WORLD ECONOMIC FORUM

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A New Vision for the Ocean

Ocean Systems Leadership and the Fourth Industrial Revolution

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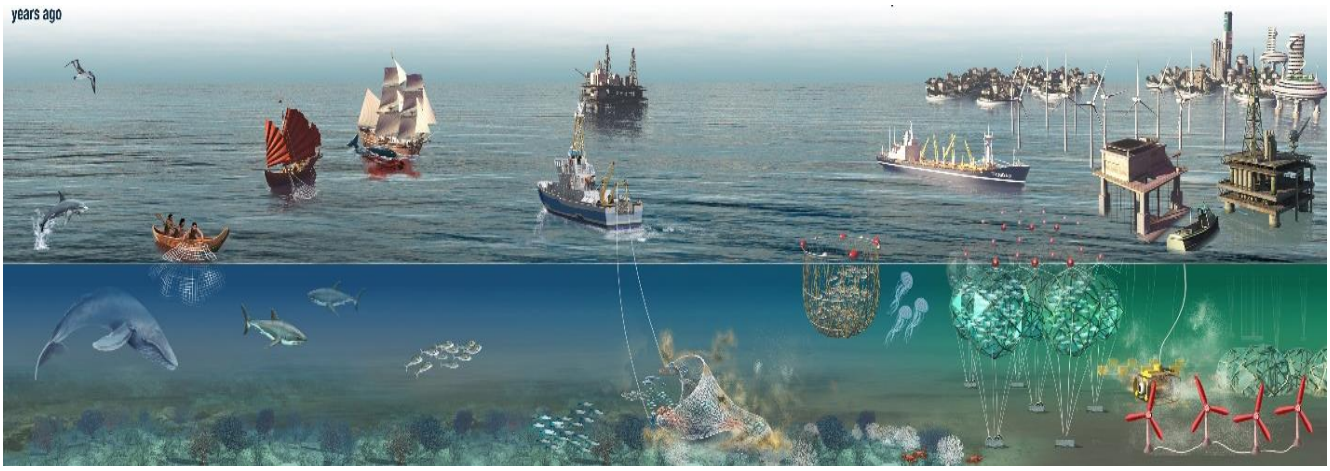

Our Oceans Matter

The world's oceans form one unique, vast and contiguous ecosystem. They provide:

- 70% of the Earth's surface area
- 97% of the Earth's water mass
- 80% of the Earths biomass
- 50% of the Earth's oxygen; and they
- Absorb 30% of the carbon dioxide produced by human activity

The oceans are responsible for much of the water we drink, the air we breathe and for the stability of our global weather systems.

They are a source of incredible natural beauty and scientific enquiry. The 1,243-mile long Great Barrier Reef, for example, is the largest living structure on Earth and can be seen from the moon. All of our major religions and mythologies since human endeavour began have referred to the combined serenity and power of the oceans. They sustain a mysterious, romantic pull on the human imagination, encouraging our deepest desire for exploration and quest. What lies under the surface or over the horizon? The romantic poet John Keats captured the universal pull of the ocean on the human spirit in his poem *On the Sea* – "*Oh ye who have your eyeballs vex'd and tir'd,/Feast them upon the wideness of the sea*"; this was a major inspiration for Herman Melville as he wrote *Moby-Dick*. Even today, knowing that we know more about the surface of the moon than we do about the ocean floor simply adds to the mystery surrounding this last great wilderness.

The oceans also provide the platform for much of the world's economic foundation. More than 90% of global trade by volume is carried by ships, more than three-quarters of the world's mega-cities are by the sea, and more than 3.5 billion people depend on the ocean for their primary source of food. The end-product value of commercial tuna alone is a $40 billion global industry. In fact, when one takes account of the 200 nautical miles of coast each nation is entitled to call their own territory, 83 of the 193 nations in the United Nation are more than 50% ocean. That is a powerful political and economic bloc.

Our Oceans Are Under Unprecedented Pressure

However, the health of our oceans is under unprecedented pressure. The drivers of these pressures mostly come from human activity in the form of pollution, overfishing and climate change.

Pollution

Eighty per cent of ocean pollution is from land sources, such as industrial and agricultural run-off, plastics pollution, heavy metals (especially mercury) from coal-fired power stations, and carbon dioxide and other harmful greenhouse gases from the transport sector.

As a result, ocean chemistry is changing faster than at any point in perhaps 300 million years, in particular due to the absorption through solution in seawater each year of around 30% of anthropocentric CO_2 gas pollution[1].The damage this is causing through rising acidification is creating an unprecedented and unpredictable impact on ocean life that cannot be easily reversed. Calcium carbonate structures, especially susceptible to rising pH levels, are found in a wide range of marine fauna. Antarctic pteropods, for example, an essential part of Antarctic's planktonic ecosystem, have already shown their shells eroded from this change in pH.

[1] International Institute for Applied Systems Analysis, Stockholm Resilience Centre and Stockholm University, *Global Commons in the Anthropocene: World Development on a Stable and Resilient Planet,* October 2016, https://www.iucn.org/sites/dev/files/globalcommonsanthropocene2016.pdf (draft paper).

In addition, about 10% of the world's estuaries are now classified as hypoxic (low oxygen) "dead zones", where nothing lives, due mainly to increases in nutrient-filled run-off from coastal cities and agriculture. Since the 1960s, these dead zones have doubled in size every decade and continued greenhouse gas absorption will likely worsen them[2]. Plastics pollution in the ocean is also now headline news, with the startling estimate released by the World Economic Forum that, unless checked, current rates of pollution would result in more plastic by weight than fish in our oceans by 2050[3].

Overfishing

Marine fisheries employ – directly and indirectly – about 200 million people. However, overfishing is contributing to the rapid decline of many fish species and fish stocks. The UN Food and Agriculture Organization (FAO) estimated in 2016 that almost a third of global fish stocks are overfished[4]. New technologies are allowing us to fish at an industrialized and indiscriminate scale. Global fishing by-catch – the unwanted fish, sharks, dolphins, turtles and seabirds also caught by nets seeking commercial catch – is thought to be as high as 40% by volume of the world's desired catch. In other words, for every 10 fish we catch for our human needs by weight, we trash four marine species. This is clearly unsustainable.

Illegal fishing

More worrisome still is the sheer scale of illegal, unreported and unregulated (IUU) fishing, which is a key driver of overfishing. According to analysis from the Pew Charitable Trust, there is a one in five chance that any item of seafood purchased nowadays has been fished illegally. IUU fishing is theft. It currently takes $24 billion a year of revenue away from nations where fisheries sustain important livelihoods, often in developing countries and small island states. This is about 20% of the $120 billion global seafood market[5]. As a result, the social and economic impact on indigenous communities dependent on fishing is profound. Iconic wild species such as tuna are most at stake. Some species, such as bluefin tuna, have seen populations plummet by over 90%, and some scientists have even suggested that, as a result, we may be on the brink of large-scale maritime extinction of particular species[6]. Nowhere else in the global food system are wild animals still hunted without any regulation. The illegal tuna fishing crisis has been termed the "last great buffalo hunt" by some, especially given the scale of industrial fishing that new marine technologies have enabled. History shows what happened to the buffalo.

> ***"In the past 500 years, more than 500 plant and animal species have been driven extinct on land. During the same time period, only 15 extinctions have been documented in the oceans. However, analysis of future extinction risk for marine wildlife suggests the good news is fragile. Many marine species have been recently rated by scientists as being at a high risk of extinction. In fact, if all such at-risk species were to go extinct in the near future, extinction magnitude in the oceans would approximate extinction values observed during the planet's last mass extinction. It seems in the oceans, we are sitting precariously on an extinction cliff."***
>
> *Douglas McCauley, UCSB*

Climate change

[2] Zielinski, Sarah, "Ocean Dead Zones Are Getting Worse Globally Due to Climate Change"*, Smithsonian.com*, 10 November 2014, available at http://www.smithsonianmag.com/science-nature/ocean-dead-zones-are-getting-worse-globally-due-climate-change-180953282.

[3] World Economic Forum, *The New Plastics Economy: Rethinking the Future of Plastics*, January 2016, http://www3.weforum.org/docs/WEF_The_New_Plastics_Economy.pdf.

[4] FAO, *State of the World Fisheries and Aquaculture*, 2016, http://www.fao.org/3/a-i5555e.pdf

[5] This is of course an estimate of the wholesale price when fish are landed - not at the end of the supply chain in the restaurant by which time the fish can be 10x this value

[6] McCauley, Douglas et al. *Marine defaunation: Animal loss in the global ocean* Science (2015)

Like CO_2, heat is transferred from the atmosphere to the ocean at the air-water boundary and the ocean is a primary storage medium for both. In fact, more heat is stored in just the first 10 feet of the ocean than in the entire atmosphere. Ocean temperatures are rising. According to NOAA[7], the average sea surface temperature has been consistently higher during the past three decades than at any other time since reliable observations began in 1880. We have to be thankful for the massive heat (and carbon) sink the oceans have provided for the Earth's environmental system. However, this function does not come without cost. Australian scientists, for example, in 2016 identified the worst coral bleaching event on record for the Great Barrier Reef – close to 70% of a 700-kilometre stretch in the north reef lost all its shallow-water corals, with an estimated recovery period of 15 years at least[8]. The absorption of all this heat into the ocean also creates more powerful storms.

Furthermore, as the oceans become warmer (and less saline in areas with significant glacial meltwater), global ocean currents can be disrupted through changes in the thermohaline circulation drivers. Changes in major currents has a knock-on effect to alter weather patterns. For example, the Gulf Stream alone has slowed down 30% in the past 50 years. The Gulf Stream is a delicate oceanographic feature with an outsized impact on creating moderate weather at relatively high latitudes in Europe. Continued perturbations to the Gulf Stream could change the climate in Northern Europe to be as extreme as that of Alaska or Antarctica.

Current Arrangements to Protect Our Oceans Are Proving Insufficient

Much of the foundational architecture for ocean governance and marine protection was developed over the past half century or so, such as the 1972 London Convention on Marine Dumping, the 1982 UN Law of the Seas and the 1985 Commercial Whaling Ban. These were – and remain – important global conventions and agreements to protect the ocean and its species. However, the world economy has changed radically in the past 40 years, creating more pressure – and more complex drivers of pressure – on the oceans systems as a result. As in other areas of global environmental management, it is not clear that existing arrangements developed in the late 20th century to protect the oceans and its species are enough to withstand the changes and accelerations that the 21st-century global economy is fuelling.

For example, the combined GDP of *emerging economies* now accounts for over 40% of global GDP, double its share since 1990. In 2013, despite the economic turbulence, emerging markets accounted for 68% of global growth. Goldman Sachs estimates that the emerging middle-income economies – and their rising middle classes – could account for close to 60% of global GDP by 2050. The Boston Consulting Group suggests that by 2020 Indonesia alone will add the equivalent of the population of the United Kingdom – 68 million people – to the global middle class. McKinsey & Company calculates that almost half the world's GDP growth to 2025 will come from 440 cities in these emerging markets; cities like Tianjin in China or Porto Alegre in Brazil. Many of these emerging cities are on the coast and their growth will be in addition to the 75% of the world's mega-cities which are already coastally located. The pressures on the oceans from this new geometry of growth will increase exponentially. Unchecked, there will be a rise in biological and human-made waste materials (fertilizer run-off, and plastics, in particular) spoiling estuaries and ocean ecosystems; there will be a rise in pollution from aquaculture, thereby driving food safety fears; and there will be further overfishing and IUU fishing in deeper waters.

Furthermore, the FAO estimates that global demand for food – in large part to sustain our growing urban global population – must increase by 60% in the period 2006 to 2050. In emerging economies, the forecast is 77%. To meet this rising demand, analysts calculate that the world's farming and fishing industries will need to produce more food in the next 20 years than they have done in the past 10,000 years of our agricultural history combined.

[7] NOAA (National Oceanic and Atmospheric Administration). 2016. Extended reconstructed sea surface temperature (ERSST.v4). National Centers for Environmental Information. www.ncdc.noaa.gov/data-access/marineocean-data/extended-reconstructed-sea-surface-temperature-ersst.

[8] Arc Centre of Excellence for Coral Reef Studies, James Cook University, *Scientists assess bleaching damage on Great Barrier Reef* [Media Release], 26 October 2016, https://www.coralcoe.org.au/media-releases/scientists-assess-bleaching-damage-on-great-barrier-reef.

As a result of these rapid changes and trends in the world economic system, the oceans today – and in the near future – face unprecedented, and systemic, stress. This is rendering the current model for ocean governance insufficient to the scope, scale and urgency of the pressures oceans now face.

- **Scope:** The issues facing our oceans have never been more complex and interrelated, ranging from overfishing, plastics pollution and widespread nitrogen and phosphate pollution from ill-managed agricultural/industrial activities being washed into the sea and accelerating the rise of so called ocean "dead zones" through to the rapid growth of new market developments in seabed oil and gas, bio-engineered fish and ocean energy sources, as well as sea-level rise. With this complexity comes the need to engage multiple stakeholders across the public, private and civil society sectors into new forms of collaboration to resolve these challenges. Governments and international organizations alone are not able to provide the scope of solutions the oceans require.

- **Scale:** The issues facing the oceans today manifest themselves not only local and regionally but increasingly as systemic global challenges. For example, coral reef bleaching in the Pacific due to ocean warming, with its impact on local reef ecosystems and livelihoods, requires a global multi-country and multi-sector response. It is time to consider the oceans more like we do the atmosphere, a shared global resource that flows into, through and out of national jurisdictions. Air and ocean pollution are both now dominated by greenhouse gas emissions. Along with warming the atmosphere and water, wind, weather and ocean patterns are changing, going as far as changing the thermohaline circulation that creates global perturbations in the atmospheric/oceanic system with major regional impacts (shifting monsoon patterns, for example) and requires a global multi-country response to the challenge of polar summer ice melt. And the rapid rise in illegal, unreported and unregulated fishing, which takes $24 billion a year of revenue away from nations where fisheries sustain important livelihoods – often in developing countries and small island states – requires a global public-private response to bring traceability across global supply chains.

- **Urgency:** Many of the issues facing the oceans today are reaching non-linear tipping points, according to Earth systems scientists. The overfishing crisis is so severe, for example, there are warnings of the imminent collapse of certain fish stocks and the possibility of large-scale marine extinction events becoming increasingly likely as a result. The change this will create in marine ecosystems – and the recovery time required to return to normal – is unknown. Forthcoming analysis for the World Economic Forum suggests that across today's global ocean system we may face 25 tipping points where urgent action is required.

A New Approach Is Needed

The 2015 Paris Agreement on Climate Change and UN Sustainable Development Goals (SDGs) both recognize the vital role oceans play in our climate and economies, and the need to alleviate the pressures on them. SDG 14 on oceans, and its associated targets in particular, sets out a much-needed ambition for change by 2030.

SDG 14 sets out laudable and important targets for ocean health. However, given the criticality of the ocean to our environmental and economic system and the unprecedented scope, scale and urgency of the pressure the oceans are facing, it is clear that a transformation in how we deliver the improvement we need is required.

Specifically, to help meet SDG 14 and its targets, is there a way in which to radically rethink how we might both conserve and sustainably use the oceans? What kinds of multistakeholder platforms and alliances can be adopted and scaled, particularly those involving developing and small island ocean economies? How can such platforms and collaborations be designed with SDG 14 and its targets at their core to accelerate delivery on such a dual "protect and produce" agenda for the oceans? How might the latest science and technologies be harnessed to help achieve this and to ensure illegal activities are eradicated? Where might one start, given the complexity and urgency of the challenge?

SDG 14: Conserve and sustainably use the oceans, seas and marine resources

Targets

- By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
- By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans
- Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels
- By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics
- By 2020, conserve at least 10% of coastal and marine areas, consistent with national and international law and based on the best available scientific information
- By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation
- By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism
- Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, 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
- Provide access for small-scale artisanal fishers to marine resources and markets
- Enhance the conservation and sustainable use of oceans and their resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want

The good news is that these types of challenges are not unique to delivery on the ocean's SDG alone.

Multiple industries, regional and global agendas are facing similarly complex challenges. In particular, there is a rapidly evolving scientific and technological context within which governments, business and civil society are all having to rethink their traditional approaches to building governance frameworks, developing policy principles and delivering projects and sustainable business models to meet the 2030 Agenda. For example, to meet SDG16 how does one ensure Peace, Justice and Inclusivity in an era of

mass digital data and rising cybercrime? To meet SDG8 on Decent Work and Economic Growth, how does one address the risk that robots may erode many of the 450 million new jobs we will need by 2030? To deliver SDG3 on Good Health and Well Being, will the health systems of 2030 be more inclusive or more unequal with the rise of personalized medicine?

The World Economic Forum has termed this societal transformation the Fourth Industrial Revolution (see overleaf).

The Fourth Industrial Revolution may well be the most transformative force affecting the 2030 Agenda, including for SDG 14. This is because the potential of the Fourth Industrial Revolution to transform how we manage and govern the environmental commons – as well as our economic and social networking models – appears unprecedented. The rapid expansion of new environmental networks and movements will promote radical data transparency, which will leverage ever more powerful digital platforms for social connectivity and information sharing. Furthermore, there are, and will continue to be, rapid, unprecedented advances in data processing and technology innovation by 2030 that will generate vast new data flows. This will support and accelerate the expansion of new global and regional monitoring programmes, as well as innovations, for the environmental commons. A digital revolution in the global oceans agenda, in particular, could be just around the corner.

However, a new generation of public-private collaboration in the global interest will be required to harness these forces of the Fourth Industrial Revolution to maximize their potential for serving the ocean public good, provide a transformative delivery focus for SDG 14 and minimize the downside risks these technologies might present. This is the role that the World Economic Forum, as the international organization for public-private cooperation, seeks to play in advancing the global oceans and SDG 14 agenda. By helping public, private and civil society stakeholders around the world to harness the potential of the Fourth Industrial Revolution – maximizing the possibilities it offers and minimizing the risks it presents – a New Vision for the Ocean could be manifest.

The Fourth Industrial Revolution

The shift in economic power and great acceleration in middle-class growth, consumer demand and urbanization over the past few decades has also coincided with extraordinary progress in communications and technology. This has enabled societies to become more connected and have more data to a degree impossible to conceive even just 25 years ago at the time of the first Earth Summit. For example, the very first web server and browser were created by Sir Tim Berners Lee in 1990, email barely existed in 1992; today, 46% of the world's population uses the internet, with half of these users in Asia and China. In 2000 just 12% of the world's population had a cellphone subscription; now the figure is about 70%, with 2 billion of these subscriptions in China and India. Use of the internet continues to grow rapidly, with mobile internet traffic in particular accelerating at more than 60% a year, an astonishing growth rate when one considers exponential trends. To this end, the smartphone has become an essential; there are about 6 billion smartphones in the world and about 2 billion subscribers, according to the Pew Research Centre; technology companies estimate there will be 5 billion smartphone subscribers before the end of the decade – 87% of US millennials say that the smartphone never leaves their side and 44% say they use their camera or video function daily. One result is the exponential growth of social media and peer-to-peer communication. Since its launch in 2004, Facebook now has over 1.4 billion regular mobile users and WhatsApp – created in 2009 – sends *30 billion* messages a day. News about celebrity gossip – or ocean pollution–travels fast.

The ever-accelerating growth in processing power and technology capabilities is having a profound impact on our ability to collect and process complex data. A standard tablet device today possesses the equivalent processing power of 5,000 desktop computers from 30 years ago, while the cost of storing information is approaching zero (storing 1GB costs an average of less than $0.03 a year today, compared to more than $10,000 20 years ago). This has completely flattened the costs of processing information. The first human genome took more than a decade to sequence, at a cost of $2.7 billion. That was 15 years ago. Today, a genome can be sequenced in a few hours and for less than $1,000. The first app only appeared in 2008 when Steve Jobs, the founder of Apple, enabled outside developers to create applications for the iPhone. By the end of 2014, the app industry was worth $100 billion – more than the global film industry.

The World Economic Forum terms this explosion in access to a ubiquitous and mobile internet, by smaller and more powerful sensors that are becoming ever cheaper, and characterized by artificial intelligence and machine learning, as the Fourth Industrial Revolution.

"We are nearing a turning point for our oceans. Incremental approaches will not be sufficient to reverse current trends. From my perspective, four areas are particularly promising: We need to build and strengthen multistakeholder partnerships that can bring relevant actors together around common solutions. We need to support effective governance. We need to scale innovative financing, including, for example, private impact investments, blue bonds and debt-for-nature schemes. Finally, we need to leverage technology."

Naoko Ishii, GEF

A New Vision for the Ocean

To unlock the power of the Fourth Industrial Revolution for the Oceans SDG agenda, we suggest a New Vision for the Ocean will require three broad dimensions of public-private activity:

- New alliances to spur innovation
- New finance models to stimulate and support innovation and action
- New public-private partnerships to turn innovation into action

New alliances to spur innovation

There are many areas of scientific, NGO and business innovation occurring within the ocean community. However, to unlock the full potential of the fast-moving science, data and technology sector to offer greatest benefit for the global oceans community to innovate, make decisions and govern, something new in the oceans agenda is required.

This could be an **Ocean Data Alliance**.

> ***"New developments in marine science and technology (such as advanced robotics capable of operating at extreme depths and pressures), as well as novel governance arrangements put into place under the United Nations Convention on the Law of the Sea (UNCLOS), will enable these resources to be converted from natural assets into financial assets and help contribute to a just and equitable international economic order."***
>
> Michael Lodge, Secretary-General, International Seabed Authority

The Ocean Data Alliance is a global alliance of leading companies, governments, universities, NGOs and civil society groups working together to develop and implement open-source solutions that provide the data needed for comprehensive monitoring of ocean resources – above the surface, on the coasts and in the deepest depths – to empower innovation, coordination and collaboration across the world to manage and preserve the diversity of life in the oceans for generations to come.

There are some notable first-mover data and technology innovations in the oceans agenda, such as Global Fishing Watch and Pew Charitable Trust Eye on the Sea. These excellent initiatives use satellite imagery from specific partner companies to help coastguards and the public to see what's going on it terms of illegal fishing. However, there is vast potential for these – and other, future – applications and initiatives to be continuously augmented, by integrating many times more data from many more sensors above, on and below the sea; especially given the pace of technology change (the use of lower-height drones to measure ocean activities rather than satellites, for example) and the scale of increase in data and data processing potential that will become available over the coming years. If this pool of ever-increasing data on the oceans can be effectively collated and harnessed, exponential improvements in its use can be unlocked, innovations created and huge value for governments, enterprises, the public and the scientific/policy-making community can be yielded.

"Today's ocean governance is patchy and fragmented leaving many loopholes and an uneven level playing field for the stakeholders involved (government, industry, civil society). Most of the times we are trying to solve the same problems in isolation. Stakeholders should come together to ensure that science and knowledge are being shared; information sharing, coordination and cooperation be transformed from words into actions; we find ways to put a value on nature as a basis for ocean conservation; and that we work closely to fill in the governance gaps. These are big tasks that require joint action, this is the only way forward."

Maria Damanaki, Director of Oceans, The Nature Conservancy

However, the wide amount of data on the oceans that is currently available and that will rapidly become available over the next decade needs a place – an open-access platform – to be able to be integrated. And this platform does not yet exist; it needs to be designed and built for the global good.

This is the first task of the Ocean Data Alliance. To both support these first-mover innovations and pump-prime the wider market place for ocean data applications, the Ocean Data Alliance will spur an unprecedented public-private initiative to design and build by 2020 an open-source integration platform – an Open API[9] for all ocean-related data, such that many oceans apps can be created or augmented, each one drawing from a growing pool of common ocean data and each one designed, targeted and continuously upgraded to meet the needs of multiple different use cases or end users (customs officials, governments, companies, scientists, etc.). Multiple business models, as well as open-source partnerships for the public good, can be yielded as a result.

The Ocean Data Alliance will seek to design and build this open-source integration platform for all ocean data and to ensure that it is geared from the outset to serve the global public interest. The key will be to encourage collaboration among all the key sensor enterprises to catalyse the process of integrating their data from a range of sources. With a design concept – a blueprint – in place for the integration platform, app designers and large data processers such as IBM Watson can then engage in public-private "design labs" to work with various oceans and fisheries stakeholders from across industry, research and government to find out exactly how best they may want to use the data streams on offer. For example, the design process would identify which data feeds are of most use, who the identified end users are, which behaviours need to be focused on to change as a result, and what the targeted access rights should be for a particular innovation (globally open access versus closed for a particular enterprise's value chain). From such a process, waves of ocean apps drawn from the open-access API can emerge.

Those who have developed technology initiatives already in the oceans agenda would benefit greatly from this data integration initiative and also make the most of their first-mover advantage. For example, existing initiatives could regularly upgrade their offerings through enhancing optionality with new imagery sources as they become available to the platform. This will turn first-stage technology projects into continuously upgradable apps.

With a strong public-private dimension to the build of the open-source integration platform, specific government or international organization stakeholders will also be supported to co-design apps that suit their own particular user needs and capacities, with further support to train their staff in the capabilities to use the apps they co-design to better manage their ocean resources (or regional or global organizations if engagement from RMFOs, or international organizations like FAO, UNDP, UN Environment and IUCN etc.).

[9] API (or Application Program Interfaces) are a set of routines, protocols and tools for building software applications. An API specifies how software components should interact.

Citizens, research organizations, civil society groups, investors, insurers and enterprises across the world will also be able to access and contribute to such an open-source integration platform (much ocean data is held by individuals and smaller organizations). This will create a self-improving system for global ocean data and enhancing the platform's use both in the global public interest as well as for a slew of new business model and government innovations.

As a consequence, creating such a platform will mean there will, literally, be no place to hide for those who perpetrate IUU. Governments, harvesters, retailers, NGOs and the public will be able to generate targeted management approaches, initiatives and partnerships to address full traceability. The platform can also offer a system that can be integrated with traceability laws in China, the Republic of Korea and Japan too, as well as what e-commerce firms may need. The potential for rapid, systemic change to help meet the SDG is huge.

A first group of companies and institutions have expressed interest to form and help develop the Ocean Data Alliance. They include machine-learning data processors (e.g., IBM Watson); satellite providers (e.g., Digital Globe, Planet Labs, Spire); academic institutions (e.g., Woods Hole Oceanographic Institute, UC Santa Barbara's Benioff Ocean Initiative, Data Science for Social Good Europe); international organizations (e.g., FAO Fisheries Division, UN's International Seabed Authority, UNDP's Ocean Program); and civil society organizations (e.g., The Nature Conservancy's Ocean Program).

The concept of the Ocean Data Alliance will be discussed at the UN Ocean Conference in June 2017. It will seek to use the demand expressed for full traceability of tuna (as evidenced by the more than 40 global companies endorsing the Tuna 2020 Traceability Declaration) as its first use-case to work on, broadening its scope thereafter.

As part of its support to the oceans agenda and SDG 14, and in its capacity as the international organization for public private cooperation, the World Economic Forum, through its Environment and Natural Resource Security System Initiative, will commit to lend its platforms and networks – including its oceans initiative at the Center for the Fourth Industrial Revolution in San Francisco – to help the parties who form the Ocean Data Alliance develop the open-source platform described above. This will include hosting and incubating the Ocean Data Alliance at the World Economic Forum, supported by a small secretariat to support the process.

New Finance Models

"The global ocean is an open-access resource that lacks investment in activities necessary to protect and sustain the marine environment. This funding gap can be addressed through a fresh approach that assesses ocean risks and identifies a broader range of finance opportunities that the global ocean as the largest habitat on Earth provides."

Torsten Thiele, LSE Institute of Global Affairs

Today, less than 5% of our oceans are imaged or sensed using satellite data. Satellite and drone vendors do have small contracts to image and measure parts of the oceans for specific purposes, but no one is monitoring large parts of the ocean consistently and that leaves human impact hard to measure except through infrequent surveys with small sample sizes. The creation of a sustainable business model by which the entirety of the oceans can be surveyed regularly, and areas of "high value" (e.g., with vessels or other activities) which can be collected for shared intelligence, will be an essential complement to the Ocean Data Alliance's work on building an open-source integration platform for ocean data.

The **Ocean Data Fund** will provide that payment guarantee to data service providers for their collection of data over the oceans. This guarantee will cut the risk for new data providers, creating market

investment incentives to launch new companies and capabilities. The fund will also invest in cloud-based storage and high speed analytical capabilities to transform ship beacons, radar, images, spectrum and other data types into industry-standard data attributes that can be published in open formats. These can be shared with governments, NGOs, universities and other commercial entities by direct data downloads and API access via the open-source integration platform that the Ocean Data Alliance will create.

To capitalize on the Ocean Data Fund, the Ocean Data Alliance seeks a combination of foundation grants, government contributions and at-risk capital repaid through a coupon. The initial fund will need to be capitalized to incentivize the production of data. This could either be a one-off bond, a rolling funding facility or capitalized via multilateral climate funding and/or long-term infrastructure capital. Repayment of the coupon could come through production sharing agreements with the organizations that develop the new data capabilities the fund acquires, verified through block-chain provenance.

A community of interested public and private sector financing partners are sought to help design and potentially capitalize this transformative Ocean Data Fund.

As part of its wider function to host the Ocean Data Alliance secretariat, the World Economic Forum will also provide its platform and networks to help develop and capitalize the complementary Ocean Data Fund.

New Alliances for Governance

> ***"That's part of what makes me see indigenous people as the best guardians of our natural world. They have been living in harmony with nature for thousands of years, their traditional knowledge and cultures firmly rooted in their environment. Their stories are the stories of the forests, of the oceans, of the planet. Not only does their livelihood depend on these lands and waters, but so does their identity."***
>
> Céline Cousteau, documentary film director and explorer

With the emergence of the open-source integration platform and the Ocean Data Fund, the remaining area of effort for the Ocean Data Alliance will be to help ensure that governments in developing countries and small island states gain maximum benefit from these new technologies and public-private architectures designed to transform efforts to meet the SDG 14 targets.

To this end, the Ocean Data Alliance will seek to work in particular with governments such as **Fiji** and **Kiribati** in the Pacific Ocean, **Mauritius** in the Indian Ocean (leveraging its role as host of the Commission de l'Océan Indien) and **Grenada** in the Caribbean (leveraging its role as chair of the Small Island States Forum). This will create a unique small island states government network, which can help the alliance co-design technology, data and traceability products from the open-source integration platform that suit their specific needs and capacities in terms of IUU tuna/traceability. Such partnerships will also enable the alliance to leverage – and provide support and capacity for – its requisite civil service, research and university departments.

"There is no doubt that amongst the 10% of the Earth's population that relies on fisheries and aquaculture for their livelihoods are some of the richest and most successful people and peoples of the Earth. However, amongst this part of the population, probably 90% of the total number of people involved in fisheries, we also find some of the poorest and most vulnerable people and peoples of the Earth. This is partly because here we find some of those that were left behind during the early phases of the Industrial Revolution but also some of those that face the greatest environmental and political challenges of our era, climate change, sea-level rises, land-based pollution, over-fishing, nutritional deficiencies, migration and refugee pressures to name the best-known ones"

Arni Mathiesen, FAO

These efforts can help find out exactly how best the government in question may want to use the datastreams on offer, e.g., which data feeds are of most use, who the identified end users are, which behaviours need to be focused on to change as a result, and what the targeted access rights should be for a particular innovation as a result (globally open access versus closed for a particular government intelligence need). Training courses, technology transfer and capacity-building programmes can then be developed from such a process, as well as bespoke government apps to equip each government with the skills and resources required to make best use of the open-source integration platform and the Oceans Data Fund. These workstreams associated with the Ocean Data Alliance could attract more standard overseas development assistance capacity building funds, etc.

In time, as the open-source integration platform takes shape, the servers and back-up facilities for the data that will be created for the platform could also be located across these partner island states, thereby ensuring that the technology and expert infrastructure containing the information on the world's oceans becomes located in and across some of the world's grand ocean states.

Conclusion

"The ocean is the world's biggest and most important asset – accounting for 72% of the world's surface, having more species than land and essential for our whole ecosystem – and it is treated as a toilet that we over-fish to feed us. It is now on a precipice. Unlike previous revolutions, which unknowingly damaged the oceans, the new wave of technologies when coupled with the awareness of people who can affect change, can create a revolution to heal the oceans and help humanity."

Ray Dalio, Bridgewater Associates

The pressure on our oceans calls for a transformative public-private agenda to accelerate delivery on SDG 14. To help meet the challenge, this paper sets out some first concepts for a New Vision for the Ocean. Harnessing the potential of the Fourth Industrial Revolution, this new vision involves at its heart the creation of a unique public-private Ocean Data Alliance which will: (1) design and develop a new open-source integration platform for all global oceans data, using the commitments made by companies and others in the Tuna Traceability Declaration as a use case, publicly accessible for reference or to drive value and innovation; (2) work with others from the financial and investment community to create an Ocean Data Fund to provide a market for the global ocean data that developers need; and (3) design in partnership with interested governments a programme of support

and capacity-building to help small island states benefit the most from these innovations and, ultimately ,become the hosts and custodians of the world's ocean data.

These ideas will be discussed at the UN Ocean Conference in June and partnerships will be built accordingly. Sponsors will be sought to help resource this growing initiative, which the World Economic Forum will host, at least through to 2020. More details on the Ocean Data Alliance and its work will be provided at the Our Oceans Summit in Malta in October 2017.

For more information, or to join the World Economic Forum's Ocean Programme, please email: oceans@weforum.org