



# **CANADA'S OCEAN SUPERCLUSTER OUR STRATEGY**

[oceansupercluster.ca](http://oceansupercluster.ca)

# SUMMARY

## *Overview and Objectives*

The Ocean Supercluster is an industry-led collaboration that will build Canada's ocean economy into one of the country's most significant and sustainable value-creating economic segments. It is built around the critical mass of ocean-based companies in Atlantic Canada; however, the Ocean Supercluster is a national undertaking, with investment from companies in eight provinces and one territory, and linkages already initiated with indigenous groups and international partners.

The Ocean Supercluster will transform Canada's ocean economy into a technology-driven, digitally-powered knowledge economy. Unlike clusters organized around a single sector, the Ocean Supercluster will be the first in the world built on a strategy to tackle the shared challenges of multiple ocean sectors through a collaborative program of innovation activities.

Companies working across different ocean-based value chains will join with providers of enabling technologies and other partners to form a new not-for-profit entity. The core strategic priorities for the Ocean Supercluster are to formulate a shared innovation map to guide technology leadership projects, and to undertake a program of cluster building to enhance the quality of collaborations, while also extending their benefits widely.

Work on the shared innovation roadmap is underway. Scoping workshops led by industry, with academic and government partners, have identified shared challenges and bottlenecks, and established the preliminary focus for technology leadership collaborations. As a result of this work, Ocean Supercluster will be ready to launch projects early in 2018.

The opportunity for Canada is significant. Today, the economic potential of Canada's ocean resources is under-developed. While ocean activities comprise 2.5% of the global economy, Canada's ocean economy accounts for only 1% of the national economy, despite having the longest coastline and fourth largest ocean territory in the world.

The Ocean Supercluster innovation roadmap will build for Canada an enduring smart ocean advantage, tackling the digitalization of ocean ecosystem data, autonomous systems to enhance operational performance, digitalization of maritime operations, and the integration of ocean data for enhanced prediction and risk characterization.

The strong "market-pull" for innovation fostered by the Ocean Supercluster will enhance the competitive advantage of Canadian ocean-based value companies as they benefit from accelerated, cost-effective technology demonstration and commercialization. This will have significant economic impact. It will also establish scalable markets for Canadian companies seeking to commercialize new enabling technologies.

Cluster-building activities will attract and develop world-class talent, including members of indigenous communities and groups underrepresented in the Canadian economy. Cluster-building will create opportunities to extend supply chains, and to start and scale companies around new technologies and business models. The Ocean Supercluster will foster linkages with other Canadian superclusters and international ocean clusters.

The ambition of the Ocean Supercluster is to grow Canada's ocean economy from \$20B to over \$30B by 2050. Canada will be positioned to lead and benefit from the growth of emerging ocean sectors like marine renewable energy, offshore aquaculture, ocean frontier oil and gas, and marine bio-resources. Established sectors like wild fishery, shipping, ship-building, maritime defence, and offshore oil and gas will be transformed into digitally-driven, sustainable sources of new economic and social value.

Atlantic Canada is one of the most promising regions in the world from which to build global leadership in the ocean economy of the future. The Ocean Supercluster is a transformative opportunity for the Government of Canada to help make this happen.

## WHAT IS THE OCEAN SUPERCLUSTER?

### *Description of Cluster and Strategic Need for Canada*



*"The ocean is the new economic frontier. It holds the promise of immense resource wealth and great potential for boosting economic growth, employment and innovation. And it is increasingly recognized as indispensable for addressing many of the global challenges facing the planet in the decades to come, from world food security and climate change to the provision of energy, natural resources and improved medical care. While the potential of the ocean to help meet these challenges is huge, it is already under stress from over-exploitation, pollution, declining biodiversity and climate change. Realising the full potential of the ocean will therefore demand responsible, sustainable approaches to its economic development."*

-The Ocean Economy in 2030, OECD

The Organization for Economic Co-operation and Development (OECD) defines the modern ocean economy as consisting of established ocean industries such as offshore oil and gas exploration and production; shipping; shipbuilding and marine equipment; capture fisheries and fish processing; maritime and coastal tourism; and marine transportation, logistics, and port activities; as well as emerging industries such as marine renewables; seabed mining for metals and minerals; marine aquaculture; marine biotechnology; and ocean monitoring, control and surveillance.

There are few places in the world better suited to a leadership role in the modern ocean economy than Atlantic Canada. More than 75% of Canada's ocean economy is in Atlantic Canada. The majority of the population lives in or near coastal communities, and ocean-related activities make up 15-20% of the regional economy. Ocean industries in the Atlantic Provinces account for more than half of all ocean-related jobs in Canada. From 2006 to 2014, the oil and gas industry accounted for over \$10B per year of Newfoundland and Labrador's economy.<sup>1</sup> The region is home to the world's highest tides and most significant potential tidal energy resource. More than two-thirds of the jobs in Canada's fishing and aquaculture sectors are in Atlantic Canada, which also accounts for most of Canada's record \$6.6 billion in fish and seafood exports in 2016.

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<sup>1</sup> Socio-economic Benefits from Petroleum Industry Activity in Newfoundland and Labrador, 2011-2014, Stantec, January 2016.



The opportunity to leverage the government of Canada's Innovation Supercluster Initiative to attract significant private investment in innovation collaborations with the potential to materially accelerate solutions to shared challenges, has brought leading ocean companies together to co-found the Ocean Supercluster. They are: Emera (marine renewable energy), Petroleum Research Newfoundland and Labrador (oil and gas), Clearwater (capture fisheries), and Cuna del Mar (aquaculture). These initial industry members are coming together with other ocean industries, and a broad spectrum of innovation partners, combining proven ability to develop sustainable technology solutions for harsh environments with world-renowned ocean science, engineering, infrastructure, and applied research.

#### *Focus of the Supercluster*

Many clusters in the world organize around a single sector or value chain, exploiting linkages like shared suppliers, common talent requirements, and shared infrastructure to amplify economic output. However, these clusters may remain siloed. The Ocean Supercluster is designed to eliminate sector silos and to promote co-investment in solutions with multiple applications in order to address the costs and challenges associated with ocean innovation and Canada's current position in comparison to some other nations.

All sectors of Canada's ocean economy are united by the dominating influence of cold, highly variable, and harsh environmental conditions on their operations. These conditions increase risk and reduce efficiency of marine-based operations, adding cost and complexity for businesses. While land-based industries can exploit ubiquitous cellular and Wi-Fi networks to deploy novel digital technologies (e.g. the Internet of Things), it remains a challenge to communicate, collect, and transmit timely data, and to operate reliably and safely in the ocean—even in near-shore conditions.

The promise of advances in communications, sensors and imaging, data analytics, autonomous systems, and biotechnology to reduce risks and uncertainties associated with operating in this environment is highly compelling for any ocean company. But cost and complexity make such developments challenging to undertake alone. The opportunity to pool energy, imagination, and resources, and to amplify the impact of research and development (R&D) expenditures, is a motivation that unites Ocean Supercluster partners.

The Ocean Supercluster takes advantage of Canada having one of the world's few ocean economies characterized by significant activity in all major sectors, including seafood, shipping, energy, defence, and tourism. It includes Canadian multinationals, branches of foreign multinationals, major technology and service suppliers, small-to-medium-sized ocean technology enterprises, and some of the world's pre-eminent ocean scientists, engineers, and R&D facilities. This breadth of activity translates into a large pool of companies facing shared challenges, who thus become potential partners for innovation collaboration in the Ocean Supercluster.

The elements are in place for Canada to become a global leader. The Ocean Supercluster will connect the pieces needed to accelerate adoption of technology across sectors, making Canadian ocean resource companies more globally competitive and giving Canadian ocean technology players early access to significant reference customers in large global supply chains. In short, the Ocean Supercluster can transform Canada's ocean economy into a digitally-powered knowledge economy.

#### *Importance of the Ocean Supercluster to Canada*

According to the OECD, the global ocean economy is worth at least US \$1.5T, making up 2.5% of the total world economy. But Canada's ocean economy only accounts for 1% of the national economy. This

despite having among the most abundant ocean resources on the planet: the longest coastline, the fourth largest ocean territory, including some of the world's most productive waters, and the largest Arctic Ocean territory in the world.

The OECD further forecasts that the ocean economy will more than double in size by 2030 as a result of mega trends like global population growth, increased life expectancy, rising incomes, and increased global trade. The impact of these trends on ocean value chains will be profound: 90% of the world's goods travel by sea (the greenest mode of transportation on a tonne x km basis); deep and ultra-deep water oil and gas will grow from 3% to 12% of the global supply of crude within 20 years; and aquaculture—the fastest growing animal food-producing sector in the world—will surpass the global value of wild fisheries within five years.

According to Kongsberg, a large, global ocean technology company, there are three key trends transforming marine industries.<sup>2</sup> Accelerated technological development is driving new vessel and asset design and new business models. Intensified competition and increased price focus are driving lower costs. And the rise of Asian builders, who are quick to adopt new and future technologies, is disrupting traditional value chains. Kongsberg sees ocean technology demand converging towards integrated solutions, digitalization, remote services, and autonomy.

Changes to the ocean itself will also drive transformation. The OECD notes, “An important constraint on the development of the ocean economy is the current deterioration of its health. As anthropogenic carbon emissions have risen over time, the ocean has absorbed much of the carbon, leading to its acidification. Also, sea temperatures and sea levels are rising and ocean currents are shifting, resulting in biodiversity and habitat loss, changes in fish stock composition and migration patterns, and higher frequency of severe ocean weather events. The prospects for future ocean developments are further aggravated by land-based pollution, in particular agricultural run-off, chemicals and macro- and micro-plastic pollutants that feed into the ocean from rivers, as well as by over-fishing and depleted fish stocks in many parts of the world.”

These global and industry trends compel Canada to urgently address the current and future state of its ocean economy. Canada has too small a piece of the proverbial growing pie. Or, put another way, Canada's ocean economy is massively undervalued, making it a significant investment opportunity. Norway, with a population of just over 5 million people, boasts an ocean economy nearly seven times the size of Canada's, and 50% higher GDP per capita, demonstrating the high value of modern ocean jobs. The potential for Canada to derive more sustainable benefits from its ocean resources is significant.

#### *Potential Impact of the Ocean Supercluster*

Industrial, technical, and scientific breadth is a globally-distinguishing characteristic of Canada's existing ocean cluster. However, its effectiveness in generating commercially-relevant innovation can be improved. Industry leaders and their immediate suppliers often have a limited awareness of the R&D activities of other sectors and the creative technological capabilities of small and medium-sized enterprises (SMEs). This limited awareness exists because there are few mechanisms for idea exchange between companies that do not have an established commercial relationship. SMEs that are not in the supply chain often have a weak understanding of large industry needs, which creates a prevalence for innovation “technology push” rather than the “market pull” of industry.

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<sup>2</sup> Kongsberg presentation to Ocean Supercluster team, Trondheim, Norway, October 25, 2017

The Ocean Supercluster will create significant supply chain business opportunities for Canada's ocean tech SMEs and other technology providers. Many of these firms are R&D-intensive and built on world-class science and technology-based products. They export into specialty markets around the globe, and are profitable for their shareholders. However, their growth often plateaus while they are still relatively small, and many are ultimately acquired by foreign conglomerates. While such exits have many important economic benefits, another effect can be to see foreign nations accrue the value of technology that was developed and proven with public funding in Canada.

Compared to Norway, which has a very high-performing, sustainable North Atlantic ocean economy, Canada's ocean activities lack integration amongst industry, government, and post-secondary sectors. As a result, it is far more challenging, if not impossible, in this country to foster a sustained dialogue with government and industry partners throughout the ocean economy that could turn Canada's natural ocean strengths into future global advantages.

The Ocean Supercluster will create a more integrated network of relationships amongst industry, regulators, researchers, technology developers, and policy-makers, which will create the foundation for Canada to establish a national ocean strategy. This would create shared long-term goals which become the foundation for ambitious targets, shared understanding of challenges and bottlenecks, greater inclusiveness and diversity, and transparency and information-sharing. By supporting a more integrated strategic approach to the ocean, the Ocean Supercluster will shape those activities and investments that will boost Canada's future ocean outputs, such as R&D, regulatory modernization, training and skills development, technology demonstration, economic development, private capital investment, and market development.

In the absence of an integrated national strategy to build a globally competitive ocean economy, there is a risk that the future value of Canada's ocean resources will be diminished as the nation turns to foreign companies (for IP, equipment, processes, capital, etc.), paying market premiums to produce its ocean resources.

#### *Key Strengths of the Innovation Ecosystem*

An overarching strength of Atlantic Canada's innovation ecosystem is the presence of large ocean resource companies in many value chains—including food, energy, defence, shipping, and tourism. These world-leading companies have significant impact on Canada's economy and employment. Their continued growth is a substantial economic opportunity for Atlantic Canada and for the country. Within the Ocean Supercluster, these companies are both drivers and end-users of innovation outputs. They anchor widespread value chains and procure significant quantities of products and services from SMEs. They also establish important links to international markets and global supply chains.

Another strength is Atlantic Canada's exceptionally high number of science-based technology companies serving global markets for ocean technology. These companies have had great success with the development of advanced sensors, analytics, subsea communications, physical oceanography, marine biology, marine engineering, robotics, un-tethered maritime vehicles (UMVs), and energy storage. These companies have among the highest level of business expenditures on R&D (BERD) of any sector in Atlantic Canada.<sup>3</sup>

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<sup>3</sup> "Nova Scotia's Ocean Technology Sector: Moving Forward" Government of Nova Scotia (2013)

The ocean ecosystem is also fueled by the region's incredible wealth of universities, colleges, and federal research labs that generate great ideas and technology while supplying an ongoing pool of well-educated, highly-qualified people.

The region's growing network of entrepreneurs, incubators, accelerators, and venture capital firms are providing more support than ever for startups and young companies to scale. The sale of Atlantic Canadian venture-backed companies over the past six years has generated nearly \$2 billion.<sup>4</sup> These exits are financing a new generation of serial entrepreneurs who are becoming angel investors and experienced mentors. Much of the technical talent remains in the region, ready to re-deploy into the next venture.

Lastly, the Atlantic Provinces are home to the government of Canada's most significant cluster of ocean science and technology capacity and ocean-related programs and assets. These include the Bedford Institute of Oceanography, Defence Research and Development Canada, National Research Council, Natural Resources Canada, and Maritime Forces Atlantic. The federal government has recently invested very significantly in ocean innovation, contributing \$97M to fund the \$220M Ocean Frontier Institute, \$1.5B for its Oceans Protection Plan, and \$325M for the Atlantic Fisheries Fund, and funds the Fundy Ocean Research Centre for Energy (FORCE). The Atlantic Canada Opportunities Agency, through its Business Development Program and Atlantic Innovation Fund programs, plays an important role in the growth of ocean businesses. The National Research Council's Industrial Research Assistance Program has been used by most ocean technology SMEs in the sector to gain early stage traction on new IP.

#### *Vision for the Supercluster and Global Competitiveness*

The vision for the Ocean Supercluster is to build Canada's ocean economy into one of the most significant, sustainable, and value-creating segments of the national economy.

The mission is to build an innovation-driven ecosystem in which companies are well-connected across different ocean related value chains, and to suppliers of enabling technologies. This will be accomplished by developing a shared innovation roadmap for technology leadership and through a program of cluster-building activity. These activities will result in better connections between cluster members that will facilitate more and faster opportunities to build new digital capabilities, to recruit and develop needed talent pools, and to de-risk solutions to urgent challenges facing ocean enterprises.

The Ocean Supercluster will grow by maintaining strong market-pull for innovation and a rigorous focus on creating value for its members. The multi-sectoral approach to complex ocean problems will encourage the cross-pollination of existing supply chains, resulting in lateral technology transfer, reduced technology adoption costs, new technology alliances, novel hardware/software platforms, and new entrants into the ocean economy. This will also create a highly scalable vector for the commercialization of R&D undertaken within science-based SMEs, startup companies, universities and colleges, and research labs. Because the Ocean Supercluster is anchored by ocean companies that operate internationally, projects will start from an intent to attain global scale and to win in global markets.

A key to sustained growth will be establishing strong bonds of trust among partners and demonstrating momentum for innovative activities. The Ocean Supercluster will do this by focusing on achieving early success. Early initiatives will prioritize projects with high impact and lower cost and complexity. As

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<sup>4</sup> <http://entrevestor.com/ac/indepth/entrevestor-study-finds-exits-bring-1.8b-2200-jobs-to-atlantic-canada>

relationships and processes are proven, the Ocean Supercluster will increase the complexity and volume of projects while retaining a priority for high impact.

As part of the development of this application, Ocean Supercluster founding partners travelled to Norway to study the design and function of several ocean clusters. Key insights included the importance of early successes to build trust and momentum, developing and sustaining communications among cluster participants, engaging strong leadership, and remaining focused on growing the economy as the prime objective. Several clusters in Southwest Norway are employing MIT's Regional Entrepreneurship Acceleration Program (MIT REAP) as a framework for cluster building activities and collective impact.

## SUPERCLUSTER STRATEGY

### *How will we be successful?*

The Ocean Supercluster has set key objectives to advance its vision and mission over the first five years:

- Accelerate the development of innovative capabilities across ocean industries by strengthening links between ocean-based value chains and providers of enabling technologies
- Develop, deploy, and export innovative technology platforms applicable to multiple ocean industries
- Fill capability gaps in the innovation ecosystem through the attraction, recruitment, training, and retention of diverse, highly qualified personnel in science, technology, and management
- Extend the global reach, attraction, network and market opportunities for Ocean Supercluster partners
- Address global challenges related to sustainability, reducing carbon foot-print and improving energy efficiency

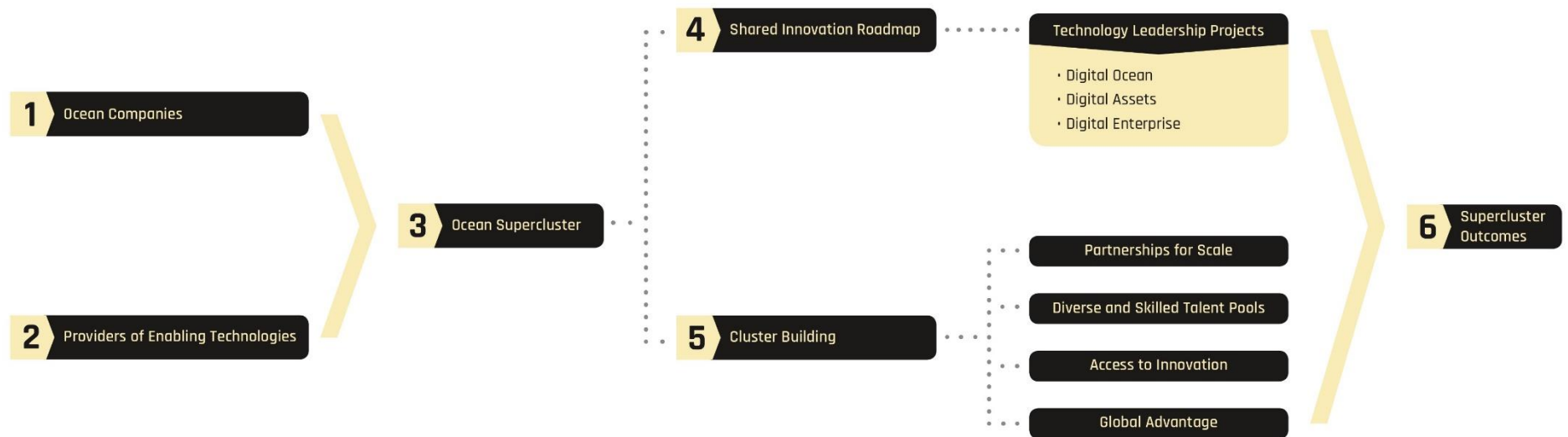
To achieve these objectives, the Ocean Supercluster will pursue a two-pronged strategy. It will create a shared innovation roadmap to accelerate the development of common technology-enabled capabilities across multiple ocean-related sectors; and it will build the innovation and entrepreneurial capacity of the cluster as a whole through both funded and leveraged cluster-building activities.

The strategy aims to facilitate large-scale collaborations amongst companies across different ocean-based value chains in order to build market-informed technology innovation objectives. Pursuing these goals will lead to the development of new capabilities, enabling more value creation from Canadian ocean resources, and establishing scalable global markets for IP developed within the supercluster. By linking large-scale technology collaborations to potential suppliers of enabling technologies in the development of the Ocean Supercluster innovation roadmap, the strategy will encourage more ambitious technology projects, more lateral technology transfer opportunities, more opportunities for talent sharing and leverage, and more opportunities for new technology entrants into the ocean economy. In turn, this will drive Canada's ocean economy.

Advancing the Ocean Supercluster innovation roadmap will be achieved through Technology Leadership Projects. Cluster-building activities will be advanced through Partnerships for Scale, Access to Innovation, Building Diverse and Skilled Talent Pools, and Global Advantage.



# CANADA'S OCEAN SUPERCLUSTER



## 1. Ocean Companies\*

- Sea farming
- Wild fishery
- Offshore oil and gas
- Marine renewables
- Defence
- Shipping
- Marine bioproducts

## 2. Providers of Enabling Technologies\*

Suppliers, SMEs, researchers, and others who develop/provide:

- Sensors and imaging
- Subsea communications
- Big data and analytics
- Biotechnology and genomics
- Autonomous systems
- Robotics
- Remote systems
- Satellite technology
- Ocean science

## 3. Ocean Supercluster

**Vision:** Build Canada's ocean economy into one of the most significant, sustainable, and value-creating segments of the national economy.

**Mission:** Build an innovation-driven ecosystem in which companies are well-connected across different ocean related value chains, and to suppliers of enabling technologies.

## 4. Shared Innovation Roadmap

Objectives for innovation include but are not limited to:

- Ocean resource protection and monitoring
- Safe and cost-effective remote operations
- Enhanced operational performance
- Advanced digital operations
- Efficient data transmission

## 5. Cluster Building

- Open call innovation projects
- Talent attraction and development
- International networks and cluster linkages
- Branding and promotion
- Cluster events and technology forums
- Supplier development
- Technology brokerage
- Incubation, acceleration, and mentorship

## 6. Supercluster Outcomes

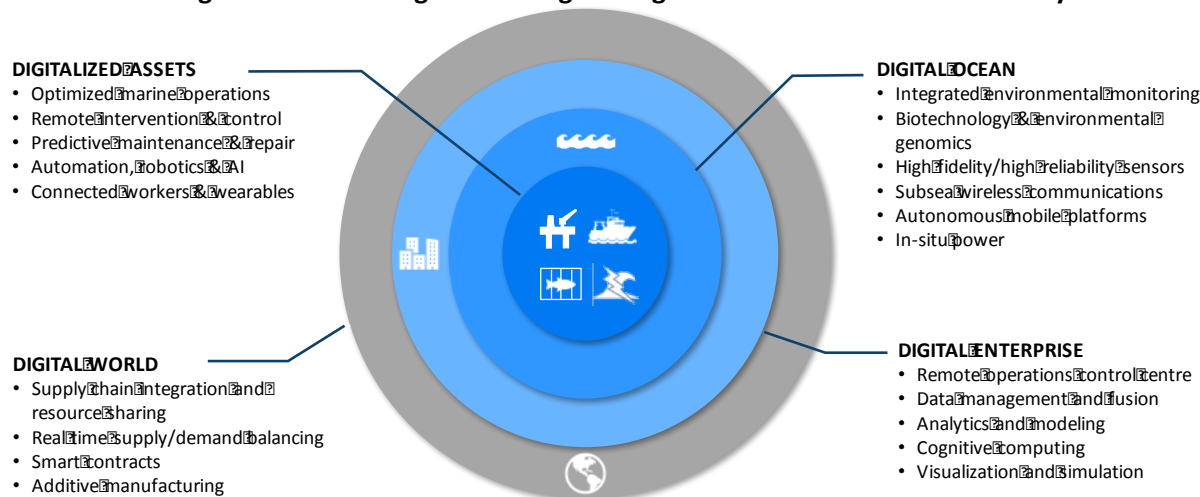
- Deploy innovative technology platforms across ocean sectors
- Strengthen links between ocean value chains and technology providers
- Fill capability gaps in the innovations ecosystem
- Extend global reach and market opportunities
- Address global challenges related to sustainability, reducing carbon footprint, and improving energy efficiency

\*These lists are illustrative and not exclusive

### Technology Leadership

Technology Leadership Projects (TLPs) are aimed at overcoming challenges and bottlenecks that currently constrain sustainable growth in ocean-based industries. All sectors of Canada's ocean economy are united by the dominating influence of cold, highly variable, and extreme marine environmental conditions on their operations. Largely because of the harsh ocean environment in which they operate, marine assets and processes are conservatively designed for worst-case scenarios, adding significant cost. Companies remain overly reliant on human intervention in harsh operating conditions. These challenges limit the ability of ocean-based companies to compete in a challenging, changing world.

**Figure 1 – Technologies Enabling the Digitalization of the Ocean Economy**



TLPs can initially be categorized into three high level domains:

- *Digital Ocean Environment* – improved monitoring, protection, development, and sustainability of ocean resource through better collection, increased access, timeliness, and quality of ocean ecosystem data
- *Digital Ocean Assets* – design and operational performance enhancements for safe and cost-effective marine remote operations
- *Digital Ocean Enterprise* – cross-cutting projects inter-linked with advances in the other two domains to deliver powerful digital transformations across ocean industries

The results of early project scoping activity have demonstrated strong technical alignment among ocean industries across a spectrum of activities and are summarized in Figure 2.

### Digital Ocean Environment

All sectors are united by their need for accurate, timely ocean ecosystem and operating environment data. Marine weather, waves, current and other key parameters, are required to predict working conditions, plan marine operations and maintain the safety of personnel. The marine renewables sector requires additional environment data due to its unique site characteristics, such as poor visibility, very high currents, and environmental noise. For industries undertaking bioprospecting and sampling activity, challenging undersea terrain and difficult environmental conditions can affect access, sample and data quality, and confidence in results. Uncertainty about physical, chemical and biological data parameters translates into increased operational costs and risks for ocean industries, challenging sustainability and growth.

Ecosystem-based marine management approaches can support superior evidence-based decision making, but require increased characterization and data interpretation capabilities that are not currently possible. Improving our ability to characterize and monitor the environment in a cost-effective, real-time manner will enable ocean industries to better protect and sustain ocean resources. Within this domain, the cluster's shared business objectives are to lower the cost of data acquisition and improve data access, timeliness, and quality. The outcomes these technology development efforts will deliver are reliable and scalable technologies for short- and long-range ocean monitoring and cost effective environmental monitoring observatories with real-time data integration.

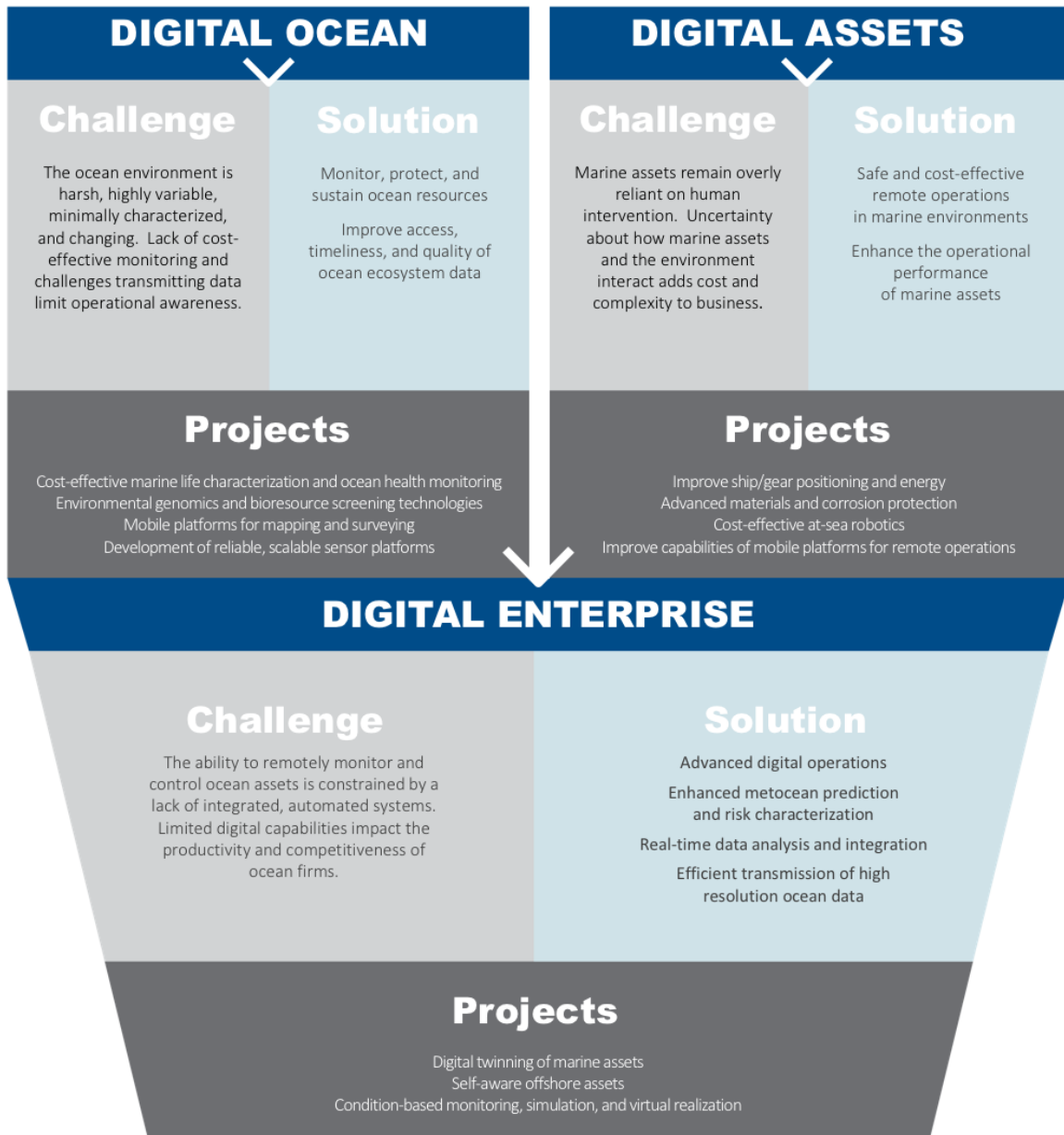
Activities within the Digital Ocean Environment domain will also include areas of targeted sub-focus. Environmental genomics is a powerful, scalable emerging technology platform that has the potential to provide cheaper, faster, and better biological data. Advances in environmental genomics technologies will break through the cost-barriers and inaccuracies associated with conventional approaches. These advances will bring cutting-edge, high-throughput DNA sequencing technology into the Atlantic region and will be one of a kind in Canada.

Another area of sub-focus within the Digital Ocean Environment domain is marine bioactives. Marine bioactives are natural sources of functional chemistry in high global demand as sustainable alternatives to petroleum-based actives. Ocean sensing technology advances will support the development of genomic and assay-guided technologies that can be used to screen for new product applications. Solution providers within these supply chains will use complementary technologies, including: environmental genomics, genetics, undersea sensors and underwater vehicles to monitor disease and environmental conditions, develop new health protection technologies, and sustainable sources of feed ingredients.

Enhanced Digital Ocean Environment capabilities will improve and innovate strategies to mitigate the effects of industrial activities on the ocean ecosystem. They will also allow companies to optimize asset design and operational processes across ocean environments. This large-scale industrial collaboration will be enhanced by partnerships with other key ocean stakeholders. Our collective increase in knowledge and understanding will improve the protection and sustainability of ocean resources and support better management of our ocean environment.

Figure 2: Shared Innovation Roadmap for Technology Leadership

## OCEAN SUPERCLUSTER SHARED INNOVATION ROADMAP



### Digital Ocean Assets

Ocean-based assets, particularly those in the North Atlantic, whether ships, production platforms, subsea turbines, or fishing tackles, are deployed in harsh, remote, and challenging environments. Operating in a harsh environment requires infrastructure and resources, which adds cost and complexity

to business. The Ocean Supercluster provides a unique opportunity to leverage cross-sectoral insight across multiple technology platforms to deliver ocean asset performance enhancements across a range of applications.

Improved monitoring and understanding of marine assets and the environment in which they operate will improve engineering and design. For example, improved understanding of fatigue, friction, and degradation of tidal turbine components will inform the development of better-performing materials and more effective design of corrosion protection systems. As another example, “smart” fishing gear that can detect bottom conditions, fish, and other objects and automatically adjust its configuration will help to avoid hazards, optimize gear retrieval, and reduce unintended by-catches.

Digital Ocean Asset TLPs will also aim to unlock the productivity and safety advantages of UMVs. High potential usage areas include mapping, sample collection, resource biomass surveying, frontier characterization, deploying fishing gear, pipeline and cable positioning, and subsea intervention and maintenance. The current utility of UMV solutions in commercial environments is limited by cost and insufficient capability in complex environments. The Ocean Supercluster will execute a unique, focused UMV capability development and demonstration effort focused to resolve a pool of cross-sectoral challenges driven by market pull. Outcomes in this area will include improved functionality of mechanical, sensing and instrument systems, development of multi-role capabilities, and reduced operating cost.

Several foundational improvements in ocean infrastructure will be required to capitalize on real-time access to exponentially greater volumes of high resolution data. These improvements include: sensor and sensor data transfer technology, underwater communications infrastructure, advanced analytics, and data access and management. Data can then be transformed into the knowledge required to optimize asset operation, develop sustainable processes, and protect the marine environment. Smarter, more self-aware ocean assets will communicate their condition, project the trajectory of ships, forecast the position of organisms and ice, predict the impact of metocean events, and recommend options to humans for action. Ocean industries will be empowered by a complete awareness of real-time conditions.

#### *Digital Ocean Enterprise*

The most sustainable, profitable companies in the modern economy are leveraging advanced digital technology throughout their supply chains, production, and distribution processes. Limited digital capabilities in ocean-based value chains results not only in potential competitive disadvantages for Canadian companies in global ocean markets, it also impacts the productivity and competitiveness of ocean firms as compared to other successful firms in the economy, which in turn affects capital costs, market value, and ability to attract top talent.

TLPs in this domain will be inter-linked with those in Digital Ocean Assets and Environment to develop next-generation ocean operating models that are only possible through large-scale digital transformation.

Development of virtual twinning technology will enable optimization of steady state operations, as well as improved scenario planning and validation for design and operations. New solutions for storing and accessing real-time and historical data from multiple sources will allow the integration of machine learning and Artificial Intelligence (AI). Increasing the usage of on-shore remote control will support the development of safe, cost-efficient platforms that can be used to increase familiarization with offshore



assets and validate marine operations in advance. Efficient work spaces, digitalized procedures, and augmented virtual simulation and training will improve our capability to remotely monitor and control the operation of multiple assets.

The enhanced ability to automate operations and reduce direct human interventions will promote safer, more cost-effective, and less carbon-intensive operations and deliver a step change in efficiency and productivity. A digitalized ocean ecosystem will significantly reduce the cost of existing operations and break-through the cost and technology barriers that currently limit ocean economic development in Canada.

#### *Cluster-Building Activities*

Cluster-building Activities aim to both improve the extent and quality of collaboration on TLPs, and ensure that the benefits of TLPs are broadly impactful. Cluster-building will be measured by the Ocean Supercluster's extended capacity for innovation and entrepreneurship. These, in turn, are driven by key factors like human capital, availability of funding, access to infrastructure, the policy/regulatory environment, culture and attitudes, and the demand for new products, services, and processes.

Cluster-building encompasses an array of activities organized into four thematic areas, and may be further grouped into those activities directly funded by the Ocean Supercluster, and those that leverage partnership activities in the ecosystem that already contribute to the strength of the innovation ecosystem. The Ocean Supercluster will not replicate programs and services already available amongst its membership or within the ecosystem. It is the strategic intent of the Ocean Supercluster to benefit the broader ecosystem by leveraging and activating its networks and capabilities; and to benefit from the critical mass of innovation and entrepreneurial capacity available in the ecosystem to enhance TLP outcomes.

#### *Diverse and Skilled Talent Pools*

Perhaps nothing is more critical to the success of the Ocean Supercluster than the ability to develop and attract the world-leading talent needed to establish Canada's smart ocean advantage. Funded activities will focus on ensuring that the modern ocean workforce is diverse and inclusive of indigenous peoples, women, and others underrepresented in the economy. A global talent fund will support the collaborative efforts of industry members to attract the world's best engineers, scientists, and ocean executives to support TLPs. A program to extend work integrated learning opportunities will connect ocean industries with the Canadian and international students studying in Canadian universities and colleges.

The Ocean Supercluster will also align with other relevant activities already underway in the ecosystem, including the SmartICE program which leverages Inuit knowledge to enhance ice monitoring technology and services; and iCorps, which provides entrepreneurship and commercialization training to researchers.

#### *Partnerships for Scale*

A key objective of the Ocean Supercluster is to create the conditions for more start-ups and scale-ups in the ocean economy. Cluster-building activities are part of the strategy to achieve that goal. They will create new opportunities for start-ups and smaller technology providers to pitch new ideas and gain deeper insight into the capability requirements of end-users. The Open Call program will provide seed funding for early stage development of potentially disruptive innovations. Supply chain development activities will help growing companies meet the exacting demands of large industrial supply chains. A

technology brokerage service will closely survey the Ocean Supercluster for opportunities to make new connections between technology partners and end-users, uncovering previously unexpected value.

Atlantic Canada's start-up ecosystem is already seeing considerable momentum. The Ocean Supercluster will align with the newly-established Creative Destruction Labs-Atlantic, which brings the Rotman School of Business acceleration program to clean-tech and ocean-tech companies. It will also establish deep relationships with existing incubators and accelerators across the region, like Propel ICT, Volta Labs, Emergence, Startup Zone, and the Genesis.

#### *Access to Innovation*

Access to specialized design and fabrication equipment are constraints facing smaller companies innovating in any sector. Ocean innovators of all sizes face increased cost and complexity trying to access ships, UMVs, marine heavy-lift equipment, computer lab infrastructure/computing resources, and waterfront facilities as they undertake technology demonstration and commercialization activity. The Ocean Supercluster will establish programs to support the costs of commercialization and technology transfer between sectors. It will also leverage significant assets like the Centre for Ocean Venture and Entrepreneurship (COVE) that provide waterfront access, specialized equipment, and the ecosystem benefits of co-locating with a critical mass of ocean innovators.

#### *Global Advantage*

The Ocean Supercluster is already benefiting from effective collaboration with ocean stakeholders in Atlantic Canada and clusters in Europe and the U.S. Wider perspective, best practices, talent sharing, R&D collaboration, technology transfer and commercial opportunities are some of the reasons the Ocean Supercluster will establish a Global Ocean Tech Alliance with leading regions for ocean innovation, including Norway, California, New England, and the U.K.

To ensure that the focal areas of the TLPs remain on the cutting-edge, the Ocean Supercluster will also establish regular forums which will be open to the broad membership and international partners, to provide progress updates and look ahead at relevant industry and technology trends that may impact the further development of TLPs. Because policy and regulations are also a significant factor in growth, and TLPs will enable regulatory modernization, semi-annual forums will also be established to look at technology focus where it intersects with public policy and the regulatory environment.

By combining the international reach and global significance of multiple ocean sectors with the demonstrated expertise of Atlantic Canadian technology providers, innovators, and researchers within a powerfully-connected innovation ecosystem, Canada's Ocean Supercluster will establish itself as a global, knowledge-driven, digital ocean enterprise leader. This will support significant growth of large industries resulting from improved utilization of Canada's ocean resources. It will also create important opportunities for smaller companies.

Opportunities to create innovative products and services that provide new value to a digitalized ocean ecosystem will increase penetration of SMEs into multiple markets and generate high value export opportunities. The advancement and proliferation of digital operations in Canada's ocean ecosystem will significantly reduce the cost of existing operations, support the enablement of new developments in challenging ocean regions, and result in large net economic impacts. This will help local providers gain opportunities to validate new products and services for global markets through supplying regional demand. Existing expertise in Canada's software, sensor, detection (satellite, radar, sonar), training, and

research service providers to develop and deploy disruptive innovations will be directed at scale towards global markets.

#### *Technical Assurance of New Technologies*

The anticipated rapid rate of change of the oceans technologic landscape will require robust tools and processes to ensure safe integration and operations, and complementary strategies to satisfy regulators and society that new technologies will reduce risk and enhance operational safety and environmental protection.

The Ocean Supercluster has established links to leading researchers in the areas of autonomous and intelligent systems integrity and policy to support development of systems of assurance to support regulatory compliance and safety of people, property and the environment. Letters of support are included with this application from distinguished researchers at: the University of York in the UK, who are leading the recently announced £12 million “Assuring Autonomy International Programme (AAIP)” of research co-funded by the Lloyd’s Register Foundation; and from the University of Toronto’s Munk School of Global Affairs, who are conducting research to investigate and inform policy related to digitalization of resource extraction industries (including mining, offshore oil and gas, and subsea mining).

#### *Diversity Strategy*

The Ocean Supercluster is committed to diversity across its programs and organization, and will undertake deliberate activities to promote inclusion of indigenous people, women, and other groups under-represented in the economy, in the achievement of overall objectives and outcomes. To ensure that women and underrepresented groups are meaningfully represented in and benefit from both TLPs and Cluster-building activities, the Ocean Supercluster will develop a Diversity Plan which set out describe gender balance and diversity goals and initiatives. The plan will include an Indigenous Engagement Strategy which will be developed collaboratively with First Nations.

#### *Long-term sustainability of the Ocean Supercluster*

The Ocean Supercluster has an ambition for significant, sustainable growth of Canada’s ocean economy over the long term. Its ability to persist beyond the initial five-year term will depend entirely on its ability to create value for industry members. To be worthy of continued investment, it must deliver new capabilities in the supply chain, enhance competitiveness, improve productivity, or identify and exploit new opportunities for investing members. The entity’s industry members have long term operations and aspirations in the region and a strong record of investing in innovation. Should the Ocean Supercluster prove a success, there is potential for re-investment.

## **INNOVATION ECOSYSTEM POTENTIAL**

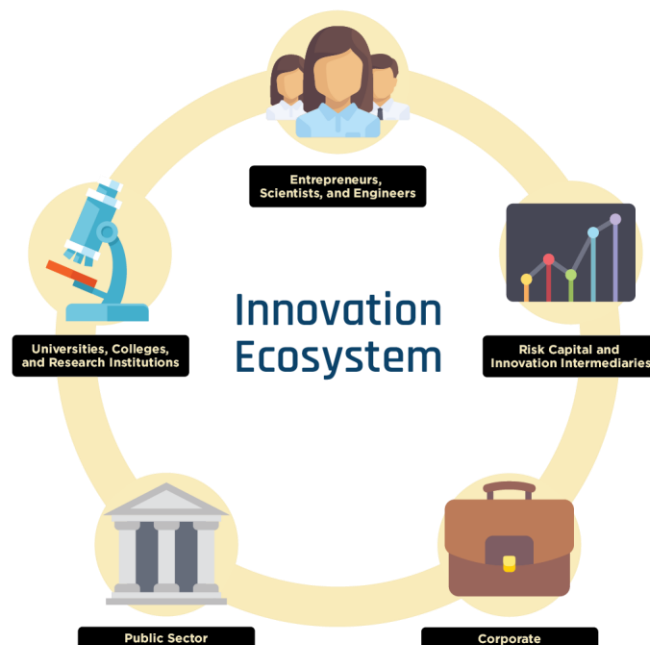
### *Driving Innovation in the Ocean Economy*



The Ocean Supercluster is built upon formal and informal networks that include SMEs and large companies, entrepreneurs, risk capital and innovation intermediaries, universities and research institutions, and governments. These relationships are essential to strong innovation-driven entrepreneurial ecosystems. Through both technology leadership and cluster-building activities, the

Ocean Supercluster will scale and deepen networks to strengthen innovation capacity and entrepreneurship capacity and deliver significant new economic benefits.

**Figure 3: MIT REAP Innovation Ecosystem Stakeholders**



### *Companies*

The Ocean Supercluster includes globally significant ocean-based companies. Clearwater Fine Foods has emerged as the most technologically advanced fishing company in the world, while omega-3 company, Ocean Nutrition, became one of the largest start-up exits in Atlantic Canadian history. Cooke Inc. is the third largest aquaculture firm in the world, and Irving Shipbuilding is building Canada's next generation of navy ships at the most advanced shipyard in North America. Emera has grown to become one of the largest investor-owned energy companies in North America. It has already undertaken significant subsea projects, and is now embarking on one of the world's most ambitious tidal energy developments. Global leaders in offshore energy, Statoil, Husky, Chevron, Suncor, and ExxonMobil are producing oil and gas in some of the world's harshest, most challenging waters.

In addition to large, widely known companies, the Ocean Supercluster includes smaller companies which provide world-leading ocean science and technology, industrial supply and logistics, data and analytics, and "Industry 4.0" solutions to ocean industries. Cluster SMEs and supply partners are leaders in the areas of environmental monitoring, remote sensing, subsea surveillance, metocean forecasting, ice management and drift modeling, marine tracking, acoustic fish tags, oceanographic sensors, passive acoustic monitoring, sonar, optical imaging, and systems integration.

The Atlantic innovation ecosystem includes world leaders in information and communication technology (ICT) and digital technologies, and data analytics. These include global players such as IBM, Deloitte, Cisco, and Siemens, local technology companies such as Mariner and T4G, and start-ups such as radiant360, Eigen and BlockCrushr Labs. The Ocean Supercluster will leverage the expertise, capabilities and assets of these digital companies to drive focus on the transformation of Canada's ocean industries.

*Case Study:* [Vemco](#) is a global leader in the design and manufacture of acoustic telemetry equipment. Vemco products have enabled new marine research, most notably the Ocean Tracking Network (OTN), which provides the only globally-connected system for studying marine life. With impact on both science and the seafood industry, this “internet of fish” is attributable to Canadian scientists and entrepreneurs.

*Case Study:* For more than 35 years, [CARIS](#) has been making software designed for the marine GIS community. Developed in cooperation with hydrographic clients and universities, the CARIS™ toolset provides clients with resource optimization and operational advantage. The newest product in the toolset, CARIS Onboard™, is a near real-time and autonomous data processing package which has been developed with autonomous underwater vehicles (AUVs) and unmanned surface vehicles (USVs) in mind. In 2016 CARIS was acquired by Teledyne Technologies Inc.

*Case Study:* [Kraken Robotics](#) is a St. John's, NL-based international ocean technology company engaged in the design, development and marketing of advanced sensors, software and underwater robotics for unmanned maritime vehicles used in defense and commercial applications. Kraken is a recognized leader in the innovation of synthetic aperture sonar (SAS), an underwater imaging technology that is disrupting seabed surveying through ultra-high-resolution imagery at superior coverage rates. Kraken's SAS was key to the successful 2016 discovery of one of the lost ships of Sir John Franklin's Arctic expedition, and to the 2017 recovery of Avro Arrow prototype artifacts from Lake Ontario.

*Case Study:* [Aspin Kemp & Associates](#), based in Montague, PEI, designs and manufactures sophisticated automation and control systems that manage the operation of hybrid diesel generator-battery power systems on oil platforms all over the world. Recently their technology has been adopted for use in hybrid diesel-electric power control of tugs, reducing fuel costs and environmental emissions.

#### *Entrepreneurs, Scientists, and Engineers*

Atlantic Canada has a strong entrepreneurial track record, particularly for creating science and technology-based start-ups. The sale of Atlantic Canadian venture-backed companies over the past six years has generated approximately \$2 billion. For example: \$540 million for Ocean Nutrition Canada; \$500 million for Q1 Labs; \$340 million for Radian6; \$246 million for PAL Aerospace; more than \$200 million for STI; \$70 million for GoInstant; and undisclosed amounts for other companies such as CARIS, Avalon Microelectronics, iCan, and Compilr.

These exits are financing a new generation of serial entrepreneurs who are becoming angel investors and experienced mentors. Much of the technical talent remains in the region, ready to re-deploy into the next venture. Every large buy-out is noted in the global venture financing community, building the reputation of Atlantic Canada as a place to invest. High-profile buyouts create confidence in budding entrepreneurs that local innovation can have a global impact.

Entrepreneurial and innovative talent is one of the most significant assets of the Ocean Supercluster. Established business owners, emerging entrepreneurs, a highly educated workforce, and a deep pool of ocean scientists and researchers combine to form a critical mass of world class talent.

The strong talent base presents further opportunity to develop a centre of gravity that will attract more global leaders and expertise to Canada, as well as investment in the people, companies, and technologies they develop. The Ocean Supercluster will develop robust international networks of leading entrepreneurs, technologists, and executives as part of talent attraction activities. It will also



focus on the development of existing talent through increased interaction, networking, and mentorship within the existing community.

*Case Study:* Gina Pecore began her career in the Royal Canadian Navy during a period that saw the placement of women in seagoing combat roles for the first time. Her experience with the Navy has underpinned Gina's career success. She helped establish Genoa Design International in 1994 and supported the company's growth from a basement enterprise to an international operation. Her business leadership, entrepreneurial thinking, change management skills, and commitment to the development of human potential has helped drive Genoa's expansion to Vancouver and New Orleans. Gina became co-CEO in 2016, and leads an executive team overseeing operations in Canada and the US. Founded in 1995, Genoa has experienced steady growth. It currently employs over 80 designers and support staff and has become a key supplier to Canada's National Shipbuilding Procurement program.

#### *Risk Capital and Innovation Intermediaries*

As Atlantic Canada's innovation ecosystem continues to grow, entrepreneur-supporting foundational institutions like Volta Labs, Propel ICT, Genesis, ideaHUB, and Creative Destruction Labs Atlantic are developing specialized expertise and mentor networks to support the growth of innovative ocean start-ups. Additionally, ocean sector stakeholders are represented or engaged through existing cluster entities such as Oceans Advance and the Offshore Technology Association of Nova Scotia, both of which are connected to other ocean tech clusters across Canada—including Tecnopole Maritime du Québec (TMQ), Ocean Networks Canada, and the Association of British Columbia Marine Industries (ABCMI)—through the Ocean Technology Alliance of Canada (OTAC), as well as through sector groups like COVE, PEI BioAlliance, and a numerous sector-specific industry associations.

COVE, in Dartmouth, NS combines unique physical assets, community networks, and services for the ocean tech sector. COVE has highly specialized facilities including docks, vessels, and specialized test equipment that provide companies with a unique set of tools to accelerate their product development. Non-resident clients will join those in residence in benefitting from tailored services and support including local mentorship and global networking. COVE's dedicated incubator/accelerator, Startup Yard, will offer these same benefits to early-stage entrepreneurs.

The Prince Edward Island BioAlliance is the private sector-led cluster development organization and innovation intermediary, working with over 50 SME and MNE businesses, eight research institutions, and federal and provincial government partners, working together in a highly collaborative cluster model. Private sector revenues exceed \$200 million, and annual R&D expenditures are more than \$70 million. Annual risk capital raised by cluster companies exceeds \$25 million. There are over 1600 employees in the sector, with a highly diverse, multi-national workforce.

The Marine Institute's Centre for Ocean Technology in Holyrood (CTec) allows academic and commercial clients to deploy and test innovative marine and ocean technologies and processes in close proximity to the harsh North Atlantic marine environment. Additionally, CTec's Smart Atlantic ocean observation system allows them to test and validate new sensors and instrumentation.

All of this is taking place in a region compact enough to allow for exceptional networking and the natural accelerative force of personal relationships.

While this stock of innovation intermediaries is strong, the available risk capital is modest. By attracting significant private sector investment, the Ocean Supercluster will fundamentally change this dynamic. A

key pillar of the Ocean Supercluster's strategy will be to target, attract, and inspire new private investors across the spectrum of venture capital, private equity, and seed/angel stages to join the ecosystem.

#### *Universities, Colleges and Research Institutions*

The region's most significant ocean research and teaching universities are partners in the Ocean Supercluster. This group includes: Dalhousie University, Memorial University of Newfoundland, the University of Prince Edward Island, the University of New Brunswick, Acadia University, l'Université de Moncton, and Université de Québec à Rimouski.

These institutions are the largest performers of R&D and source for highly qualified personnel for the ocean sectors. Other partners performing applied research and supplying skilled talent to ocean sectors include Nova Scotia Community College, the College of the North Atlantic, New Brunswick Community College, the Huntsman Marine Institute, C-CORE, NSCAD, and the Marine Institute.

Springboard Atlantic is the regional non-profit network with the mandate to encourage and support commercialization of intellectual property from Atlantic Canada's universities and colleges. Springboard supports industrial liaison and technology transfer resources in 19 universities and colleges.

This rich academic environment provides both fundamental new discoveries and key talent to the regional ocean cluster. It also provides an environment that inspires entrepreneurship and cross-domain connectivity, bringing new entrants from other sectors, including Industry 4.0, to the ocean economy. Atlantic Canada's academic institutes execute 2200 industry collaboration agreements and contracts annually.<sup>5</sup> Many of the firms in the Ocean Supercluster are repeat collaborators with member institutions, including Clearwater, Petroleum Research Newfoundland and Labrador (PRNL), Amirix-Vemco, Emera, and others. Numerous new start-up companies have resulted from these industry/academic collaborations.

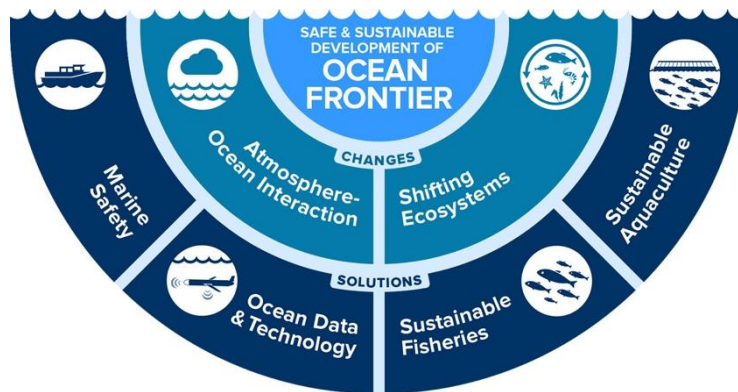
While this foundation is strong, there are strategic gaps the Ocean Supercluster will fill. In particular, increased connectivity to technology deployment and market pull to meaningful application will enhance the academic sector's skills, services, and strategies in intellectual property development, licensing, and commercialization.

*Case Study:* Ocean Frontier Institute (OFI) was established in September 2016 through a partnership led by Dalhousie University, Memorial University of Newfoundland and the University of Prince Edward Island. This \$220M partnership established one of the world's most significant international institutes for ocean research. It brings together three of four Atlantic Canadian research universities with the world's top ocean institutes, 19 industry partners, three federal departments, and the Royal Canadian Navy. OFI research is focused on understanding key aspects of ocean and ecosystem change and developing strategic and effective solutions that can be applied both locally and globally. OFI research outcomes are highly relevant to Ocean Supercluster objectives, as they will help to advance policy decisions supporting the development of a sustainable ocean economy and fundamental research results that will drive new ocean commercial opportunities.

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<sup>5</sup> Data provided by Springboard Atlantic from internal metrics reported to ACOA annually.

**Figure 4 - OFI Research Focus 1**



*Case Study:* SmartICE Sea Ice Monitoring & Information Inc. ([smartice.org](http://smartice.org)) is a northern social enterprise that provides communities with technology that helps them adapt to unpredictable sea-ice changes that result from climate change. SmartICE is an award-winning (Arctic Inspiration Prize, 2016; UN Momentum for Change, 2017) climate change adaptation service that integrates on-ice technology, remote sensing and Inuit knowledge to generate near real-time information on sea-ice conditions. The SmartICE information system directly benefits public safety, food security, and health and wellbeing in northern communities while supporting local economic activities (e.g., ice-based fisheries and tourism). Through technological innovation and science, SmartICE strives to integrate and augment Inuit knowledge about local sea-ice conditions, not replace it, through the involvement of Inuit in all aspects of its operation and decision-making. SmartICE is also a catalyst for embracing knowledge and research as a vehicle for economic development in northern communities. The SmartICE social enterprise empowers Inuit communities—especially youth—to view research and local expertise as part of their knowledge economy, inspiring a new generation of Inuit entrepreneurs in the process.

#### *Public Sector*

Federal and provincial governments play many significant roles in the ocean economy, as performers of R&D, monitors of the environment, consumers of science and technology, regulators of the environment and the economy, and as promoters and developers of the regional economy. Federal departments like Fisheries and Oceans and Defence play especially important roles in the ocean and are, in many cases, vital access links to the sea through ship time. Other departments like Natural Resources Canada, Environment and Climate Change Canada, and Transport Canada have key research, protection, and monitoring mandates in Canada's oceans.

The vast majority of Canadian federal public assets related to ocean activities are concentrated in Atlantic Canada.

*Case Study:* FORCE, Canada's leading test centre for in-stream tidal energy technology, works with developers, regulators, and researchers to study the potential for tidal turbines to operate in the Bay of Fundy environment. FORCE provides a shared observation facility, submarine cables, grid connection, and environmental monitoring at its pre-approved test site. FORCE receives funding support from the Government of Canada, the Province of Nova Scotia, Encana Corporation, and participating developers.

#### *Relevance of Ecosystem Capabilities to Supercluster Success*

Canada's ocean innovation ecosystem has the two most crucial ingredients for the Ocean Supercluster's success: large, ocean-based value chains capable of driving significant economic impact, and the innovation partners needed to provide R&D, technology, entrepreneurship, and talent. The core function of the Ocean Supercluster will be to more deeply connect these networks.

Canada's tremendous natural ocean assets, its strong and strategically important ocean sectors, as well as its technology and innovation expertise, combine to create an extraordinary opportunity for sustainable and inclusive economic growth. The Ocean Supercluster will create a nexus of development and application of these new disruptive technologies to enable the digitization of our ocean. It will also leverage innovation, increase productivity, and sustainably bring more resources into production in Canada's ocean sectors. In short, the Ocean Supercluster will allow Canada to unlock more much value from its world-leading ocean resources.

## COLLABORTATION AND ENGAGEMENT

### *Approach to Fostering a Collaborative Environment*



The scale and complexity of the ambition to grow Canada's ocean economy requires the commitment and participation of many stakeholders. For this reason, the Ocean Supercluster will approach collaboration and engagement through a collective impact framework to foster an environment that spurs and accelerates innovation in pursuit of the larger shared goal.

Collective impact is a particularly effective framework for tackling challenges where the solution is not already known, and even if it were, no single entity would have the resources or the authority to undertake it. There are five conditions for the success of collective impact: a common agenda, a shared measurement system, mutually reinforcing activities, continuous communication, and a backbone organization.<sup>6</sup>

*Common Agenda:* The Ocean Supercluster has defined a common agenda of Technology Leadership and Cluster-building in support of a vision to build Canada's ocean economy into one of the most significant, sustainable, and value-creating segments of the national economy.

*Shared Measurement System:* The Ocean Supercluster has established clear objectives and milestones for the outcomes of Technology Leadership Projects and Cluster-Building Activities, and has also established macro-economic ambition for Canada's ocean economy as a whole.

*Mutually Reinforcing Activities:* The impact of the Ocean Supercluster is not derived from the sheer number of participants, nor the uniformity of their efforts, but from the coordination of differentiated activities through a mutually reinforcing plan of action. Cluster-building activities will extend the impact of technology leadership collaborations beyond the immediate partners to the broader ecosystem.

*Continuous Communication:* Partners in the Ocean Supercluster are already realizing benefits from the regular, informal communication involved in the development of this application. The Ocean Supercluster has established as operational priorities both formal and informal channels of

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<sup>6</sup> "Collective Impact," John Kania & Mark Kramer, *Stanford Social Innovation Review*, Winter 2011

communication amongst members, and also broader communication with external national and international networks and the public.

*Backbone Organization:* The Ocean Supercluster entity will function as backbone organization, coordinating, communicating, and connecting in order to sustain the common vision and strategy, support aligned activities, establish shared measurement practices, build public will, advance policy, and mobilize funding.

Particular activities to promote large scale and ongoing collaboration include:

- Funded competitions
- Technology forums; regular lectures and workshops
- International summits and workshops
- Open calls for Technology Leadership Projects
- Expertise/mentorship exchanges
- Collaborative engagement in trade missions/ tradeshow/global conferences

In addition, Canada's Ocean Supercluster has reached out to other funded Superclusters to discuss areas of alignment and potential collaboration, as the Ocean Supercluster presents an excellent end-use opportunity for the Superclusters more singularly focused on enabling technologies.

As entities are finalized, the Ocean Supercluster intends to seek either talent or technology-based collaborations across Canada.