



OCEAN / MARITIME CLUSTERS: Leadership and Collaboration for Ocean Sustainable Development and Implementing the Sustainable Development Goals

World Ocean Council White Paper

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Acronyms

BTCA	BlueTech Cluster Alliance
ETG	Economic Transformations Group
ENMC	European Network of Maritime Clusters
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GPP	Green Port Program
GSE	Global Center of Expertise
GSP	Green Ship Program
GTP	Green Technology Program
IMO	International Maritime Organization
IOC	Iceland Ocean Cluster
MPA	Maritime and Port Authority of Singapore
MSGI	Maritime Singapore Green Initiative
NCE	Norwegian Center of Expertise
NMBMC	Nelson Mandela Bay Maritime Cluster
NMMU	Nelson Mandela Metropolitan University
NOx	Nitrogen Oxides
NOK	Norwegian krone
R&D	Research and Development
SDG	Sustainable Development Goals
SIDS	Small Island Developing States
SOx	Sulfur oxides
LCD	Least Developed Countries
WOC	World Ocean Council

Executive Summary

The world depends on the ocean for trade, transport, energy, food, tourism, recreation and many other goods and services. At the same time, the ocean faces multiple challenges due to increasing pressure from human impact, e.g. plastic pollution, overfishing, ocean acidification, etc. Through the U.N. Sustainable Development Goals (SDGs) the world pledged, in SDG 14, to “Conserve and sustainably use the oceans, seas and marine resources for sustainable development”.

Ocean/Maritime Clusters can and must play a major role in advancing ocean sustainable development. Research and analysis of eleven Ocean/Maritime Clusters by ETG indicates that the way forward is a focus on business growth and investment opportunities for responsible, sustainable ocean use (sometimes referred to as the “Blue Economy” and “Blue Growth”), which considers the intersection of ocean economic benefits, environmental health and societal value in policies and best practices. By combining purpose in innovation, competitiveness-productivity-profit and environmental impact, Ocean/Maritime Clusters can lead ocean sustainable development and realize economic benefits.

This paper highlights the opportunity to develop Ocean/Maritime Clusters as a key part of achieving ocean sustainable development and implementing the SDGs. The research indicates that four key concepts underpin success for sustainable ocean/maritime clusters:

1. Leadership
2. Action
3. Cluster Environment
4. Value Proposition

The case studies presented in this paper highlight Ocean/Maritime Cluster best practices which demonstrate success factors rooted in collaborative action, key partnerships with government support, and value-adding through innovation. By pinpointing Ocean/Maritime Cluster best practices, we are working to enhance the exchange of knowledge and provide a platform for expansion of Ocean/Maritime Clusters to advance ocean business community leadership and collaboration and in achieving ocean sustainable development.

Key recommendations for organizations working to advance the role of the business leadership and collaboration in ocean sustainable development:

- enhance and expand the role of ocean/maritime clusters in implementing sustainable development
- accelerate the networking of ocean/maritime clusters for collaborative learning and action in support of sustainable development
- support the development of ocean/maritime clusters for developing countries and small island developing states

1. Introduction

The World Ocean Council (WOC) has been working to advance global ocean business community leadership and collaboration for developing industry-driven solutions to ocean sustainable development. This includes encouraging Ocean/Maritime Clusters to focus on sustainable development and facilitating international interaction among Ocean/Maritime Clusters to address ocean sustainable development. ETG, a leading cluster economic development consulting firm working globally, is supporting WOC in this effort. ETG helps leaders, companies, industry organizations and institutions come together around ocean sustainable development and competitive economies by developing the dynamic business engine that Ocean/Maritime Clusters can provide.

The Future of the Ocean – a Global Challenge

Ocean ecosystems health is declining due to increasing pressure from human impacts and global change and while the ocean is providing an ever-increasing level of goods and services upon which humanity and the global economy depend. The Sustainable Development Goals (SDGs) recognize these twin challenges in Goal 14 **“Conserve and sustainably use the oceans, seas and marine resources for sustainable development”**. Countries, communities and companies are increasing their efforts to understand and address the challenge of ocean sustainable development.

What are Ocean/Maritime Clusters?

Ocean/Maritime Clusters are geographic concentrations of similar or related maritime firms - such as shipping, seafood, marine technology, and/or port operations - that share common markets, technologies, worker skill needs, and are often linked by buyer-supplier relationships and operate in close interactions with another directly and through multiple networks¹. Larger companies use these networks to improve their efficiency and engage a networked economy. In some cases, Ocean/Maritime Clusters have emerged as organizational entities that aim to enhance the competitiveness and collaboration among their ocean/maritime company participants, related institutions, and other stakeholders. In addition to providing a platform for the companies in maritime sectors that are related to each other, Ocean/Maritime Clusters may link all companies and/or organizations within a specific sector.

At the core of the cluster are companies producing key products, such as vessels built by the shipbuilding industry, or shipping companies providing maritime transport, or seafood processors and their products. Shipping companies, ports, and offshore industries form a complex and diverse network together with their contractors, subcontractors and co-operators. Linked to this are the technology providers who develop the tools and equipment for the

¹ Viederyte, Rasa., Maritime Cluster Organizations: Enhancing Role of Maritime Industry Development, Procedia, social and behavioral sciences, 81,01 Jun 2013; 624-631., Elsevier B.V., 23 Jul 2017.

companies in the network. The cluster also includes a multitude of companies, starting from supporting industries and producers of different special services such as education, research, classification, and financing services.

Competitive advantages are generated in the interplay between companies, further increasing the quality of related and supporting sectors - creating favorable conditions to mutually reinforce the Ocean/Maritime Cluster ecosystem. Promoting Ocean/Maritime Clusters can deliver added value including higher income and employment level, sustainable consumption and production, and the effective functioning of many industries in support of overall sustainable development.

Ocean Sustainable Development

The ocean represents an estimated \$1.5 trillion in global value added, yearly². Regional and global economies depend on healthy oceans; from large-scale fisheries to subsistence fishers; from international luxury hotel chains to the 3 billion people dependent on seafood as their primary source of protein. In addition to those economic contributions, the intrinsic value of the ocean is deeply rooted in the cultural, spiritual, and scientific benefits of the ocean.

Business leaders and decision-makers are increasingly recognizing the value-added advantages of collectively engaging companies and industries through clusters and adapting the cluster business model towards sustainable development. This comes both from a competitiveness point of view and from concern about sustainability.

This document highlights how clustering practices by Ocean/Maritime Clusters are innovating the cluster concept to achieve this combination of competitiveness and sustainable development within the ocean business community. The case studies in this report highlight Ocean/Maritime Cluster best practices, which demonstrate success factors rooted in collaborative action, key partnerships with government support, and value-adding through innovation.

² Maria Damanki, *Committed to the Ocean: The First United Nations Ocean Conference*, June 2017, The Nature Conservancy, <<https://global.nature.org/content/committed-to-the-ocean-the-first-united-nations-ocean-conference?intc3=nature.oceans.lp.splash1>>

2. Drivers for Ocean Sustainable Development

U.N. Sustainable Development Goal 14

“Conserve and sustainably use the oceans, seas and marine resources for sustainable development”

In 2015, the United Nations announced the Sustainable Development Goals (SDGs), highlighting explicit targets for economic growth, sustainable use of resources and ecosystems, and responsible consumption and production patterns. With respect to the maritime and coastal industries, SDG 14 addresses the sustainable use of the ocean, seas and marine resources. Considering the limits in marine pollution control and sustainable fishing practices, the U.N. calls for reducing and reversing ocean degradation and increasing research, development, and innovation activities. Furthermore, SDG 14 underlines the urgency to improve efficiency and productivity, develop sustainable infrastructure, implement waste management strategies, ensure water quality, and adopt renewable energy sources.

SDG 14 includes ten targets, which act as building blocks towards the sustainable use of the ocean. Efficient and innovative sustainable ocean clustering techniques can contribute to many facets of the SDG 14 by directly or indirectly covering multiple aspects of the targets.

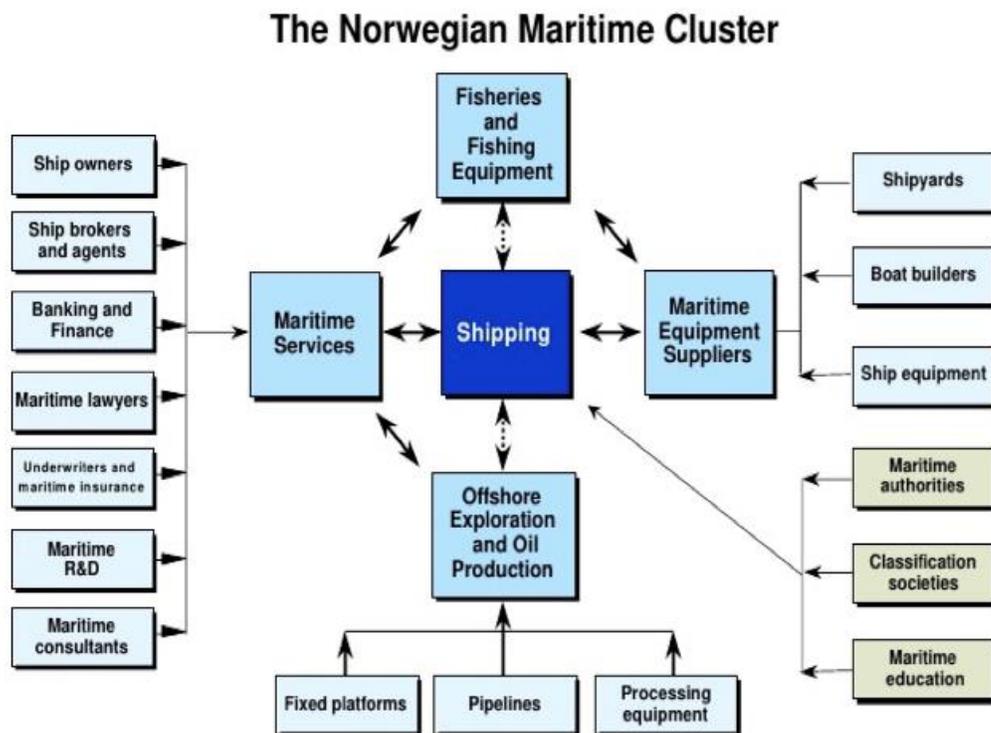
Business’s Role in Achieving Goal 14 and Promoting Sustainable Development

As communities and countries work to tackle the most important ocean issues, the role of business sector responsibility is essential. The World Ocean Council (WOC) has been leading the effort to engage the global ocean business community in adopting and implementing the SDGs. The business community can play an influential role in promoting sustainable practices, producing products and developing business models that implement sustainable concepts, reduce environmental impacts and create social value. Creating sustainable value chains within ocean and maritime industries is a key priority for the private sector. Since maritime technology has been developed and private companies have put more value on businesses with supporting ocean sustainability than before, the concept of Blue Economy has received increasing attention and interest.

3. Case Studies in Maritime/Ocean Clusters and Best Practices

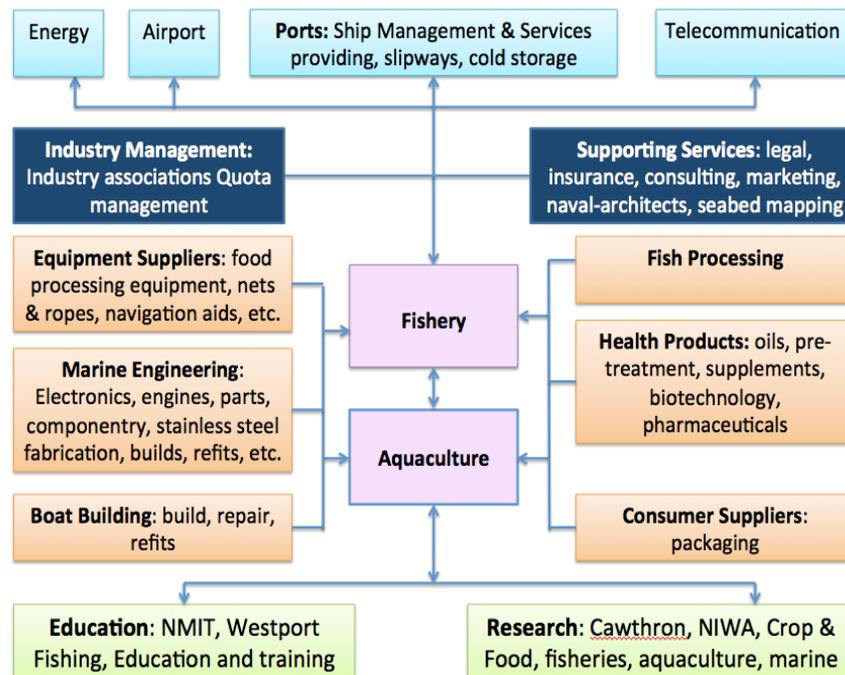
Advancing Ocean Sustainable Development through Ocean/Maritime Clusters

Clusters are geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions fields that compete but also cooperate. Clustering brings business people together and catalyzes value-added innovation. In Ocean/Maritime Clusters, the core sectors are often comprised of ports, shipping companies, seafood, and offshore industries. Related industries in the cluster depend upon the area's focus for growth and activity. Below are some visual representations of Ocean/Maritime Clusters; one with shipping as the core industry (Norway), and one with fisheries as the core (Nelson, NZ).



Source: Sven Ulling, MIT presentation

Nelson (New Zealand) Seafood Cluster Map



As sectors collaborate and work together, they have the potential to unlock value across the entire cluster network, creating entrepreneurial opportunities, as well as increasing revenues and growth. Ocean/Maritime Clusters can move towards sustainability first by improving existing practices in extractive, manufacturing, and commercial activities, and secondly by encouraging up-and-coming high-growth maritime activities that promote sustainability, such as clean tech. Ocean/Maritime Clusters are able to coordinate action between organizations, foster intellectual capital and enable sharing, institutionalize standards and best practices, and seed growth in a particular direction.

Best Practice for Comprehensive Approach to Cluster Development: Iceland Ocean Cluster

The Iceland Ocean Cluster demonstrates the benefits of sustainable ocean clustering. Dr. Thor Sigfusson, founder and CEO of the Iceland Ocean Cluster, saw a large disconnect between the professionals in the software industries and the traditional engineers working in fishing and natural resource-based industries. As he recognized the potential for collaboration, Dr. Sigfusson launched the Iceland Ocean Cluster that aimed to close the gap between the "traditional industry and those developing new ideas in high-value-added products from seafood"³. Professionals involved in the cluster, previously isolated from each other, began discussing ways to optimize

³ Sigfusson, Thor, Dr., and Ragnar Arnason. *Iceland Ocean Cluster Concept Paper*, June 2017

value from codfish, Iceland's main export.

This collaboration of 50 Icelandic companies with different specialties and skill-sets created an ideal environment for entrepreneurial growth and has already resulted in the creation of multiple spin-off companies. According to Dr. Sigfusson, "evidence suggests that Iceland's cod utilization rate is higher than other countries in the North Atlantic. Moreover, there has been an average increase in annual turnover for businesses focusing on fully utilizing the fish of 15-20%."⁴ In the fishing industry, interaction between related industries has given the companies involved in the Iceland Ocean Cluster confidence that the industry potential can at least double over the next 10 years.

The cluster is comprised not only of the fishing sector itself, but also of all the industries that rely on the fishing sector, directly or indirectly. The fishing industry provides a direct contribution to Gross Domestic Product (GDP) through its employee salaries and profits, while there is an even larger indirect contribution from the industries tasked with supplying and sourcing the fishing companies with what they need to be successful. Some of these related industries include the packaging, shipping, textile, public administration, metal manufacturers, fishing gear manufacturing, and mechanical manufacturing industries.

One of the industries that relies heavily on demand from the fisheries sector is the textile industry, which is responsible for manufacturing nets and fishermen's gear. According to the Iceland Ocean Cluster Concept Paper, approximately half of the industry's total turnover can be traced to the fisheries sector. Additionally, 30% of metal-working services and repairs play an important part in building and maintenance of fishing vessels and fish processing plants.⁵ Without the fishing sector, none of these activities would exist within the local economy. In Iceland, the intrinsic value of both direct and indirect added value is approximately 17.5% of the GDP. When considering the additional economic benefits of wages paid by the companies within the cluster, the demand effect leads to a chain reaction throughout the economy that can be quite substantial. Investments would likely increase the economy's manufacturing capacity and thereby lead to economic growth in the future.

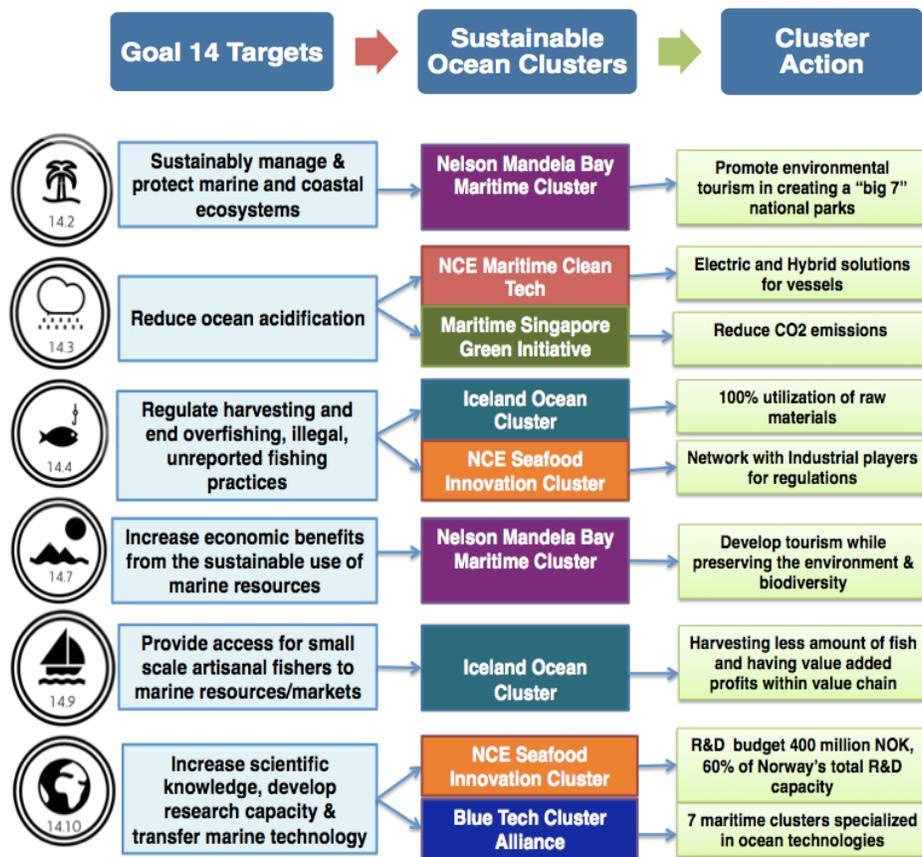
In Iceland, fisheries act as a base structure, supporting industries that contribute to from 25% to 35% of Iceland's GDP. Many companies responsible for supplying the fishing sector with resources and further processing and distribution of their products have gradually developed in Iceland. These operations have a significant contribution to the national GDP, almost as great as the direct contribution of the fishing sector. The added value created by the increase in wages and profits among all companies included in the cluster have led to an increase in demand for goods and services for both consumption and investment. If the cluster has the capacity to meet the increased demand locally, projections indicate the probability of future production increases. The Iceland Ocean Cluster has proven that a base industry has the potential to act dynamically and sustainably, functioning as a cornerstone for sustainable development of a broad range of other industries that may subsequently even outgrow the core sector.

⁴ Ibid.

⁵ Ibid.

4. Ocean/Maritime Clusters and SDG Targets

The follow section highlights Ocean/Maritime Clusters most related to relevant SDG 14 targets. More details about each of the cluster cases are presented in Annex 1.



SDG 14.2 Protect Marine and Coastal Ecosystems
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

Case: Nelson Mandela Bay Maritime Cluster (NMBMC)

Nelson Mandela Bay Maritime Cluster, a voluntary association of coastal and maritime stakeholders in East Cape region in South Africa, is a joint initiative of the Nelson Mandela Metropolitan University, Nelson Mandela Bay Municipality, and the Nelson Mandela Bay Business Chamber.

Since it was founded in 2012, the cluster has been governed by a Steering Committee and is comprised of six-sub-cluster: Ports Consultative Committee Cluster, Nelson Mandela Metropolitan University, WESSA Algoa Bay Coastal and Maritime Cluster, Nelson Mandela Bay

Maritime Business Cluster, Nelson Mandela Bay Fishing and Fish Processing. Through preserving the terrestrial and marine biodiversity of “big 7”, composed of whales, great white sharks, elephants, lions, leopards, buffalo, and rhinos, at Greater Addo Elephant Park in Nelson Mandela Bay region, the South African cluster is moving towards developing environmental tourism industry contributing to a sustainable provincial economy.

SDG 14.3 Reduce Ocean Acidification

Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels

Case: NCE Maritime CleanTech

As one of leading marine tech clusters based in southwest of Norway, NCE Maritime CleanTech cluster specializes in development of clean, energy efficient maritime solutions. Through effective networking and collaboration of over 51 cluster members, from business partners to research institutions, the cluster has resulted in innovations of electric and hybrid solutions for vessels. This new technology contributes to reducing pollutant emission, including CO₂. The *Ampere*, for instance, is one of the representative results of the cluster as the world's first battery driven ferry. Based on the predictable routes, established patterns, and data, it has been operating since 2015, reducing fuel cost by 60-70%.

Case: The Maritime Singapore Green Initiative (MSGI)

The Maritime Singapore Green Initiative is a government-driven initiative launched in 2011 by the Maritime and Port Authority of Singapore (MPA). The initiative consists of three programs: the Green Ship Program (GSP), the Green Port Program (GPP), and Green Technology Program (GTP). These are voluntary programs designed to recognize and incentivize maritime companies to adopt clean and green shipping practices and fulfill the mandated environmental sustainability requirements. Through the GSP, MPA aims to reduce carbon dioxide (CO₂) emissions. The program encourages Singapore-flagged ships to reduce CO₂ and sulfur oxides (SO_x) emissions. Based on the Energy Efficiency Design Index requirements of the International Maritime Organization (IMO), qualifying ships can receive up to 75% discounts on the Initial Registration Fees and 50% discounts on Annual Tonnage Tax. In June 2016, the GSP achieved more than 50% of qualifying ships exceeding the current Energy Efficiency Design Index frame required by IMO.

The GTP aims to encourage local maritime companies to develop and adopt green technologies. To promote sustainable shipping, MPA provides GTP grants of up to \$3 million per project for maritime companies based in Singapore to adopt or develop green technologies that reduce emissions of SO_x, NO_x, and CO₂. GTP has supported more than 20 projects involving over 60 vessels and in 2015 MPA committed a total of \$50 million to the program. To date, the program has benefited 21 maritime companies in the shipping, port and harbor craft sectors, with the projects yielding an estimated direct reduction of 285,000 tons of CO₂ per year.

14.4 Regulate Harvesting and End Overfishing

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

Case: Iceland Ocean Cluster (IOC)

Comprised of a group of experts, engineers, and entrepreneurs in the seafood industry, the Iceland Ocean Cluster manages fisheries with blue technology and exploits the harvested raw materials in maximum level within its value chain. By maximizing the usage of white codfish, the cluster has created a great deal of value added within the fishing industry. The efforts of Iceland Ocean Cluster to utilize 100% of raw material contribute to maintaining fish stocks at biologically sustainable levels. Using the entire fish adds to the value chain, benefitting both buyers as well as the fisheries themselves. Since the benefit of the 100% utilization can be applied when the supplier or fishers are registered and connected within the value chain of the cluster, this idea of 100% utilization helps decrease undocumented fisheries and over fishing.

Case: NCE Seafood Innovation Cluster

Concentrating on improving the sustainable value chain, the NCE Seafood Innovation Cluster works closely with the important industrial players both within and out of the cluster to improve sustainability of fish resource by acknowledging the lack of strategic approaches and by putting forth the efforts of world leading seafood industries to reduce the global extent of illegal, unregulated fisheries.⁶ These activities and efforts have linked private enterprises in a common movement to save the marine biodiversity by restricting illegal fishing and undocumented fisheries.

14.7 Increase Benefits to Small Island and LDCs

By 2030, increase the economic benefits to Small Island Developing States (SIDS) and Least Developed Countries (LCD) from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism

Case: Nelson Mandela Bay Maritime Cluster

Working to form a business environment in the region, the endeavor of NMBMC to develop their tourism industry with effective clustering techniques is an effective example of using regional

⁶ NCE Seafood Innovation Cluster, “*Collective action and the evolution of social norms*”
<http://www.tuftsgloballeadership.org/blog/exploring-ocean-cluster-model-iceland-jack-whitacre>

resources while preserving the environment and biodiversity. Within the Addo Elephant National Park, conserving seven important species in the region, the NMBMC aims to connect small-scale businesses and disadvantaged communities in the coastal region to improve economic benefits and to enhance the existing coastal and marine tourism sector.

14.8 Increase R&D

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

Case: NCE Seafood Innovation Cluster Norway

The NCE Seafood Innovation Cluster Norway research and development (R&D) budget is 400 million NOK (about \$47.6 million) which is 60% of Norway's total R&D capacity⁷. The seafood cluster also conducts various R&D and projects based on technologies. AquaCloud is one of the projects applying artificial intelligence in sea lice management.⁸ The project offers researchers and fish health managers a marine technological tool to improve the challenge with sea lice.

14.9 Support Artisanal Fishers

Provide access for small-scale artisanal fishers to marine resources and markets

Case: Iceland Ocean Cluster (IOC)

IOC shows a model of how clustering can contribute to improving fisheries by applying innovation and technology. The networking groups of engineers and experts developed the fisheries' competitiveness and efficient raw materials management. Codfish, the most produced marine resource in the region, is 100% utilized, providing the local fish industry related stakeholders and players with market access by harvesting less at sustainable yield level, creating more value-added profits within the supply chain. According to the Icelandic cluster, the amount of codfish caught in Iceland had significantly decreased from 460,000 tons in 1981 to 180,000 tons in 2011. However, the export value of went from \$340 million (present value) in 1981 to \$680 million (present value) in 2011.⁹ IOC developed the value pyramid as the framework of comprehending the value added and application of the full of raw materials.¹⁰

⁷ NCE Seafood Innovation Cluster, 2016 "Status Report 2016"

⁸ NCE Seafood Innovation Cluster, AquaCloud, The use of artificial intelligence in sea lice management, http://www.seafoodinnovation.no/article/213/AquaCloudThe_use_of_artificial_intelligence_in_sea_lice_management

⁹ Iceland Ocean Cluster, 2013, "IOC Analysis: Double value for 40% of the catch"

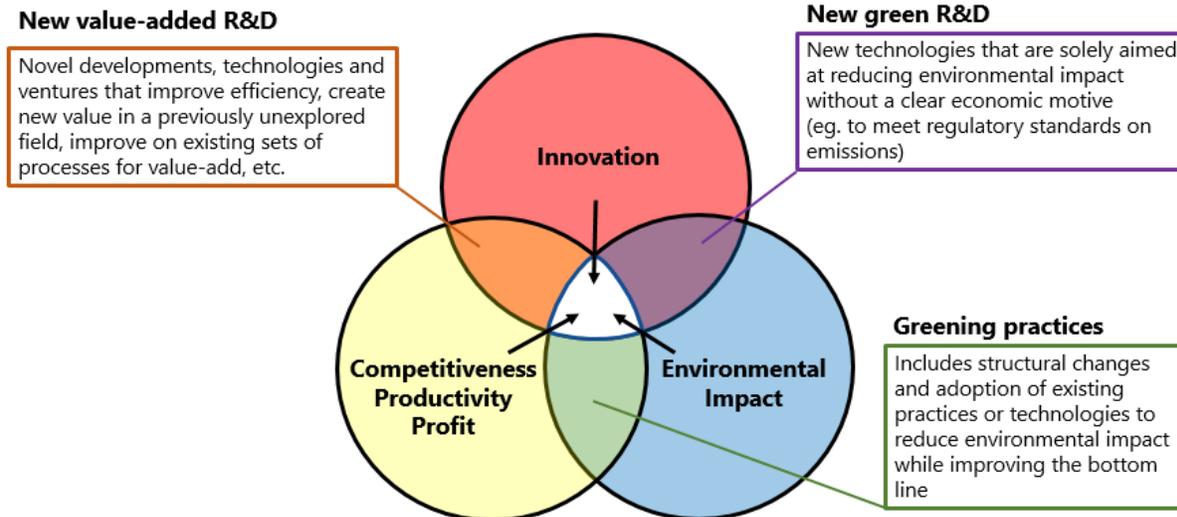
¹⁰ Joseph Anthony Mattos-Hall, 2014, "Strategy Under Uncertainty: Open Innovation and Strategic Learning for the Iceland Ocean Cluster"

5. Ocean/Maritime Clusters and Sustainable Development – An Analytical Framework

Ocean/Maritime Clusters and Sustainable Development: Three Key Spheres

Ocean/Maritime Clusters and sustainable ocean development can be analyzed in relation to the three key spheres of **Innovation**, **Competitiveness-Productivity-Profit** and **Environmental Impact**.

Research and analysis of eleven Ocean/Maritime Clusters indicates that the way forward is a focus on business growth and investment opportunities for responsible, sustainable ocean use. (See Appendix 1 for details of the analysis of the eleven Ocean/Maritime Clusters.)

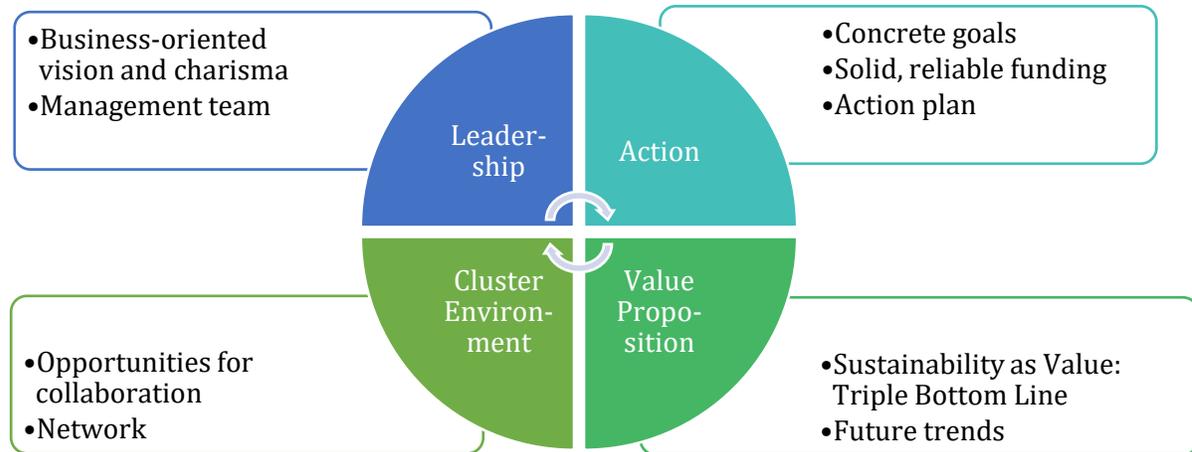


Ocean/Marine Clusters are most successful when they are geared towards the intersection of these three spheres. Clusters should pursue strategies that push themselves further into the central nexus of the framework. By combining purpose in innovation, competitiveness-productivity-profit and environmental impact, Ocean/Maritime Clusters can best lead ocean sustainable development and optimize economic benefits.

How to Create Successful Ocean/Maritime Clusters for Sustainable Development

Four key concepts underpin the success of Ocean/Maritime Clusters in moving towards a sustainable development focus

1. Leadership
2. Action
3. Cluster Environment
4. Value Proposition



A cluster's success depends on communication and collaboration among its members. The cluster environment itself must be heavily geared towards teamwork among cluster companies, which needs to be considered more fully by business leaders. In the Iceland Ocean Cluster House, which provides office space for its 50 cluster companies, there are glass walls separating each space to facilitate sharing and promote intra-industry conversations. The emphasis on collaboration is so strong in the Iceland Ocean Cluster House, that entrepreneurs uninterested in having such structural vulnerability are often not considered ideal candidates to become part of the cluster community. Facilitating communication requires a very strong management team behind the cluster, guiding its members towards each other, encouraging brainstorming activities and value-added activities.

At one of the first networking events hosted by the Iceland Ocean Cluster House, a CEO of a large fishery discovered that there was a cosmetics company that had been using the intestines of fish from his fishery to manufacture cosmetics. This connection and similar ones create relationships between experts of different industries who all rely on the ocean for the success of their business. These relationships and the new ideas that come from them are the greatest hope of the ocean economy to establish new businesses and ideas. To address these issues and promote ocean sustainability, innovative solutions that prevent and mitigate detrimental impacts to the marine environment are essential.¹¹ Experts in these industries also must be alike in their interest to promote sustainable practices among themselves, realizing their mutual necessity to preserve and replenish the waters which support their livelihoods. Each company must possess a deep appreciation that sustainability is beneficial not only to the planet, but for long-term economic and business success.

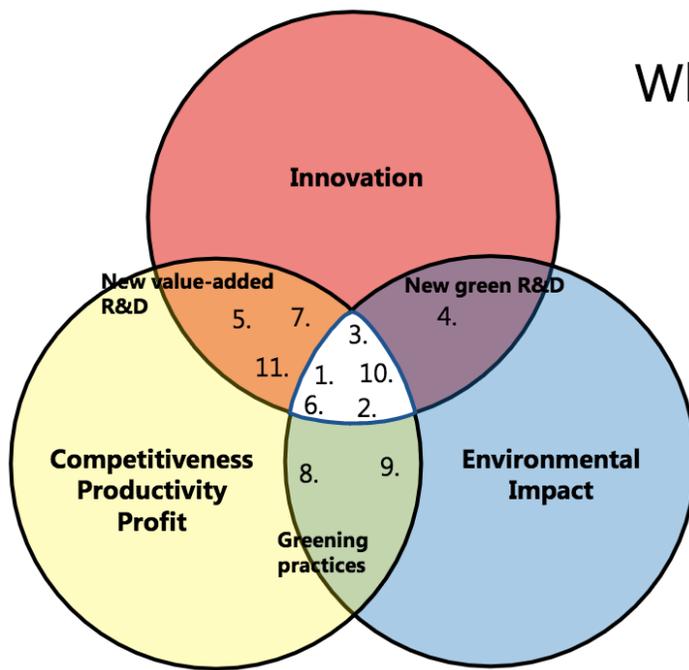
ETG conducted an analysis of 11 ocean/maritime cluster using the following set of questions.

Cluster	<ul style="list-style-type: none"> • Who are you? • Where are you located?
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¹¹ SDG Compass, <http://sdgcompass.org/sdgs/sdg-14/>

	<ul style="list-style-type: none"> • What are the origins of your cluster?
Business model	<ul style="list-style-type: none"> • How are you funded? • What is your role in the industry? • Who are your cluster members and partners?
Niche	<ul style="list-style-type: none"> • What is your main focus? • What sector do you belong to? • How do you tackle sustainability and what is your value proposition for sustainability?
Keys to success	<ul style="list-style-type: none"> • Which factors are unique to the success of your cluster? • What are your biggest accomplishments and how are they achieved?
Success indicators	<ul style="list-style-type: none"> • What does success look like to you? • How has progress been made over time?

Answers to these questions provided an assessment of the orientation of these 11 Ocean/Marine Cluster cases (summarized in Annex 1) within the ocean sustainable development framework introduced above. In this framework, clusters want to move towards the central nexus of the diagram to fully capture the three elements of innovation, competitiveness-productivity-profit and environmental impact. Five cluster highlighted in bold below are shown to have an optimal balance between the three spheres.



Where are you in this space?

Our Case Studies

- 1. Iceland Ocean Cluster**
- 2. Blue Legasea Norway**
- 3. NCE Maritime CleanTech Norway**
- Nagasaki Marine Industry Cluster Promotion Association
- Oceans Advance St John's Canada
- 6. NCE Seafood Innovation Cluster Norway**
- GCE Subsea Norway
- Nelson Mandela Bay Maritime Cluster South Africa
- Maritime Singapore Green Initiative
- 10. Maritime by Holland**
- The Maritime Alliance

6. Networking Ocean/Maritime Clusters for Sustainable Development

Ocean/Maritime Cluster Networks

Because many of the challenges and opportunities of ocean economic development are often transboundary and cannot be solved by one entity, international networks of Ocean/Maritime Clusters are beginning to form. The efficiency and benefits that can result from Ocean/Maritime Clusters can lead to multi-directional approaches via cross-sectoral clusters that demonstrate greater efficiency and impact. The multilateral cluster networks profiled below are examples of international networks of Ocean/Maritime Clusters that have formed.

European Network of Maritime Clusters (ENMC)—The European Network of Maritime Clusters (ENMC) is a confederation of clusters or equivalent structures in 18 European countries launched in 2005. ENMC aims to promote and reinforce the European maritime sector and the maritime economy as a whole. The national clusters within ENMC have a common identity as a European maritime cluster and work to boost the blue economy in the region.

BlueTech Cluster Alliance (BCTA)—The BlueTech Cluster Alliance (BCTA) is an international alliance of 7 maritime clusters specialized in oceans technologies in seven nations. Each of the members are recognized as key maritime clusters with ocean technologies and are expected to advance the cluster-to-cluster and B2B collaboration with promoting Blue Economy.¹² Through collaborating on maritime technologies, BCTA aims to share the knowledge and information of marine technology.

World Ocean Council (WOC)—The World Ocean Council (WOC) works to explore how Ocean/Maritime Clusters might best interact to tackle the global challenges of - and realize the economic benefits of - ocean sustainable development. WOC efforts help to analyze the role and potential of clusters, and international networks of clusters in relation to the SDGs.

The WOC focuses on cluster interaction, innovation, and collaboration for ocean sustainable development, considering:

- 1) The conditions and characteristics that lead to Ocean/Maritime Cluster success;
- 2) How can clusters best contribute to sustainable development and the SDGs;
- 3) The opportunities for collaboration among clusters in support of sustainable development - at national, regional and global scales.

The WOC brings Ocean/Maritime Clusters together at the annual Sustainable Ocean Summit (SOS), the only global gathering of the ocean business community dedicated to sustainable development. At the SOS, Ocean/Maritime Clusters can interact with each other and the CEOs/senior managers from a diverse range of ocean industry companies and associations.

¹² The Maritime Alliance, 2017, “BlueTech Cluster Alliance”, <https://maritimealliance.maps.arcgis.com/apps/Cascade/index.html?appid=8a667ebbcab442b5a986cb2cb7b5304f>

7. Recommendations

Organizations and clusters working to advance the role of the private sector leadership and collaboration in ocean sustainable development are encouraged to consider the following recommendations.

Recommendation # 1: *Enhance and Expand the Role of Ocean/Maritime Clusters in Implementing Sustainable Development*

Ocean business/sustainable development organizations should work with Ocean/Maritime Clusters to develop a better understanding of the role of clusters in implementing ocean sustainable development. In doing so, clusters should seek to capture the three key elements of innovation, competitiveness-productivity-profit and environmental impact. Critical steps include: Engaging in research to develop strategies for sustainable ocean clusters; Implementing long-term ocean sustainable development cluster projects; Monitoring results and scaling-up successful initiatives.

Recommendation # 2: *Accelerate the Networking of Ocean/Maritime Clusters for Collaborative Learning and Action in focused support of Sustainable Development*

Ocean business/sustainable development organizations should work with Ocean/Maritime Clusters to initiate networks in support of the Blue Economy. The Networks should help Ocean/Maritime Clusters become more competitive and sustainable by creating a platform and develop opportunities for maritime clusters to come together, learn, and take collaborative actions. For example, Ocean/Maritime Cluster Networks should develop avenues for collaborative research, cross-sectoral cluster information sharing, best practices exchange, and benchmarking. These can focus on complex global ocean issues, e.g. biofouling, or regional situations, e.g. responsible use of the Arctic.

Recommendation # 3: *Support the Development of Ocean/Maritime Clusters for in Developing Countries and Small Island Developing States*

Ocean business/sustainable development organizations should work with developing countries and small island developing states (SIDS) to develop Ocean/Maritime Clusters. This can include working with countries to obtain international assistance to build clusters to address critical issues affecting them, e.g. addressing port and coastal infrastructure resiliency and disaster risk reduction; developing strategies for conserving, protecting, and enhancing natural resources and coastal ecosystems, such as improved fisheries management systems, reef management, and mangrove protection and restoration; creating capacity to collect marine data and monitor coastal ecosystems in support of sustainable fisheries and economic development.

Appendix 1: Case Studies of Select Ocean/Maritime Clusters

ETG reviewed available information for eleven Ocean/Maritime Clusters. Information on each cluster was organized for presentation in a standardized format, as much as possible. The format categories include: business model, niche, keys to success, and success indicators. The information was used to facilitate the analysis of each cluster in relation to the three key spheres of Innovation, Competitiveness-Productivity-Profit and Environmental Impact.

Each cluster case is presented below.

1. Iceland: Iceland Ocean Cluster



Iceland Ocean Cluster
Reykjavik, Iceland est. 2011

Case Study #1

"Create value by connecting entrepreneurs, businesses and knowledge in the marine industries."

Business Model

- Incubator + Innovation Hub (Iceland Ocean Cluster House)
- Privately-owned company:
 - Office rent
 - Membership fees
 - Shares in new start-ups
 - Analysis and consultancy
- Led by Thor Sigfusson



Keys to Success



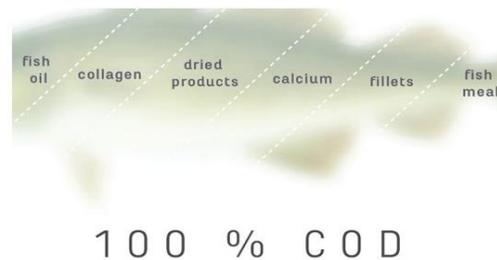
"Key to our success is to bring the business people together and let the business lead the way."

- Thor Sigfusson

- Interaction + Cooperation + Trust
- Network of traditionally isolated fishing companies built and interwoven with other ocean-related industries
- Seeing new opportunities and catalyzing action by guiding businesses

Success Indicators

- Houses 50 companies
- Average increase of 15-20% in annual turnover for businesses focusing on fully utilizing fish
- Creation of 2 spin-off companies:
 1. CODLAND
<http://codland.is/>
 2. Ocean Excellence
<http://www.oceanexcellence.is>
 3. Trillium
<https://www.trilliumsoftware.com/sites/default/files/Iceland-CaseStudy.pdf>



2. Norway: BLUE LEGASEA



Case Study #2

Marine Bio-Mass (Lipids & Proteins)

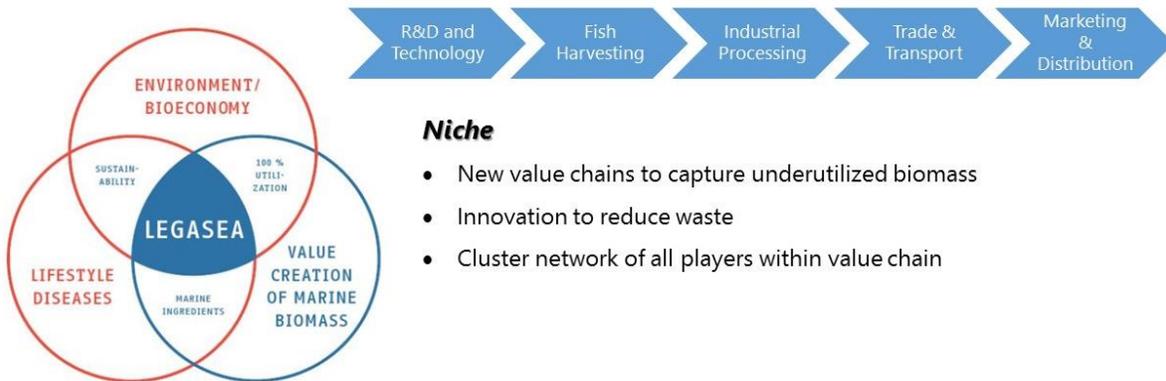


Norway: Møre and Romsda

Business Model

- Government-supported: Arena status under Norway Innovation Cluster program
- Cluster includes:
 - Fishing vessels
 - Marine ingredient producers
 - Fishing companies
 - Onboard ingredients plants
 - Fish farmers
 - Research organizations
 - University college
- Previously known as OMEGALAND

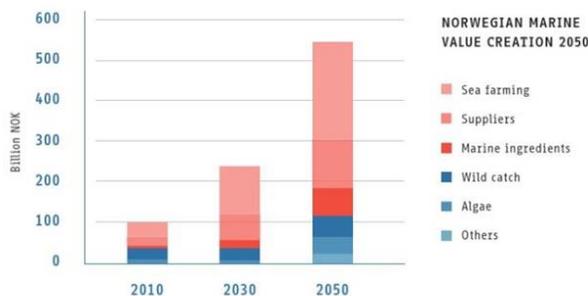
“Exploiting blue ocean opportunities with value-added innovation”



Niche

- New value chains to capture underutilized biomass
- Innovation to reduce waste
- Cluster network of all players within value chain

Cluster Targets



Keys to Success

- National sustainability and innovation policy direction of “bio-economics”
- Moving away from oil-based economy
- Norwegian marine industry already progressive in sustainability

3. Norway: NCE Maritime CleanTech



Case Study #3

Sustainable Maritime Tech Solutions



Business Model

- Government-supported:
 - Arena status under Norway Innovation Cluster program
- Cluster includes over 60 partners:
 - Design & Engineering companies
 - Shipyards
 - Ship owners
 - Equipment & service providers
 - Renewable energy companies
 - Research institutes
- One of 51 signatories calling on IMO states to match the ambition and pace of UNFCCC COP21

“Reducing harmful emissions from maritime activities”

Niche

- R&D projects in new energy-efficient and environmentally friendly technology with commercial potential
- In line with environmental regulatory pressures to meet restrictions on gas emissions from IMO convention MARPOL and local port authorities

Keys to Success

- Cluster organizes regular strategy meetings to connect companies
 - Catalyze R&D projects
 - Help with searching for funding from national bodies
 - Enable knowledge sharing between parallel projects.

Success Indicators



Urban Water Shuttle

We have developed the concept of a zero emission, fast moving vessel. The vessel will be built in low weight and sustainable materials like aluminium and propelled using the latest hybrid technologies, a combination of fuel cells and battery power. The concept is developed in collaboration with Fjellstrand, Wärtsilä, Servogear, Apply, Anel, CMR Prototech, Storm Design and SKL.



Short Sea Pioneer

Another example of our innovative projects: a revolutionary two-vessel solution that may change the way we transport goods in Europe. The Short Sea Pioneer consists of two ship types: mother vessels and daughter/feeder vessels. NorthSea Container Line lead the project, which also gathers participants from Wärtsilä, Westcon, Marintek, Storm Design and NHH.

4. Japan: Nagasaki Marine Industry Cluster Promotion Association



Case Study #4

Nagasaki Marine Industry Cluster Promotion Association (NaMiCPA)

Business Model



- Located in Nagasaki Prefecture, Japan
- Companies involved include electric and power utilities, diving companies, fisheries, ship-building and heavy construction companies, economic and environmental research institutes
- International partners include the European Marine Energy Centre (EMEC) in Orkney, Scotland
- NGO funded by membership fees (Special members – USD 9000, General members – USD 500, Supporting members – free)



A floating wind power test turbine off the Goto islands in Nagasaki prefecture.

Niche

- Working groups for specific business opportunities
- Provides resources for training and capacity-building
- Encourages collaborative learning to bring innovative ideas into the market
- Aimed at reducing cost of development, encouraging private participation, strengthening international competitiveness of industry with overall aim of achieving regional economic revitalization
- R&D demonstration projects of ocean renewable energy



Keys to Success

- Novel in field – first major Asian testing site for marine energy
- Knowledge sharing through reciprocal visits with international partners in Scotland
- Environmental ethos in siting offshore wind and tidal energy projects, and setting up 3 demonstration projects (locations on left)
- Specific initiative on ocean renewable energy (offshore wind and tidal power generation) began in 2013 with the creation of special zone, followed by partnership with EMEC



Fig. 2 Marine renewable energy test fields in Nagasaki Prefecture designated by the Japanese Government

5. Canada: Oceans Advance



Oceans Advance
ST. Johns, Canada est. 2005

Case Study #5

*“The voice of the Newfoundland and Labrador
Ocean Technology Innovation Cluster.”*

Business Model

- Government Driven Industry Strategy
 - Founded by Newfoundland & Labrador (NL) academic, industry and government leaders
- Non-Profit
- Funders
 - ACOA (Atlantic Canada Opportunities Agency)
 - NSERC (Natural Science and Engineering Research Council of Canada)
 - RDC (Research and Development Corporation)
 - IBRD (Department of Innovation, Business and Rural Development)

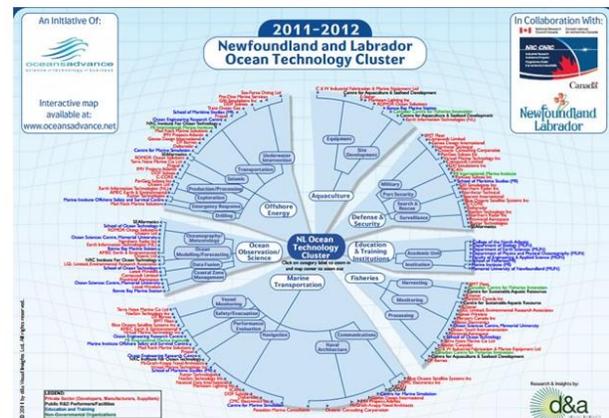
Niche

- Ocean Tech
 - Advanced Offshore tech
 - e.g) Weather Forecasting, Ocean observation and Management
- Partnerships with R&D and educational institutions.
- Government procurement of ocean tech solutions for publicly aimed facilities, vessels, and equipment
- Access to funding for startups and incubation facilities
 - New Ocean Tech Development Fund



Success Indicators

- 250 companies
- Aim to grow industry's value to \$ 1 billion, with more than 6,600 employees by 2015 (600% higher)
- Members
 - 50 Expert-driven companies
 - 20 R&D companies
 - Municipal, provincial, and federal governments
 - Academic institutes
 - Trade Associations



6. Norway: NCE Seafood Innovation Cluster



NCE Seafood Innovation Cluster
Bergen, Norway est. 2015

Case Study #6

“Sustainable Seafood Cluster”

Business Model

- Government funded
- Granted the status of a Norwegian Centre of Expertise (NCE) by the Norwegian Government in 2015
- Collaboration between business, R&D and education through strategic collaborative projects between the cluster’s partners and external partners



“Promote further sustainable growth of the Norwegian Seafood by strengthen collaboration between business, R&D and education, through strategic collaborative projects between the cluster’s partners and external partners.”

Niche

- Atlantic Salmon production
- Promote further sustainable growth of the Norwegian Seafood by strengthen collaboration between business, R&D and education, through strategic collaborative projects.
- Contribute to Food Security and Nutrition
 - Sustainable Value Chain
 - Social, environmental, and economic sustainability



“The cluster is aware of the environmental and social responsibilities, and environmental sustainability is a prerequisite for long-term development and growth.”

Key of Success

- Cluster projects and programs
 - Training and talent development
e.g. NHH Executive - MBA Seafood
 - Sustainable Innovation
e.g. Big data
 - Supplier Development
e.g. ACCEL Seafood



7. Norway: GCE Subsea



GCE Subsea
Bergen, Norway est. 2006

Case Study #7

"The combined and varied experience and operational expertise of the industrial players, supporting businesses and the R&D and educational institutions make GCE Subsea a global knowledge hub within oil & gas."

Business Model

- An industry driven initiative
- 135 companies and organizations
- Collaboration between business, R&D and education through strategic collaborative projects between the cluster's partners and external partners



Niche

- Oil & gas sector
- Subsea equipment of recovering oil & gas from the reservoirs
- Aims to increase the cluster's competitiveness and global market share, and take a leading position in sustainable utilization of ocean resources



Cluster milestones to the left and to the right the future of subsea solutions.

Key of Success

- Innovation & collaboration with major private companies
- Closer collaboration with related export-oriented clusters
- Secure active participation



8. South Africa: Nelson Mandela Bay Maritime Cluster



Nelson Mandela Bay Maritime Cluster Port Elizabeth, South Africa

Case Study #8

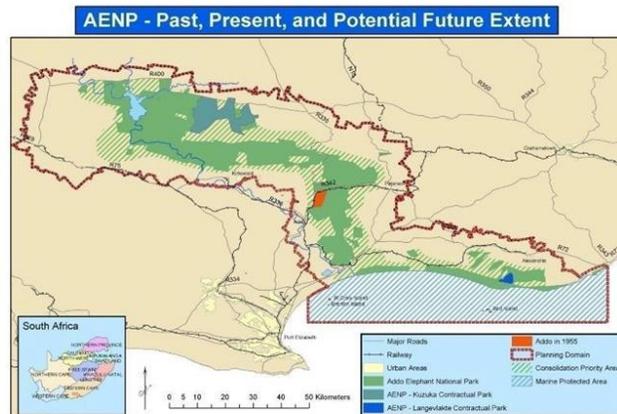
Maritime Clusters in South Africa

- Only two maritime clusters in South Africa
 - The eThekweni Maritime Cluster (EMC) in Durban
: Top-down public sector approach
 - The Nelson Mandela Bay Maritime Cluster (NMBMC) in Port Elizabeth
: Bottom-up private sector approach
- Facilitate joint efforts for the Protection of the vulnerable Marine Environment
- Promote Regional Cooperation and Integration



Niche

- Responsible Ocean Governance
- Coordinate four Steering Committee meetings and one Annual General Assembly a year at which all Sub-Sectors are expected to attend.
- Terrestrial Biodiversity converges with Marine Biodiversity creating a 'Big 7' National Park



“Passion and Teamwork – the twins for successful Cluster Management”

Success Indicators

- Research, Development & Innovation Sub-Sector
 - South African Environmental Observation Network
 - South African Institute of Aquatic Biodiversity
 - NMMU Coastal & Marine Research Unit
 - NMMU Chair in the Law of the Sea and Development in Africa
 - Agulhas and Somali Current Large Marine Ecosystems Project
 - South African International Maritime Institute



9. Singapore: Maritime Green Initiative



Maritime Singapore Green Initiative Singapore, est. 2011

Case Study #9

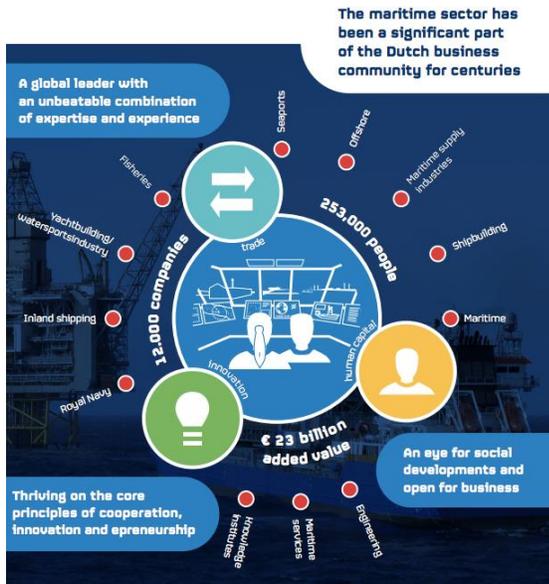
- Launched in 2011 by the Maritime and Port Authority of Singapore (MPA)
- Invested by MPA up to \$100 million over a five-year period
- Consists of three programs
 - Green Ship Program (GSP)
 - Reduce carbon dioxide (CO₂) and sulphur oxides (SO_x) emissions
 - Green Port Program (GPP)
 - Over 3,700 vessel calls have switched to marine fuel with sulphur content not exceeding 1%
 - Green Technology Program (GTP)
 - Granted 21 maritime companies with all the projects yielding an estimated direct reduction of 285,000 tons of carbon dioxide per year



10. Netherlands: Maritime by Holland



Case Study #10



Cluster Strategy

- Market-Driven Initiative created in 1997, in line with the then new Dutch shipping policy
- Aims to strengthen and promote the Dutch Maritime Cluster
- 23,7 billion euro industry comprises 12,000 companies employing more than 265,000 people

Niche

- Connects 12 maritime sectors
- Seeks to co-finance a range of projects to further the interests of the Dutch maritime community
- Connect the individual sectors within the maritime community and also with governments and academic institutions

Keys to success

- Branding “Maritime by Holland” to provide added Value to all maritime businesses
- Strong Sectors: Shipping, fishing, shipbuilding, the navy and inland shipping (2013)

Success Indicators

- The total value added of the maritime cluster increased with 3.9% faster than the GDP of the Netherlands (+2.0%) in 2015



11. The Maritime Alliance



Case Study #11

Cluster strategy

- A blue tech maritime cluster based in San Diego, founded in 2007
- BlueTech focused clustering
- More than 1,400 companies with approximately 46,000 employees are in maritime industry in San Diego County

Niche

- Focusing on: Economic Development; Ecosystem Development; and National and International Outreach
- Provides opportunities to operate in a hostile maritime environment offshore energy and minerals exploitation value chain by identified 14 maritime technology sectors
- Creating BlueTech and Blue Jobs by promoting sustainable, science-based ocean industries
- Contributing to STEM education - OceanSTEM initiative

Keys to success

- Effective clustering among government, private sector and academia
- Fast growth of Blue Economy focused on BlueTech cluster

Success Indicators

- Total direct revenue from the maritime cluster totals more than \$14 billion, and Total Gross Regional Product (GRP) contributed by the shipbuilding and repair industry and through its ripple effects summed to \$1.75 billion¹³
- The largest, fastest-growing part of the local Blue Economy with 19,000 direct jobs and \$6.2 billion in direct revenue¹⁴

¹³ http://www.sandiegobusiness.org/sites/default/files/Maritime%20Profile_1.pdf

¹⁴ http://workforce.org/sites/default/files/pdfs/reports/industry/san_diego_maritime_cluster_analysis.pdf

Appendix 2: Working List of Ocean/Maritime Clusters

The following is an initial list of Ocean/Maritime Clusters, or similar organizations. Ocean/Maritime Clusters not included in this list are encouraged to contact the World Ocean Council to help ensure that they are included in efforts to advance the role Ocean/Maritime Clusters in ocean sustainable development. Contact: info@oceancouncil.org

	Ocean/Maritime Cluster	Website
1	Alaska Ocean Cluster Initiative	http://nautilusii.com/news/alaska-ocean-cluster/
2	Arctic Maritime Cluster, AMC	http://arena-amk.no
3	Asian Seafood Improvement Collaborative	http://www.asicollaborative.org
4	Blue Economy	http://www.qdhd.gov.cn
5	Blue Innovation	http://en.xfafinance.com/html/Industries/Materials/2015/44292.shtml
6	Blue Legasea	http://www.legasea.no
7	Blue Maritime Cluster	http://www.bluemaritimecluster.no/
8	Centre of Expertise Programme(OSKE)	http://www.tekel.fi/in_english/science_parks_in_action/programmes_and_networks/oske/
9	Cleveland Water Alliance	http://www.clevelandwateralliance.org/
10	Cluster Excellence Denmark	http://www.clusterevellencedenmark.dk/
11	Dubai Maritime City	http://www.dubaimaritimecity.com/
12	European Network of Maritime Clusters	http://enmc.eu/
13	GCE Subsea	http://www.gcesubsea.no
14	International Maritime Centre	http://www.mpa.gov.sg/
16	Irish Maritime and Energy Resource Cluster (IMERC)	http://www.imerc.ie/
17	MARCOD - Maritime Centre for Operations	www.marcod.dk
18	Marine South East	http://www.marinesoutheast.co.uk/
19	Maritime Cluster	http://www.gmbports.org/maritime-cluster

20	Maritime Cluster Funen (Fyns Maritime Cluster)	http://maritimeclusterfunen.eu/
21	Maritime Cluster Northern Germany (MCN)	http://www.maritimes-cluster.de/
22	Maritime Technology Cluster FVG - <i>mare</i> TC FVG	http://www.marefvg.it/en
23	Nagasaki Marine Industry Cluster Promotion Association	http://namicpa.jp/
24	NCE Maritime CleanTech	https://maritimecleantech.no
25	NCE Seafood Innovation Cluster	http://www.seafoodinnovation.no
26	Nederland Maritiem Land (NML)	http://www.maritieland.nl/
27	Nelson Mandela Bay Maritime Cluster	http://klastermorski.com.pl/?page_id=890
28	New England Ocean Cluster (NEOC)	http://www.newenglandoceancluster.com/#neoc
29	Norwegian Innovation Clusters	http://www.innovationclusters.no/english
30	Oceans Advance	http://www.oceansadvance.net/
31	Pôle Mer Méditerranée	http://en.polemermediterranee.com/Pole-Mer-Mediterranee
32	Smart Ocean Initiative	http://www.smartocean.ie/
33	Technopole Maritime du Québec	http://www.tmq.ca/
35	Foro Marítimo Vasco	http://www.foromaritimovasco.com/en/
36	French Maritime Cluster (CMF)	http://cluster-maritime.fr/en
37	Iceland Ocean Cluster (IOC)	http://www.sjavarklasinn.is/en
39	The Maritime Alliance	http://www.themaritimealliance.org/
40	Maritime Development Center	http://mdc.center
41	Ocean Technology Council of Nova Scotia (OTCNS)	http://otcns.ca/
42	Vancouver International Maritime Centre	http://vancouverimc.org/
43	Vinnväxt	https://www.vinnova.se/m/vinnvaxt/

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- http://www.sandiegobusiness.org/sites/default/files/Maritime%20Profile_1.pdf
- [http://workforce.org/sites/default/files/pdfs/reports/industry/san diego maritime cluster analysis.pdf](http://workforce.org/sites/default/files/pdfs/reports/industry/san_diego_maritime_cluster_analysis.pdf)