulating, coordinating, designing national activities. These Committees would connect to the global process by identifying national contributions and reporting on national activities.

3.2 Specify the form and structure for the Decade

This section discusses the form the Decade and its activities should take and outlines a possible governance framework consistent with such an approach. The ambitious and transformative nature suggests it should be systematic and planned, and not *ad hoc*. Compared with the governance described below, this would likely be headed by a Decade Coordination Group or similar, with ultimate responsibility residing in the established mechanisms.

Figure 2 below shows schematically how the Decade work and activities might be structured. The *Portfolio* level occurs at the level of the enterprise, which in this case is the Decade itself. The Portfolio will largely consist of *Programmes* of work but may also have *Projects* for specific tasks. The next level

breaks up the enterprise into a small number of *Programmes*, for example research or capacity building and training.



Ideally the *Programmes* should be of comparable size, but this may vary depending on risks and the degree to which the Decade wishes to keep certain areas visible at the *Portfolio/Enterprise* level.

Finally, there are the *Projects* which will vary in scope, duration, difficulty, dependencies and so on. For the Decade where many projects will be volunteered/contributed, the degree of control and direction flowing through this structure will be problematic.

Given the approach described in section 2 of this document, the definition of portfolio and programmes would happen at the global level through the work of the Executive Planning Group, whereas projects may be defined at the regional, basins scale, or local scale levels as well as through thematic networks.

During the preparation phase, we also expect there may be needs for sub-groups experts to inform the definition of activities and programmes. In particular, the development of an outline of the research programme(s) for specific objectives or outcomes will require additional expertise beyond that likely to reside within the Executive Planning Group – each distinct research thrust will likely need an outline of a Research Plan[2]. The EPG may then draw from outside expertise, for example within existing science networks, to seek guidance. Similarly, the consultation process will require experts

[2] There is some potential for confusing terminology since the Decade itself requires an Ocean Science (Implementation) Plan, and within that Plan will a distinct Science Plan!

in communication and engagement and in the development of an engagement plan to guide the process.

3.3 Engage, consult relevant communities and communicate about the Decade

It is imperative to underline that this is *not* an "IOC Decade". It has to be **co-owned** by all partners. IOC is only organizing the preparatory process and will be facilitating the implementation.

Consultation will be essential throughout the Preparation Phase (2018- 2020) and through the Decade itself (see "**Error! Reference source not found.**" in Annex 6 for more details), to guide the development and evolution of the Decade's activities and to ensure that outcomes respond to specified plans, and are in harmony with other UN, non-UN and non-governmental initiatives.

Such activities, including communication should be captured in an Engagement and Communication Plan, either as part of the Implementation Plan or separately, and be one of the deliverables of the Preparation Phase.

Regular reporting to primary stakeholders on the preparation of the Implementation Plan will also be essential. This should be accompanied by informal reporting to key regional and national stakeholders, particularly those who are potential contributors. Self-organization and reporting within constituencies of partners is strongly encouraged.

3.3.1 Member States

As highlighted in Figure 1, consultations with and reporting to Member States are expected to occur at several stages and levels of the process. IOC and UN Member States will be invited to provide inputs on the Decade initial phase (Roadmap) and its design (key scientific questions they would like the Decade to address). At the same time, IOC will also work through other UN-affiliated bodies to engage their respective Member States. Specific activities are also foreseen to report on progress to UN missions in New York.

3.3.2 UN partners and Intergovernmental Organizations

The IOC will engage with relevant United Nations funds, programmes and specialized agencies on a bilateral basis as well as through UN-Oceans, the inter-agency coordinating mechanism on ocean-related matters. A first exchange amongst UN bodies took place during the UN-Oceans meeting hosted by IOC in Paris on 26 March 2018. This helped understanding where key science priorities lay within each agency, inviting potential contributions and identifying synergies from agencies to the preparation phase of the Decade.

Several UN agencies have responded positively to the IOC invitation to collaborate on the development of the Decade. These include FAO, IMO, WMO, UN Environment, OLA/DOALOS, ISA, CBD, UNDP as well as GEF. All intergovernmental and international organizations active in the ocean, such as ICES, PICES, and European Commission with its relevant Directorates (particularly DG for Maritime Affairs and Fisheries, DG for Research and Innovation, DG for International Cooperation and Development, DG for Civil Protection and Humanitarian Aid), IHO, IUCN, the Pacific Community, CPPS, SPREP, participants in the Galway Agreement, and all others will be invited to participate.

3.3.3 Other key stakeholders

The Planning Group will also develop strong collaboration with non-UN partners and invite inputs on the preparation and implementation of the Decade. For engagement, consultation and communication purposes, six main categories of stakeholders have been identified:

1. Ocean Science Community
2. Policy-makers and managers
3. Businesses and industries
4. Civil society
5. Donors and foundations
6. Public

Each of these groups, would be represented in the meetings of the Stakeholder Forum. They would also benefit from targeted messaging and engagement strategy given that their respective potential contributions to the Decade are specific.

OCEAN SCIENCE COMMUNITY

This category includes **Ocean Scientists** (interdisciplinary and specialized Scientists) and the **Innovation and Technology community** (Ocean Science support infrastructures). It is critical that the science community is engaged as early on as possible in the process. They will connect Oceans Science to societal needs. They will bring Ocean Science Perspectives to the Decade and provide scientific technologies and services to the Decade (leading technological developments).

It is important that the Decade builds recognition and engagement from within the ocean sciences community. SCOR, IAPSO, AGU, AMS, EGU, EMB, AORA and many other science networks active globally and regionally provide opportunities to communicate the aims and benefits of the Decade, but also to gather ideas and possible contributions, and to engage young scientists. Convening "Town Hall" style meetings at the AGU Fall meeting and the Ocean Sciences meeting in late 2018 and early 2019 are two examples of such opportunity.

Of note for the Decade, Future Earth has established Knowledge Action Networks, including one for the "Ocean Knowledge-Action Network". The Future Earth Ocean Knowledge-Action Network seeks to address several of the scientific challenges and issues that have been identified in the scoping process for the Decade (see for example, IOC/INF 1341-REV).

It will be important to emphasise engagement and involvement and the value the Decade may provide rather than create unrealisable expectations and/or impressions that the Decade somehow sits above pre-existing plans and activities.

POLICY-MAKERS AND MANAGERS

This category includes **policy-makers within** IOC, UN, other UN bodies Members states, **Ocean Managers** (working at the interdisciplinary and sectoral level), as well as representatives of UN bodies relevant to ocean management. Typically, these may be managers within national authorities working on marine biodiversity or cultural or natural heritage protection and marine conservation, fisheries management, pollution abatement, climate change, ocean research policies, or more focused on area-

based/ecosystem-based management approaches. These will connect ocean science activities with their sustainable development agenda at various scales. They will be equipped with tools and solutions to inform decision making process, leading to the achievement of SDGs.

PRIVATE SECTOR/BUSINESSES AND INDUSTRY

This group will gain insight into their business environment (regulatory process, business opportunities, and business technologies). The Decade will provide access to tools and information required to find solutions to ocean sustainability and secure investments in the blue economy. Through innovation and R&D, these may also contribute to the dissemination of new technologies and solutions in support of the Decade's objectives. The private sector will be broadly consulted with a view of engaging its capacities in the activities under the Research and Development Priority Areas. A not less important initiative will be to communicate with the private sector on emerging technological possibilities and scientific knowledge that would enable more productive and more sustained use of ocean space and resources. The Decade should offer to the private sector a new level of business opportunities and the sector will be encouraged to turn the Decade into a successful "business case". Business associations such as the Action Platform for Sustainable Ocean Business under the UN Global Compact and the World Ocean Council and some other networks will be requested to promote participation of private capital in the Decade.

CIVIL SOCIETY/NGO

NGOs will connect ocean science to societal needs. NGOs will give evidence base, provide prioritization advice and voice to civil society interests. It will be a conduit for communicating and disseminating information about the Decade to various interest groups.

DONORS/FOUNDATIONS

Through alignment and leveraging of investment in high impact ocean research, this group will provide support to the Decade and its activities in order to fulfill intervention objectives. Philanthropic organizations will be proactively invited to support the Decade preparation and implementation.

PUBLIC

The Public will be well informed about ocean issues and will engage at its level to contribute to the sustainable development and ocean protection. Access to new information leading to increased awareness and ocean literacy will be instrumental in triggering behavioral changes, such as adaptation of the lifestyles, joining NGOs, choosing ocean-affiliated professions, etc.

3.3.4 Regional and Global Consultation Workshops

These workshops will be an essential mechanism to engage regional and more local ocean stakeholders in the design of the Decade. The aims of these workshops should be somewhat like those of the Preparation Phase itself:

1. To communicate the purpose and expected results of the Decade to all stakeholders
2. To brief the participants on proposed arrangements for the Decade, including structure and governance, and solicit feedback.

3. To engage and consult the ocean community concerning the implementation plan for the Decade (for example, identifying priorities in research or in capacity development and training).
4. To workshop possible themes or topics that may be part of the Decade.
5. To draft plans for such initiatives, as appropriate, including scope, objectives, expected results, participation and possible schedule.
6. To identify opportunities (but not necessarily commitments) for investment and resource mobilisation for the Decade.

Participation should be dictated by the above goals, but the sessions should be arranged in such a way that the aims 1 and 2 can be undertaken with a broad audience, including webinars and video-conferencing; aims 3-5 with a selected (by the region/topic convenors) group with interest and expertise in the topics that are the focus of the workshop; and 6 with high-level managers and others who can speak to national commitments and other types of resources needed for the decade. They may proceed in a different order in practice.

Opportunities should be sought to take advantage of existing initiatives that bring regional and/or global communities together. For example, the International Indian Ocean Expedition -2 (IIOE-2) is engaging communities throughout the Indian Ocean to advance our understanding of the Indian Ocean and its role in the Earth System and might provide an opportunity for a regional Decade workshop. Subsidiary bodies, and particularly those of the IOC (e.g., GOOS, IODE), should be encouraged to submit ideas on how they might promote or support relevant consultation. At least two types of workshop should be considered (in addition to the forums outlined in previous sections):

REGIONAL WORKSHOPS

Several regional workshops are foreseen to take place from the second half of 2018 to the second half of 2019. These meetings will be an integral part of the Decade design process. The Executive Planning Group will provide guidance in the organisation and structure of these workshops. Ideally, as a minimum, five regional workshops would be needed to cover the following ocean basins:

1. The North Pacific,
2. The South Pacific,
3. The Indian Ocean and marginal seas,
4. The North Atlantic, the Baltic Sea, the Mediterranean Sea and the Black Sea; and
5. The South Atlantic (between the African and American coasts) and the wider Caribbean.

Marginal seas and polar regions will also be considered in context of these regional workshops and/or through other organizations/regional groupings that are foreseen to meet or through complementary dedicated workshops. Some of the workshops are expected to be organised in conjunction with the

planned meetings of IOC Regional Subsidiary Bodies[3] and/or other organisation/regional groupings[4] that are foreseen to meet in the first quarter of 2019.

GLOBAL PLANNING MEETINGS

Two Global Planning Meetings are envisioned to be organised in early 2019 and early 2020. The first meeting will aim to assess the status of ocean research vis-a vis the Agenda 2030 requirements and scope the development of an outline of research programme(s) to be conducted under the Decade. The second meeting would aim at consolidating inputs from various consultations, including regional workshops referred to above, into a draft implementation plan, as well as the drafting of an integrated science plan, and the formulation of capacity development actions.

Stakeholder forum meetings are foreseen to take place in conjunction with these two global meetings so as to ensure inputs from providers and end-users of the Decade. Again, the Planning Group will guide the organisation and structure of these meetings.

TOPIC SPECIFIC GLOBAL WORKSHOPS

Given the existing global mechanisms for research (Future Earth, IMBER, SCOR, WCRP/CLIVAR, SOLAS, COASTS, etc.) and for infrastructure (e.g., GOOS, GCOS, CEOS, IODE, etc.) there may be value on harnessing these mechanisms for the Decade. The WCRP Grand Challenge on sea level and coastal impacts of climate change might be repackaged as a Decade initiative, while still retaining the oversight of WCRP. Consistent with the guidance above, such re-packaging and/or branding should only be done where there is clear ocean science community and Decade value in doing so.

The prominence of specific science topics in the high-level goals (Objectives I, II and III) for the Decade suggests they might be afforded special attention in consultation.

INVITING IDEAS

The Interim planning phase and EC 51 provide opportunities to reach out to potential partners and seek expressions of interest for hosting and/or organising workshops, framed around the purpose outlined at the head of this sub-section. The EC 51 decision could include an invitation to Member

[3] The IOC Sub-Commission for Africa and the Adjacent Island States; the IOC Sub-Commission for the Caribbean and Adjacent Regions; the IOC Sub-Commission for the Western Pacific

[4] The Global Ocean Observing System Regional Alliances.

IOC is organised into Regional Groups (I: Europe and North America, II Eastern Europe/Russia, III: Central/South America, IV: Asia and the western Pacific; and V: Africa) and it might be convenient to use these groupings as an organisational framework (note, however, that unlike the Regional Associations of WMO, these Groups do not meet formally).

States and other potential partners (including those identified in the UNGA decision) to submit expressions of interest and offers around the key elements of the preparation phase, including consultation workshops.

The Planning Group might also use other non-Decade meetings as "workshops of opportunity", adding on specific tasks that will contribute to the aims listed at the start of this section.

3.3.5 Other Communication opportunities

All possible events to communicate about the Decade will be listed. Communication materials will be developed by IOC Secretariat to support this communication. As introduced under the engagement chapter, there are many opportunities for communication other than through Decade-dedicated forums. These may include for example:

- The Intergovernmental conference related to the development of a BBNJ agreement (to take place in 2018 and 2019);
- The 'Our Ocean' Conference to be organised by Indonesia in October 2018;
- The Intenational Conference on the Blue Economy to be organised by Kenya and Canada in November 2018;
- OceanObs '19 is currently in its planning phase and there should be early engagement on how the Conference might assist the planning phase and the Decade itself (noting that OceanObs'29 is already being discussed and falls close to the end of the Decade).
- The Second UN Conference on SDG 14, to take place in Lisbon in spring 2020

A dedicated web portal and other channels of communication (social media to engage new generations) will be developed to share information on all developments related to the Decade Preparation Phase in order to promote inclusiveness, transparency and efficient and effective communication with stakeholders.

3.4 Develop a resource mobilisation (business) plan for the Decade

There is a clear need for a document (as part of the Implementation Plan or separately) that articulates the motivation and rationale for engaging and investing in the Decade, and the returns (benefits) that the ocean science community and nations more generally should expect from such engagement. The value proposition needs to be articulated well, and early, to help mobilize resources, including financial support and human and physical capacity and capability.

Resource mobilization should not be presented as a cost to and/or imposition on Member States and other participants, but rather as an opportunity for win-win partnerships.

3.4.1 A business plan for the Decade

A business plan should articulate expected results and/or milestones to track responsibilities and actions; and make (possibly rudimentary) projections of resources (mobilization) needed to plan and manage inputs, resource flow and budget expenses. Possible expected results are discussed above. This sub-section refers to a Resource Mobilization Plan and only discusses a part of what is needed for a business plan, but the recommendation is that the Executive Planning Group should use the Roadmap as an initial outline for a Decade Resource Mobilization and Business Plan that outlines goals

and details of how to achieve those goals through actions and resource mobilization. The Decade Business Plan (or whatever terminology the Executive Planning Group chooses to use) would sit alongside the Implementation Plan and its Research Plan(s) and Engagement and Communication Plan as resources for the successful and effective implementation and management of the Decade enterprise.

3.4.2 Resource mobilization within the UN system

The proclamation of the Decade indicated that it should be implemented *within existing structures and available resources*. We interpret this to mean that the Decade will not require the creation of any new intergovernmental financial mechanisms or any new intergovernmental appropriated resources, in particular new appropriations from the regular budget of UN. The realisation of the Decade is therefore intrinsically linked to its capacity to mobilize extra-budgetary or other forms of financial and human resources. Indeed, the business plan for the Decade should proceed on an assumption that the Programmes and Projects of the Decade will need to be self-supporting. Member States will need to contribute to the activities and implementation of the Decade on a voluntary basis; that is, there is no mandated contributions through the financial systems of the UN.

RESOURCES FOR THE PREPARATION PHASE

We anticipate expenses for the following activities:

- To support governance arrangements and specifically the activities and meetings of the Planning Group;
- To support engagement and consultation with the ocean community, including targeted regional and global topical workshops and participation in selected other fora and meetings that are aligned with the Decade strategy;
- To support drafting of the Resource, Science, Capacity Development, Communication/Engagement and over-arching Implementation Plan;
- To support engagement and consultation within the UN system and, in particular, reporting to the UNGA; and
- To support communication activities such as the web site, networking with scientists and production of outreach materials.

Given the lead time to identify and mobilize support for research and infrastructure (e.g., new observing technology) and for capacity building, it should be anticipated that work on such mobilization will begin during the Preparation Phase. The IOC Information Note prepared in the process of developing the Decade proposal referred to "… making proposals to existing funding organizations, many of which will be encouraging the Decade-related work with specific solicitations". Such work must be started immediately, on the basis of this Roadmap and preliminary drafts of the Implementation Plan. Similarly, if mechanisms like the Belmont Forum are to be used to support lines of research, resources will need to be set aside during the Preparation Phase to initiate such discussions.

It is unlikely that the Executive Planning Group can undertake such consultations (though they should guide and direct) and it would be a mistake to assume the IOC can absorb such consultations within its already over-burdened work load. A dedicated resource is needed. In this context, the IOC will have to broaden its circle of contributors and funders and explore new partners that may be interested to

invest in the Decade. For example, partnerships with the private sector, private funds and foundations should be pursued.

RESOURCES FOR THE DECADE

The financial, human and physical resource requirements of the Decade are of two types: direct and indirect administration and coordination needs and expenses, and direct activity project support.

Coordination and administration

For any enterprise such as the Decade or a major research programme, there is a base level of resourcing needed to set up and operate the enterprise. This base level will need to scale up depending upon the scope and size of the undertaking and will likely be disproportionally skewed to the start-up phase while waited for contributions to materialize. Resources should be mobilized centrally to support Portfolio (enterprise-level) coordination and administration functions (see **Error! Reference source not found.** in Section 3.2 on structure) and probably some Programme level functions (e.g., where it is not possible or practical to resource the programme entirely through a voluntary contribution).

In general, the case for establishing Programmes and Projects for the Decade should include a supporting business case of the type outlined above – that is, specified goals and objectives, expected deliverables and milestones, benefits to be realized at the Programme/Project level as well as for the Decade itself, and a resource plan. To the extent possible, coordination and administration should be decentralized and supported at the Programme/Project level.

Contributions to coordination and administration can come in a variety of forms:

- National, regional or other in-kind contributions for hosting and organization of scientific meetings, workshops, etc.
- National, regional or other in-kind contributions supporting travel and effort devoted to scientific meetings, workshops, etc.
- Hosting of a Decade Project or Programme Office
- Extending existing support mechanisms (e.g. a regional IOC Programme Office) to cover relevant Decade administration and coordination
- Seconding or contributing staff to support central and/or distributed offices
- Direct financial contributions to a dedicated central Decade Fund or similar fund attached to a decentralized Office

Any such contribution should be planned and acknowledged and not assumed. A good principle is that if the beneficiaries and partners in an activity are not willing/unable to support coordination and administration costs, then the business case is likely flawed and the activity at risk.

Finally, it is useful to recall that while the proclamation of the Decade assigned lead responsibility to IOC, it also invited other bodies to engage and support the Decade. Broad ownership of the Decade is key for its success. The resource base should therefore be also broad and flexible and not be unduly focused on IOC and its existing mechanisms. Such a resourcing strategy will decrease the risk of single points of failure while at the same time encouraging broader engagement and ownership of the Decade (see the next sub-section for further comment on financial mechanisms).

Support of activities

Resourcing the activities and projects of the Decade will be a substantial undertaking, many times larger than the task of supporting coordination. As noted previously, the majority of this support will be in the form of nationally-determined voluntary contributions such as research cruises, research and sustained measurement networks, technical training, data systems, national funded research projects, etc. Such activities will usually be approved and funded through national mechanisms but may also be supported through regional and international funding mechanisms, with perhaps the Decade identified as a beneficiary or motivation for the project. This does create challenges for the Decade since the governing structures described above will operate with many external dependencies beyond their immediate control and influence; voluntary commitments will often be tentative/indicative or provisional and will be confirmed at a time dictated by the funding source, not by the Decade.

The Decade encourages the championing of its programmes/projects by its Member States through direct support. Ideally, projects responding to the Decade Plans should be afforded high visibility and/or priority within national or regional funding mechanisms.

3.5 Develop an Implementation Plan for the Decade

This is the primary task and output of the Preparation Phase. Annex 6 provides an outline of the elements that are expected to be covered by such plan.

ANNEX 1: Context within the UN system[5]

The Decade will support and reinforce the science base of a number of UN processes. A few examples are provided below:

UNCLOS

The relationship was well summarized by the United Nations Legal Counsel in his remarks at the IOC side event held on 25 September 2017 on the margins of the informal consultations on the draft resolution on oceans and the law of the sea:

"Marine science and the Convention are closely intertwined. The Convention provides the enabling framework for the conduct of marine scientific research, which it addresses in Part XIII and for the development and transfer of marine technology, which it addresses in its Part XIV. Marine science is an essential underpinning of the implementation of the Convention and achievement of its objectives, namely the equitable and efficient utilization of the resources of the ocean and seas, the conservation of their living resources, and the study, protection and preservation of the marine environment. The Decade would not only help fill some of the identified knowledge gaps, it would also contribute to the strengthening in a number of ways the implementation of the Convention which is key to achieving all SDG 14 targets. The Convention requires States and competent international organizations to promote and facilitate the development and conduct of marine scientific research as well as to promote international cooperation in marine scientific research. It also requires the publication and dissemination of information on proposed major programmes and their objectives as well as knowledge resulting from marine scientific research. Under the Convention, all States are also to cooperate, in accordance with their capabilities, to promote actively the development and transfer of marine sciences and technology on fair and reasonable terms and conditions in order to help developing countries. A UN Decade would contribute to implementing those obligations by stimulating international cooperation in marine scientific research and sharing of knowledge. By helping understand the impacts of cumulative stressors and promoting interdisciplinary research, it could also contribute to the development of an integrated approach to the management of ocean-related activities. It could further improve the capacity of States, in particular developing States (especially SIDS and LDCs), to acquire the required knowledge to sustainably manage human activities in the ocean and to realize the benefits of sustainable and effective development of marine resources and uses of the oceans."

2030 Agenda and Sustainable Development Goal 14

Achieving the targets of the Sustainable Development Goal 14 to "conserve and sustainably use the oceans, seas and marine resources for sustainable development" requires novel science- based solutions and their systematic transformation into informed policies and decisions. The Decade will directly support the target 14.a that calls for "Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic

[5] This Annex is largely based on the Information Note provided to the 72nd UNGA, with some minor editing and rearrangement to fit with this Roadmap.

Commission Criteria and Guidelines on the Transfer of Marine Technology, in order 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." Target 14.a is a cross-cutting target which underpins other SDG 14 targets, such as those related to marine pollution, ocean acidification, ecosystem-based management, fisheries management, marine protected areas, or blue economy. Beyond SDG 14, there are several other SDGs that would also benefit from improved knowledge of the ocean through its relationship to other global goals such as food security (SDG 2), Climate action (SDG 13) learning opportunities (SDG 4), gender equality (SDG 5), sustainable economic growth (SDG 8), or human health (SDG 3).

The Decade proposal was registered as a voluntary commitment to the UN Ocean conference (#OceanAction15527) by IOC. Out of the 1400 SDG commitments registered by international stakeholders, about 500 relate to actions for advancing target 14.a on marine scientific knowledge. This highlights the priority that governments, UN bodies, and NGOs, amongst others, give to the need to improve scientific collaboration with a view to improve knowledge. The Decade could harness these commitments and provide a framework for advancing research and capacity development in a more concerted and coordinated manner. Beyond 2020, the Decade would contribute to the regular review of SDGs conducted in the framework of the United Nations High-level Political Forum on Sustainable Development (HLPF) as well as in the context of the Global Sustainable Development Report produced every four years.

World Ocean Assessment under the UN Regular Process for reporting and assessing the State of the Marine Environment, including socio-economic aspects ("Regular Process")

The IOC is actively engaged in providing scientific and technical support to the UN Regular Process and its Group of Experts. This support is framed within the provisions of UNGA resolution 71/257 that *inter alia* invited IOC as well as other UN bodies, to assist in the implementation of the second cycle of the Regular Process with regard to the following activities: awareness-raising, the identification of experts for the Pool of Experts, technical and scientific support to the Bureau and the Group of Experts, hosting workshops and meetings of the writing teams, capacity-building and the scoping process for the assessment(s) of the second cycle.

The 1st integrated ocean assessment published in 2016 identified many scientific knowledge gaps and concludes that "Major disparities exist in the capacities around the world to undertake the marine scientific research necessary for proper management of human activities that can affect the marine environment. The other chapters of this Assessment demonstrate how these disparities constrain the tasks of managing these human impacts. Capacities to undertake marine scientific research exist in most parts of the world …".

Throughout the WOA-I report and chapters, several gaps are identified, particularly in the following areas: physical structure of the ocean, oceanic circulations including sea temperature (both at surface and at depth), sea-level rise, salinity distribution, carbon dioxide absorption, nutrient distribution and cycling, biota of the ocean and human interactions with the ocean. The first provisional objective of the Decade, namely the one on multi-stressors, directly responds to this key conclusion of the WOA-I.

These conclusions will be particularly useful for guiding the formulation of underpinning scientific questions and themes of the Decade. They should be revisited during the preparation of the Decade Implementation plan.

The Second cycle of the WOA (WOA-II) was initiated in 2016 and should conclude by 2020. Again, it is expected that knowledge gaps will continue to be identified and should be included in the WOA assessment outputs. These should in turn be considered in the planning process of the Decade. Close interaction with the Regular Process Group of Experts will be pursued to ensure that these are integrated in the Decade planning.

The activities to be developed in the framework of the Decade should be seen as complementary and supportive to the Regular Process. The Decade does not have an assessment objective *per se* but will provide a coordinated framework for formulating research questions, conducting collaborative research, collecting and disseminating data, and building technical capacity, all of which essential building blocks are for the conduct of robust integrated marine assessments.

IPCC

The Special Report on the Ocean and Cryosphere in a changing climate (SROCC) established under the sixth assessment cycle of the Intergovernmental Panel on Climate Change (IPCC) will be finalized in 2019 and will further contribute to the assessment of knowledge gaps on the ocean-climate nexus to be considered under the Decade.

ANNEX 2: Linking Objectives with specific SDGs and their targets

The table below provides an overview of how the preliminary of the Decade support specific SDGs and their targets.

	STRATEGIC / SDG OBJECTIVES	SDG 1	SDG 2	SDG 3	SDG 4	SDG 5	SDG 6	SDG 7	SDG 8	SDG 9	SDG 10	SDG 11	SDG 12	SDG 13	SDG 14	SDG 15	SDG 16	SDG 17
Decade Preliminary Strategic Objectives	1. Knowledge of the ocean system		2.4		4.7		6.5		8.4				12.2		14.1 14.2 14.3 14.5 14.7 14.a 14.c	15.5		
	2. Evidence for ecosystems-based management and blue economy	1.5	2.4	3.9 3.d								11.b		13.1 13.3				
	3. Ocean-related hazards	1.5	2.4	3.d								11.b		13.1 13.2 13.3 13.b	14.2 14.3			
	4. Cooperation in observation, data and other infrastructure									9.5				13.3	14.3 14.5 14.a			
	5. Scientific and technical capacity and education	1.5		3.9 3.d	4.7 4.b	5.5	6.5		8.4	9.5		11.b	12.2 12.8 12.a	13.1 13.2 13.3 13.b	14.1 14.2 14.3 14.5 14.7 14.a 14.c	15.5		17.6 17.9 17.16
	6. Enhanced cooperation, coordination, and communication	1.5		3.d	4.7 4.b	5.b	6.5			9.b		11.b	12.8 12.a	13.1 13.2 13.3 13.b	14.1 14.2 14.3 14.5 14.7 14.a 14.c			17.6 17.7 17.16 17.18

ANNEX 3: Examples of Actions and Expected Benefits

This Annex provides examples of actions and their associated benefits for each of the Objectives given above; they should be seen as an initial draft and subject to further consultation and refinement through the preparation phase. They are an important element of the strategy since they provide concrete examples of how the Goals and Objectives will be achieved. The Implementation Plan will provide additional details.

Objective (I) Knowledge of the ocean system

The objective is intentionally broad and addresses both overarching Goals of the Decade.

The Special Report on the Ocean and Cryosphere in a changing climate established within the 6th Assessment cycle of the Intergovernmental Panel on Climate Change (due in 2019), and the Second cycle of the World Ocean Assessment that was initiated in 2016 and likely to conclude by 2020, will inform planning for activities under this Objective.

EXAMPLE OF ACTIONS

Action Ia Further develop and accelerate a coordinated program of research on ocean acidification.

Action Ib Complete a comprehensive eDNA sequencing of ocean life.

Action Ic Establish a small group of experts to consolidate requirements for ocean science stemming from the Regular Process, the IPCC Special Report on the Oceans and Cryosphere, Future Earth and SCOR, the WCRP, among others.

Action Id Document the potential impacts from environmental and climate changes on the established and emerging maritime industries, especially for LDCs and SIDS.

Action Ie Implement an integrated program of global and regional research on climate change impacts, including vulnerabilities in ocean health and in ecosystems and the services they provide, and into adaptation.

Action If Establish an initiative to greatly enhance uptake of ocean science knowledge at the science-policy interface, at global, regional and national levels.

Action Ig Complete mapping of the seabed, subduction zones and hot vents.

BENEFITS

- Oceanographic research and technological development guided by the identified needs of sustainable development and supported by governments and private sector, civil society and the broad public
- Provides a systematic pathway toward prioritisation against the high-level policy objectives.
- Maintains relevance and momentum toward the over-arching goals of the Decade.

- A sound scientific basis for policy-making and decisions in response to marine environmental and climate change.
- Scientific basis for adaptation strategies
- Complete mapping of the ocean conditions and resources, the bathymetry, subduction zones and hot vents.

- …

Objective (II) Evidence for ecosystems-based management and blue economy

This objective aims to develop a comprehensive evidence base (data and knowledge) in support of an interdisciplinary adaptive approach for ecosystem-based management. Targets include coastal zone management, coastal adaptation strategies, nationally determined contributions to the UNFCCC, management and regulation of fisheries, and establishment of marine protected areas. Emphasis will also be given to socio-economic aspects of sustainable use of the ocean and socio-economic research.

EXAMPLE OF ACTIONS

Action IIa Implement a global program of research on the well-being of the ocean, including the effects of cumulative stressors, land-based sources of pollution and abnormal nutrient loadings, anoxia, plastics, climate change, fishing, underwater noise, hazardous substances etc.

Action IIb Build a coordinated ocean productivity and biodiversity research program.

Action IIc Address the science needs emerging from the IPCC Special Report and the World Ocean Assessment.

Action IId Complete the implementation of a global biogeochemical profiling float array, with all data freely exchanged within the ocean community.

Action IIe Extend marine environmental services (physical, biogeochemical, ecosystem), including for satellite and other ocean data, so that they are accessible by all interested communities for management.

Action IIf Targeted scientific products supporting operations of maritime sectors

…

BENEFITS

- Improved evidence-based management of ecosystems in general and, specifically, substantially enhanced capability in LDCs and SIDS.
- Scientific evidence to improve the functioning of the ocean.
- A globally deployed integrated research program supporting all forms of ocean management.
- Science-informed Investments in sustainable ocean economy
- Greatly enhanced uptake of data and products for the purposes of ocean/marine management.
- …

Objective (III) Preparedness, response to and mitigation of Ocean-related hazards

The developing world and smaller economies are particularly at risk from ocean-related hazards and at present have limited scope for reducing vulnerabilities and prevention.

Ocean science, through an accelerated program of research supporting multi-hazard early warning systems, accompanied by improved community preparedness and awareness, can reduce risks from ocean-related hazards for coastal communities and people using the sea to derive their livelihoods.

EXAMPLE OF ACTIONS

Action IIIa Substantial improvement in warnings (lead-time and spatial specificity) for coastal hazards arising from extreme weather, including storm surges and extreme waves;

Action IIIb Increased capability to predict dangerous tsunami events, including those arising from unstable bottom layers (through better mapping of potential hazards);

Action IIIc Accelerate and enhance research on advanced warning of ocean hazards and risks, with focus on coastal communities.

Action IIId Complete the WCRP Grand Challenge "Regional Sea-Level Change and Coastal Impacts"

…

BENEFITS

- Saved lives, reduced risks and enhanced safety, security and prosperity
- Informed decisions for coastal management and planning.
- Resilient coastal communities in various ocean-related disasters

…

Objective (IV) Cooperation in observation, data and other infrastructure

In the context of the Decade, ocean infrastructure means the basic physical and organizational structures and facilities that are needed to support ocean science for the on-going sustainable development and the maintenance of the normal functioning and well-being of the ocean; Infrastructure enables ocean science, its application in dependent systems, and the use of ocean science for policy and decision making.

Ocean infrastructure includes observing networks (both sustained and research, in situ and remote), data systems (for information exchange in real-time and delayed-mode high quality), ocean models (e.g. coupled ocean-sea-ice-wave models), production systems (such as operational data assimilation and model forecast systems), communication networks (for effective and efficient exchange of information), service provision (for example, tsunami early-warning systems), as well as networks and mechanisms that facilitate cooperation and coordination in ocean science and its application.

Much of this infrastructure is developed and tested in research mode before being deployed in a sustained manner.

EXAMPLE OF ACTIONS

Action IVa Complete the implementation of a global biogeochemical profiling float array, with all data freely exchanged within the ocean community.

Action IVb Complete the initial deployment of a Deep Ocean Observing System, including support for the conservation and sustainable use of marine biological systems beyond national jurisdiction, and the mapping of bathymetry and benthic communities, including around subduction zones and hot vents.

Action IVc Complete a regional pilot project on low-latitude western boundary currents and associated biogeochemical and biological systems, led by the western Pacific Ocean community.

Action IVd Extend marine environmental services, including for satellite and other ocean data, so that they are accessible and usable by all interested communities.

Action IVe Establish a high-level expert group to guide the development of modelling and data assimilation infrastructure across the interdisciplinary span of ocean sciences.

…

BENEFITS

- Herald in a new era for biogeochemical oceanography, with global coverage by ocean colour satellites and BGC-Argo, and supported by systematic ship-based and other autonomous instruments.
- Introduce a break-through in cost-efficient, sustained observation of the deep ocean, encompassing all relevant variables and providing direct support to BBNJ discussions and negotiations.
- New major players introduced into the maintenance of critical infrastructure.
- Broader uptake and utilisation of ocean data and derived information.
- Transform to ocean-first and ocean-led infrastructure and expert guidance, working with other groups as appropriate.

Objective (V) Scientific and technical capacity and education

This objective is aimed at greatly improving the scientific knowledge base and transfer of marine technology to regions and groups that are presently limited in capacity and capability, especially SIDS and LDCs. Such a strategy will significantly enhance the opportunities and equitable access to economic benefits arising from marine resources and technology.

The objective also aims to increase literacy, training and education about the ocean and its seas, including in schools, for users of the ocean, and among policy- and decision-makers.

To meet the Goals of Agenda 2030 and agreements such as the SAMOA Pathway for SIDS, a business-as-usual approach will be inadequate.

Just as the Nationally Determined Contributions under the UNFCCC create a constructive feedback loop between national and international decision-making on climate change, the Ocean Decade will need to foster and articulate nationally determined contributions to Agenda 30 and other high-level ocean agreements and, to the extent such contributions are scientific and/or technical, or are applying science, they could be brought together under the banner of the Decade of Ocean Science as nationally determined contributions to Sustainable Development (in all its manifestations within the Decade). Marine technology transfer and other forms of capability growth would be afforded priority.

EXAMPLE OF ACTIONS

Action Va Strengthened and directed capacity building activities linked to technology transfer, including new technologies, and sustained observations with related training through research.

Action Vb Extend the community for ocean observations and data systems deeper into the developing world.

Action Vc Facilitate and coordinate a form of national determined contributions for Ocean Science for Sustainable Development to create a constructive feedback loop between national and international decision-making for sustainable development of the Ocean.

Action Vd Consolidation of the ocean science communities through communication, dialogue, and regular exchanges between governments and their agencies, other users of the marine environment and its resources, the public, and the different science communities, e.g. natural, social, economy, human health;

Action Ve An information portal responding to the new role of science in communication and use of scientific results, regularly providing and updating information on the state of the ocean to all stakeholders, hence supporting the UN Regular Process and its World Ocean Assessment, through available new communication and data assimilation technologies;

…

BENEFITS

- An acceleration of marine technology transfer and in the deployment of ocean knowledge, particular for SIDS and LDCs.
- Nationally determined contributions provide a mechanism to reflect each country's ambition for sustainable development of the Ocean, taking into account their circumstances and capabilities.
- The developing world more directly involved in ocean observations.
- …

Objective (VI) Enhanced cooperation, coordination, and communication

This objective seeks enhanced cooperation, coordination, and communication, including for ocean research and observations, with faster and more effective delivery of new and existing knowledge to policy and decision-makers. Considerable focus will be placed on infrastructure (observing networks and models), as well as on the data systems that make this information available to all.

EXAMPLE OF ACTIONS

Action VIa A partnership amongst like-minded institutions and agencies, working at national, regional and international levels, with strong cooperation, coordination; both within and outside the UN system.

Action VIb Establish a Reference Group for the Decade of Ocean Science to provide feedback and advice on progress.

Action VIc Strengthen the link of science, sustained ocean observations and ocean services to governments, management with related institutions, decision-makers and the science-policy interface, and the public at large.

Action VId Consolidation of the ocean science communities through communication, dialogue, and regular exchanges between governments and their agencies, other users of the marine environment and its resources, the public, and the different science communities, e.g. natural, social, economy, human health;

Action VIe Enhanced and transformed national arrangements and coordination of national activities for sustained development.

Action VIf A new generation of observing technologies for the ocean and its seas emanating from efforts of technologically developed and developing countries introduced into the Global Ocean Observing System (GOOS) for sustained observations, expanded to include more biochemical, biological, biodiversity and ecosystem related parameters, in support of ecosystem-based management;

Action VIg Use of the new generation of inter-compared coupled modelling tools for prediction of ocean conditions, including biological and biochemical parameters such as oxygen and pH, going beyond the existing abilities to describe the physical state of the ocean;

BENEFITS

- Delivers a whole-of-ocean community basis for the Decade.
- A new basis for stronger and more effective national arrangements
- Maintains relevance and momentum toward the over-arching goals of the Decade.
- …

ANNEX 4: Stakeholder Forum

1. Purpose

The overall formulation of the Decade's Implementation plan will be supported through two interlinked mechanisms, namely an Executive Planning Group (EPG) composed of appointed experts, and a Stakeholder Forum (SF) composed of institutional members representing various interest groups. The purpose of the EPG is to serve as an expert advisory body to the IOC governing bodies to support the development of an Implementation Plan for the Decade and the delivery of other activities needed to establish the Decade.

Whereas the Stakeholder Forum acts a consultative body to the IOC governing bodies and aims to engage a wide range of relevant stakeholders, it will provide inputs through the expertise, knowledge, data, information and capacity-building experience of its members on the work carried out by the EPG.

2. Principles for the Establishment of Stakeholder Forum

A Stakeholder Forum consisting of institutional members will be established following a call for expressions of interest and subsequent invitation from the IOC Executive Secretary. It is expected that UN bodies, non-UN bodies, NGOs, science focused organisations, donors/foundation and representatives from industry will be included. Membership will be open ended. It is expected that the Stakeholder Forum will meet twice in the course of the preparation phase and will also work through electronic communication.

Representatives of the EPG would be invited to the meetings of the Stakeholder Forum to share information, inter-act and receive inputs on the elements of the implementation plan. The Stakeholder Forum will act as both contributors and end-users of the Decade's implementation plan and will be composed of representative of institutions with a stake in ocean sustainability.

These may:
1. Contribute to the activities of the preparation phase through their experience, expertise, knowledge, data, information and capacity-building experience;
2. Use or benefit from the outcomes of the Decade;
3. Encourage and support the participation of scientists and knowledge holders in the preparatory work of the Decade.
4. Interact with representatives of the Executive Planning Group with a view to provide inputs to the design of the Implementation plan.

Members of the Stakeholder Forum could be clustered around 5 categories as follows:

Group 1: Ocean science and technology (these would include national, regional and international organisations, networks, associations);
Group 2: Ocean policy and sustainable development (these would include ocean policy setting institutions at national, regional and international, as well as representatives of UN bodies);
Group 3: Business and industry;
Group 4: Civil society and NGOs;
Group 5: Donors and foundations.

Meetings /timeline

Two physical meetings would be organised, back to back with the global meetings foreseen in the preparatory phase. Individual stakeholders will also have the capacity to participate in the regional workshops.

ANNEX 5: Interim Planning Group (IPG)

1. IPG Membership

The members of the Interim Planning Group have been selected by the Chair of IOC regarding their personal involvement and expertise in Ocean Science and Sustainable Development, as well as in intergovernmental processes and coordination and the science-policy interface.

Theses members are acting on their personal capacity.

The Interim Planning Group is composed of:

1. Craig McLean (NOAA, USA);
2. Martin Visbeck (GEOMAR & Future Earth);
3. Sue Barrell (Bureau of Meteorology, Australia);
4. Sigi Gruber (Head of Marine Resources Unit, DG Research and Innovation, European Commission);
5. Kristina Gjerde (IUCN);
6. Julius Francis (Western Indian Ocean Marine Science Association);
7. Representatives of UN Office of Legal Affairs/DOALOS/UN-OCEANS focal point).

2. IPG Role

The actions of the Interim Planning Group include:

- Develop a circular/initial communication on the status and next steps; key stakeholders outside the IOC should also be included. Through this communication, note that the Decade will be seeking preliminary guidance on potential activities and commitments and that a web page will be available to provide information and feedback. Communication will emphasise transparency.
- Develop an initial engagement plan for the Preparation Phase.
- Set up mechanisms for expressions of interest for hosting key preparation phase events like a Preparatory Committee meeting, regional workshops, etc.
- Consider and, if appropriate establish a process for nominations to the Planning Group. As noted above, it should be an open call but subject to the final decision of EC 51. Established channels to member states and the UN, and to partner bodies should be used to identify potential experts.
- Workshop some ideas around the financial structure. Options include dedicated lines (trust funds) in IOC and key partners (diversity is valuable), but also consider an option to have a separate legal entity established to work alongside other mechanisms.
- Begin drafting Principles for the Decade.

3. IPG Meetings

The Interim Planning Group will meet as often as necessary and at least once a month, via Skype meetings.

ANNEX 6. Elements of the Implementation Plan

This section provides an outline of the elements expected in the Implementation Plan for the UN Decade of Ocean Science for Sustainable Development. Most of these elements have been discussed in the previous sections. The elements are presented in the form of an annotated Table of Contents for the Implementation Plan. Pending further clarification of the need for this Plan to be endorsed (considered) by the General Assembly, additional UN context might be needed.

Many of the elements are more or less standard for implementation plans:

- Why the Decade exists, the overarching rationale and goals, and the high-level benefits of executing the Decade.
- What the initiative will do and accomplish in terms of actions, outputs and outcomes. The Decade is ambitious and transformative, in line with the 2030 Agenda.
- How the participants will go about planning, scheduling, resourcing and undertaking the various tasks in order to accomplish the objectives and goals.
- Where and when activities will take place. Initially, this will be high-level: global, regional or local/national; prior, early, middle or late in the Decade, or through the entire initiative.
- Who will be responsible, from the highest level of governance to contributions into projects?

The Implementation Plan is intended to bring surety into the execution phase and provide a systematic way for responding to issues and managing risk. It should also provide guidance on milestones and reporting, for individual projects and for the initiative overall, and for how progress and benefits will be monitored throughout the project.

1. Introduction

This section of the Implementation Plan will cover much the same material as the Introduction section of this Roadmap. The introduction may need to include additional IOC context (e.g., discuss the relationship with Main Line of Action 3 and the expected results as adopted by the 30th session of the IOC General Assembly) and UN background (e.g., some of the detail now included in Annex 1).

The Introduction should orient the audience in terms of documents and decisions that underpinned the development of the Plan and provide the audience with a high-level overview of the things discussed in the Plan and those that are not. It should explain the implication of a UN proclamation of the Decade; the term “Ocean Science” and what that implies for the scope; and Sustainable Development (building new scientific knowledge to inform sustainable development).

Finally, the Introduction should describe the broad structure of the Plan and point to any other documents that are needed to support the Plan.

2. Overarching goals and objectives

This section will be modelled on the section “Strategic Approach for the Decade” in this Roadmap, updated as appropriate based on consultation during the Preparation Phase. The overarching goals and strategic objectives should remain focused on change/transformation and not diverted to describing existing activities, no matter how worthy those activities are.

It is also important to remember that the strategy guides priorities or, if you wish, ensures a balanced approach to change with focus on the right things to achieve the transformation you want. Specific business as usual activities and regional initiatives should not appear in the goals. Avoid lists.

The actions and benefits can be global, regional or national, and they can refer to existing mechanisms that will be important for achieving the change. However, much of that detail should be in the specific plans below.

3. Structure and set up

This Roadmap recommends a structure for the Decade, but we should recognize there is no single preferred way of structuring such endeavors. This Roadmap attempts to balance the intrusion of intergovernmental process into the methods and processes of the Decade against the scientific appeal. Others may take a different view and it will be up to Planning Group to recommend the right structure.

4. Science Plan

For the purposes of this document we assume a single Science Plan covering the first three objectives which in turn will consist of several Research and/or Infrastructure Projects, each of which will develop a Plan of a similar structure to the Implementation Plan itself. The Research Project plans' goals, activities and benefits can build on those outlines, as appropriate, with some additional elaboration as outlined below. The Science Plan should describe how the component parts work together to deliver a balanced, coherent and synergistic Programme of research for the Decade.

Taking the dot points at the head of this section, each Research Project Plan of the Science Plan should:

- Discuss why the Project exists, its overarching rationale and goals and their relationship to the goals/objectives of the Decade, and the anticipated benefits of the Project (e.g., with respect to the Sustainable Development Goals).
- What the Project will do and accomplish in terms of actions, outputs and outcomes. These may be specified in terms of research sub-projects. The Decade is ambitious and transformative, in line with the 2030 Agenda, and many Projects are likely to be similar. We might anticipate only a small number of research Projects and perhaps just a single Research Programme. This part will often take the form of a series of scientific questions to be addressed.
- How the participants will go about planning, scheduling, resourcing and undertaking the various tasks (executing projects) in order to accomplish the objectives and goals of the Project, and the type of governance arrangements that will be put in place. If the Decade adopts a structure similar to **Error! Reference source not found.** then one anticipates Projects will largely follow that model (unless the Project pre-exists in another suitable form).
- Where and when activities will take place. Initially, this will be high-level: global, regional or local/national; prior, early, middle or late in the Decade, or through the entire initiative.
- Who will be responsible, from the level of Project governance down to contributions to individual projects?

We should anticipate that all levels of the governance structure will be responsible for managing risk and issues at their level. Dependencies beyond the control of a Programme should be monitored.

The Science Plan will be built and refined based upon a number of consultations with the scientific community to be undertaken in 2018-2019 (see "Engage, consult relevant communities and communicate about the Decade" above). Each Project Research Plan should be synthesizing the results of research activities undertaken within that Project and providing progress reports to the Programme.

Just as the Implementation Plan will not contain all detail, the Science Plan included with the Implementation Plan will be high-level and not contain all the detail of individual projects. However, a detailed Research Plan should exist for all Projects.

This part of the Implementation Plan is also likely to be a living part of the document. Programmes/Projects of work will adjust as commitments are made or withdrawn, as new ideas emerge, or when results dictate a change in direction. Those changes will normally be documented and managed at the Programme level unless they are of such a nature that the Decade itself will need to adapt.

5. Capacity Development Plan

Objective V and R&D Priority Area 7 (see section 2) both focus on capacity development and provides much of the background needed for this element of the Implementation Plan. The discussion on engagement in the "Preparation Phase" section is also relevant.

The objective is to greatly improve the scientific knowledge base, transfer of marine technology, and education in regions and for groups that are presently limited in capacity and capability, especially SIDS and LDCs. The Plan will provide detail on the strategy and actions needed to significantly enhance the opportunities and equitable access to economic benefits arising from marine resources and technology, including from Areas Beyond National Jurisdiction.

The Capacity Development plan has a longer-term view to facilitate improved scientific knowledge transfer to wider segments of society and regional/national governments, and to enable educational and capacity development opportunities in support of early career scientists.

The Decade Capacity Development Plan will need to be harmonized with the IOC Strategic Plan at least.

6. Communication and Engagement Plan

Guidance for this section is provided in the "Preparation Phase" sub-sections "Engage, consult relevant communities and communicate about the Decade" and "**Error! Reference source not found.**" above, though those considerations will now need to be extended to the Decade as a whole. We can anticipate Research and System/Infrastructure Plans to also develop communication and engagement strategies within their own remit.

This section should aim to provide some overall guidance and principles, particularly around issues such as "Decade" branding; designation of spokespeople; the need for dedicated resource(s); use of web-based and other modern forms of communications; etc. Linked-in or other networking tools could be investigated for the challenge of networking Decade scientists.

It is important to ensure several layers of engagement, like a tree with many branches, in which all the participants strive to expand the circle of involved participants, reaching out to more colleagues and networks, requesting them to continue to spread the message about the Decade and the opportunities it provides.

7. Establishment and Schedule

The preceding three Implementation Plan sub-sections describe the proposed major Programme areas of the Decade. One would anticipate each of those Programmes being established early in the Decade, particularly for Science/Research. The Planning Group may expedite this process by developing draft terms of reference for the Steering Committees and including those with the Implementation Plan.

At present there does not seem to be a rationale for a cross-cutting Regional Programme of work (though that may change after consultation). Each of the three Programmes outlined in sections 4 through 6 of the Implementation Plan will have global and regional aspects and will also identify national contributions to the Decade (many of these will have restricted national objectives and outcomes and so will not be contributing directly to the Decade programme of work but will be relevant to the overarching goals). Some of the regional intergovernmental bodies may coordinate regional contributions to one or more of the Decade programmes.

The Implementation Plan should include a Gannt Chart or similar device (e.g., a Decade equivalent of Figure 1) indicating key decision points, high-level milestones (e.g., Systems and Infrastructure Programme established, mid-term progress Report to UNGA, mid-term Review) and high-level reporting points.

8. Resource Plan

The section “Develop a resource mobilisation (business) plan for the Decade” above provides an initial outline of this section. Where Decade-specific mechanisms are to be established, they should be described in the Implementation Plan (e.g., a Decade Trust Fund).

By the end of 2019 there should be a much clearer picture of firm and provisional commitments to the Decade and so the Implementation Plan should be able to convey some sense of the scope and size of Decade activities and potential participation.

9. Monitoring progress and reporting

The Decade governing body, once established at the start of the Decade will be charged with monitoring and reviewing progress, and with reporting to key stakeholders, including the governing bodies of the IOC (annual) and the UNGA (perhaps biannual).

Monitoring, reporting and review will also be important at the level of Programmes and Projects, including at close-out (benefit realization).

Reporting should be standardized and functional. Typically, reporting will be against the specific goals (of the Decade, Decade Programme or Project; e.g., on track, with some minor issues/risks; major concerns); on resourcing (financial, participation, contributions, etc.) and on issues and risks that are

pertinent at that reporting level. Other forms of communication should be used to raise awareness of the details, such as important scientific break-throughs, implementation of new technology, etc.

The Decade should be reviewed at least twice, in year 5 and during years 9 and 10. The first review allows an opportunity to tune/modify the structure and governance of the Decade and to revisit objectives and activities. The latter review should focus on synthesis and benefit realization: to what degree is the Decade going to meet expectations and what lessons can be learned?

The UN Decade of Education for Sustainable Development (2005-2014) produced a final report and consideration should be given to the form of the Decade of Ocean Science closing report. A close-out Conference may be appropriate for the Science objectives.

ANNEX 7: SUMMARY OF INPUTS FOLLOWING CONSULTATIONS ON THE DECADE ROADMAP

A first version of the Roadmap (version 1.0, 6 February 2018) was reviewed by IOC Member States, UN-Oceans members and benefited from inputs by the Informal Planning Group established by the IOC Chair. Fifteen IOC Member States (Australia, Brazil, Canada, China, Colombia, Ecuador, Finland, Indonesia, Japan, Mauritius, Norway, the Philippines, Republic of Korea, Slovenia and the United-States of America) provided comments as well as several members of UN-Oceans. These ranged from general comments to very detailed observations and suggestions. A synthesis is presented in the tables below.

IOC MEMBER STATES

Process	Roadmap content/structure	Actions and expected benefits	Governance	Strategic Objectives	Resources Mobilization	Stakeholders engagement
1. Resource constraints will require more coordination with existing major international activities, programs and events. 2. Top-down/bottom-up approach: - Top down: large scale objectives that every Group and region of the world should support. Top down objectives of mapping, observing systems, and ecosystem monitoring, plus the inclusion of social science and capacity development. - Bottom-up: to encourage nations and regions to share their ambitions e.g. in regional conferences, based on more local needs. 3. Include IOC on-going programmes and projects in	1. Needs to be shortened and plainly stated, written for a broad audience/shorter version with more detailed information presented in one or more annexes. 2. Needs justification for an Ocean Decade (not because UN proclaimed it but because Oceans are in deep trouble. 3. Explain what problems the objectives, actions and benefits are trying to solve and match-up actions and benefits to consider which actions are providing the most important benefits. 4. Strategic objectives differs in the different IOC documents (IOC Assembly Resolution, Information note, and website).	1. Early focus on a smaller set of ambitious actions to meet specific goals is recommended (the set of actions are both broad and ambitious but in the same time, in some areas, very specific and driven by science projects such as e-DNA). / identify a limited number of clear achievable results at a global scale that have a measurable impact on society and policy. 2. Need stronger emphasis on societal benefits and costs (fisheries sector, hazard mitigation). 3. Focus not only on improved ocean information but also a diverse range of solutions (use the word "solutions").	1. PG ToRs have to be circulated ASAP. 2. Enlarge the scale of the PG. 3. IOC regional subsidiaries bodies should play a more important role in the preparation and implementation phase. 4. More clarity or illustration needed on the selection process of the groups and more transparency on the IPG actions and members.	General comments on the objectives (more detailed comments on each objective are given in another table): 1. Need to carry lasting benefits. 2. Need emphasis on socioeconomic aspects of sustainable use of the ocean and socioeconomic research (missing link in the debate related to the socioeconomic impact of MPAs, fishing at lower trophic levels, coastal regulations). 3. Focus on economic aspects. 4. Several well identified threats to the Ocean (acidification, marine litter, underwater noise and hazardous substances)	1. Mobilize existing funding mechanism (such as GEF) or create new ones. 2. Greater clarity about strategies for attracting funding are needed (IIOE-2 = "bad" example). 3. Establish ground level support for this initiative, and to ensure that it enables action.	1. Among several regional organizations, we miss CIESM - The Mediterranean Science Commission. 2. Inclusion of the private sector. 3. Different stakeholders may in some cases promote rather different viewpoints, not just politically, but also scientifically so IOC could play a role in promoting sound science, peer review and independence. 4. The plan to engage stakeholders in the process remains vague and seems reliant on communication rather than real engagement and consultation. consideration should be given to early engagement with stakeholders.

the Roadmap and in the Decade. 4. Add an IOC IP for the Decade in the IP. 5. Gather lessons learned from previous Oceanographic campaigns regarding what worked and what did not. 6. IOC could play a productive role in promoting the importance of regional indicators for assessment of ocean sustainability and management. 7. Providing support for mobility of junior scientists, and leveraging and connecting existing programs that are already aligned with the general objectives of the Decade is an effective way to move forward. Thus consideration should be given as to the preference between coordination and networking rather than “steering” and “top-down, structured”. The roadmap to its credit does raise the question as to which approach is preferable (in Section 3.2). This is a key question that requires early resolution. The coordination	5. Link specific Strategic Objectives with specific SDGs. 6. Link the Decade and related international conferences and organisations (OceansObs'19). 7. Even if it is not a Science or Implementation Plan, the Roadmap needs preliminary ideas on the "how" and the "who". 8. The Roadmap could use regional experiences (regional seas conventions, polar oceans)/examples where Ocean Science and Ecosystem-based management have been successfully combined to support societal well-being and sustainable development. 9. The Decade should be used to define the concept of sustainability. 10. Explain the difference between the decade and the world Ocean Assessment. 11. Include references to countries which lack basic infrastructure and knowledge in order to make them able	4. Usefulness of the list of examples of action and benefits (maybe arbitrary): concrete examples as tools of communication is good as long as they are conceived as examples and not as an exhaustive list. The list of benefits seemed to be less thoroughly prepared.		should be given more attention. 5. The two overarching goals could be made even clearer. 6. UNCLOS implementation should not be mentioned.		

should work towards common objectives and standards so that locally generated knowledge can be used globally.	to use the ocean in a sustainable manner. 12. Wherever it is appropriate for the 's' to be removed from the word 'ocean' it should be done, given IOC's motto, 'One Planet, One Ocean. 13. Inclusion of traditional knowledge, especially on behalf of indigenous people. 14. Add specific references to social science. This is especially critical for the transfer of knowledge and expertise to Least Developed Countries (LDCs) as specifically called for in the document.					

UN Partners

Process	Roadmap content/structure	Actions and expected benefits	Governance	Strategic Objectives	Resources Mobilization	Stakeholders engagement
1. The Decade would be instrumental in achieving sustainable development if it succeeds to avoid duplications and create synergies. 2. Consider gender and geographical balance in the Decade process.	1. Demonstrate to MS how ocean science could provide support to their ocean management issues and bring economic benefits. 2. Identify how the Decade could contribute to peace and diplomacy. 3. The Roadmap should emphasize the food production aspect recalling insecurity related to food and nutrition and migration affecting coastal communities. 4. The Roadmap should highlight land-based pollution issue and the role of Ocean in climate change as important issues. 5. The Roadmap should present the Decade benefits for UN processes.	1. The Decade should focus on delivering multiple breakthroughs and these breakthroughs should be solution-oriented (e.g. Marine Pollution). 2. The Decade should enable actions more than taking actions. 3. More synergies between research and capacity-development. 4. Detail benefits for fisheries management. 5. 3 areas for improvement: forecasting of extreme events, sub-seasonal forecasting and multi-decadal monitoring. 6. UNCLOS and UNFSA. 7. Development of national capacities for researching states and coastal state,	1. UN-Oceans represents a platform to coordinate inputs from UN agencies on the Decade.	1. Need to communicate on sustainable development as the overall objective of the Decade. 2. The Decade should focus on transitioning from observations to forecasting services (considering that transition is what managers need to take decisions around). 3. The Decade should identify priorities, focuses areas, efforts to be made with a lasting impacts to help policy-making-bodies. 4. The Decade should offer science solutions for policy decisions (acting on data information to management) to empower decision-makers. 5. We know more about the state of Ocean but also science is accessible to everyone through open	1. Need to mobilize resource for the Decade which otherwise may not work. 2. GEF suggested to promote Decade related commitments on science as part of GEF project partnerships. 3. The Preparatory phase needs to focus on resource mobilization.	1. Critical aspects of the Decade would be around its capacity to include developing States and to facilitate their participation in data management. 2. The Preparatory phase requires robust coordination arrangements to engage all stakeholders.

	6. Capacity-development should be embedded across all themes of the Decade.	including the development of capacity-building projects with a particular focus on SIDS/LDC. 8. The Preparatory Phase needs to refine specific Decade's outcomes with inputs from UN-Oceans and its members.		access to relevant data and information.		