



Maritime leadership now and in the future

Blue Economy: a sea of opportunities!

Capt. Marc Nuytemans, FNI

CEO Blue Cluster





BLUE ECONOMY

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The Blue Economy is sustainable use of ocean resources for economic growth, improved livelihoods and jobs, and ocean ecosystem health.

The Blue Economy encompasses many activities...

RENEWABLE ENERGY
Sustainable marine energy can play a vital role in social and economic development.

FISHERIES
Marine fisheries contribute more than **US\$270 billion** annually to global GDP. More sustainable fisheries can generate more revenue, more fish and help restore fish stocks.

MARITIME TRANSPORT
Over **80%** of international goods traded are transported by sea, and the volume of seaborne trade is expected to double by 2030 and quadruple by 2050.

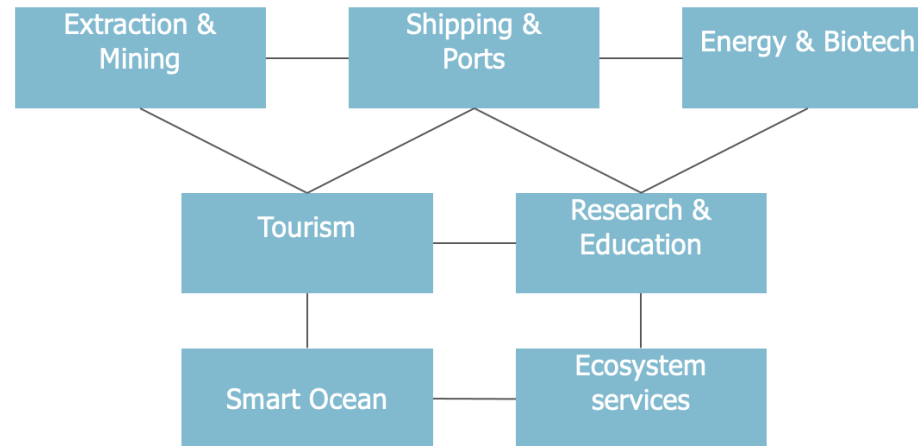
TOURISM
Ocean and coastal tourism can bring jobs and economic growth. Coastal Least Developed Countries and Small Island Developing States receive more than **41 million** visitors per year.

CLIMATE CHANGE
The impacts of climate change on oceans—rising sea-levels, coastal erosion, changing ocean current patterns, and acidification—are staggering. At the same time, **oceans are an important carbon sink** and help mitigate climate change.

WASTE MANAGEMENT
80% of litter in the ocean is from land-based sources. Better waste management on land can help oceans recover.

To learn about other aspects of the blue economy, visit www.worldbank.org/oceans

WORLD BANK GROUP






Indicator	EU Blue Economy 2019
Turnover	€667.2 billion
Gross value added	€183.9 billion
Gross profit	€72.9 billion
Employment	4.45 million
Net investment in tangible goods	€6.1 billion
Net investment ratio	3.3 %
Average annual salary	€24 739

The Blue Economy: an unknown strong pillar

5,2% of the Flemish GDP

Direct Impact

 Turnover	 Employment	 Added value
Chemistry & life sciences	€ 46B	Blue Economy 77,000 FTE
Food	€ 41B	Chemistry 68,000 FTE
Blue Economy	€ 31B	Food 51,000 FTE
		Blue Economy € 7.2B
		Chemistry € 5.5B
		Food € 1.9B

Source:
 "Economic and societal importance of the Blue Economy for Flanders", a study by Idea Consult, 30 December 2019

The 5 Blue Growth sectors



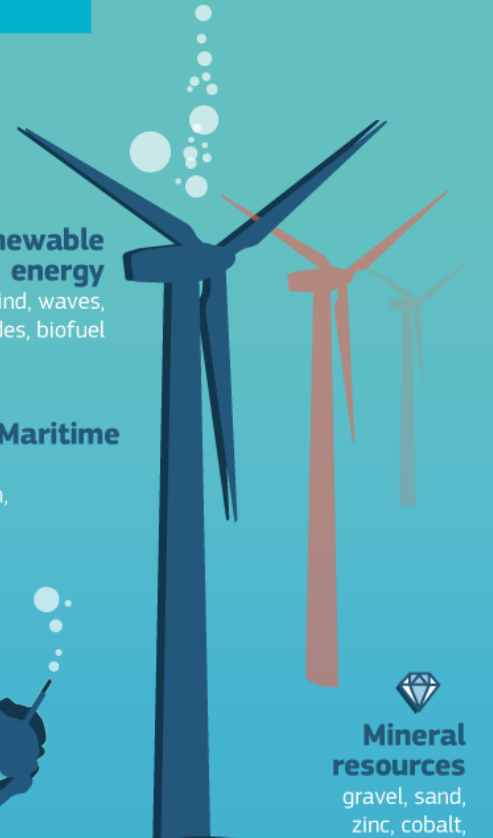
Biotechnology

medicines,
industrial enzymes



Renewable energy

wind, waves,
tides, biofuel



Coastal & Maritime Tourism

coastal tourism,
cruise tourism,
yachting



Aquaculture

farming of fish,
shellfish, marine plants



Mineral resources

gravel, sand,
zinc, cobalt,
copper



BLUE CLUSTER

Mission:

Blue Cluster is the preferred partner for businesses who want to develop innovative activities and valorise their expertise in the sustainable blue economy whether at home or abroad.

We **reduce** the **risk of innovation** in five areas:

- Strategy (roadmaps)
- Finance (subsidies and external financing)
- Resources (partners)
- Commerce (market knowledge)
- Rules and regulations (policy & stakeholder management)

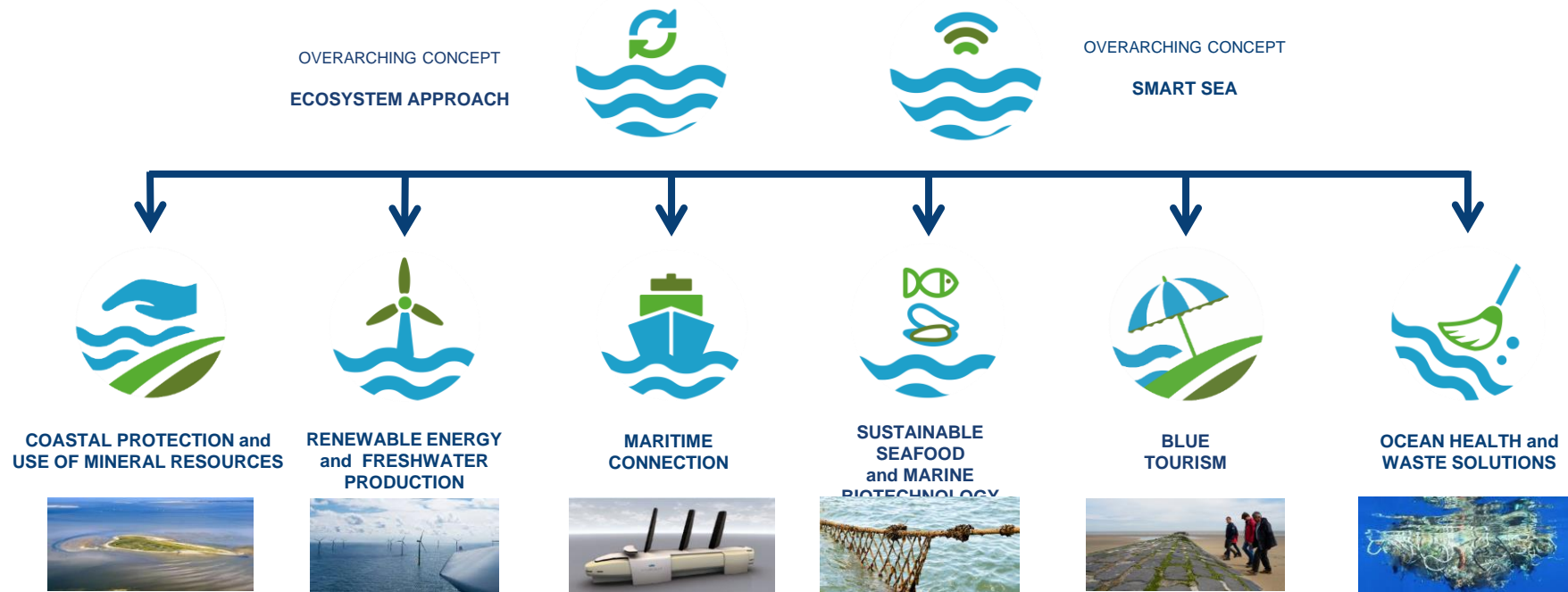
AND

We want to be a strong and reliable partner for the government

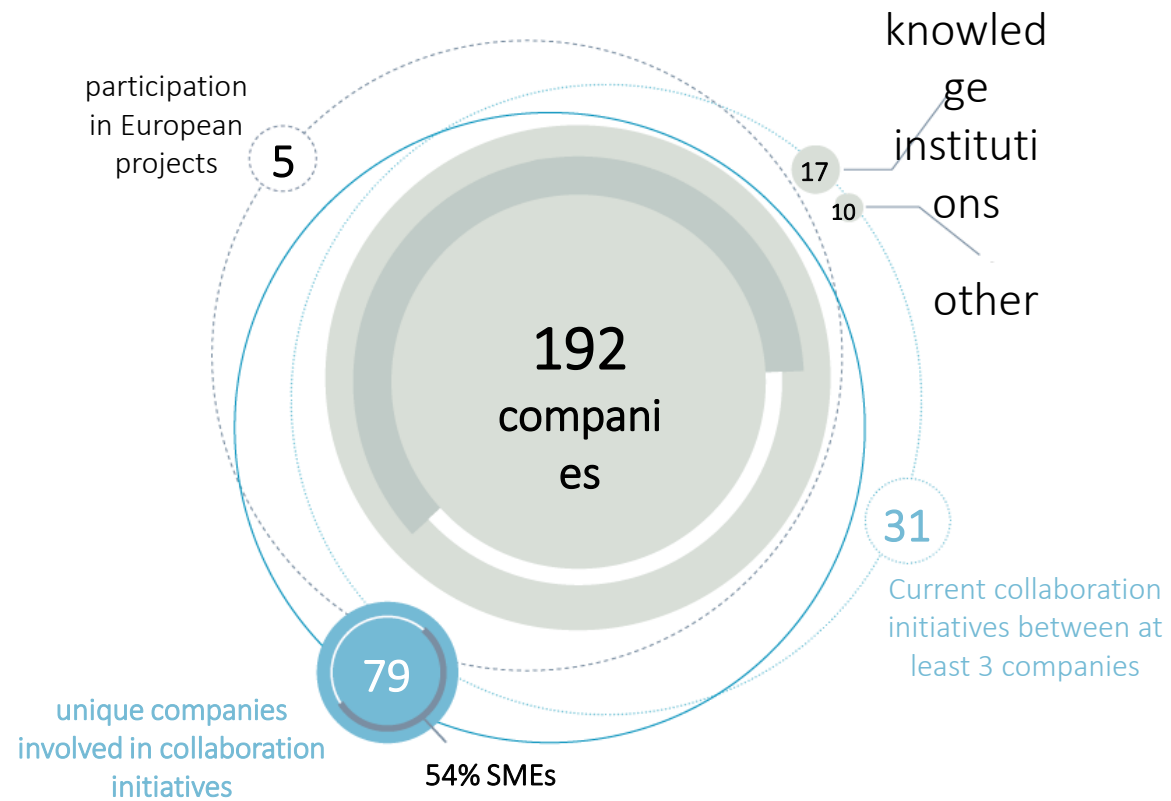
In which areas are we active?

6 focus areas
2 cross-sectional areas

A roadmap for each area



Members and partners



INNOVATION ROADMAPS



RENEWABLE ENERGY ROADMAP

LCOE REDUCTION IN WIND FARMS Horizon 2020-2030

Operational expertise (OPEX - AEP)	Value creation (CAPEX - DEPEX)
<p><i>Optimisation of the lifespan, operation, maintenance and energy production of existing installations by means of supporting technological processes and decision models as well as the minimisation of human intervention by means of logistical processes and models supported door digitisation, automation, drones and robotics.</i></p>	<p><i>Developments covering the entire supply chain during the construction of new wind farms: integrated design, taking into account current and future trends, including the optimisation of the industrialisation, foundation works, installation techniques and logistics chain of decommissioning (end of life)</i></p>

- SMART - GBF
- SMARAGD
- CTO
- BOPTIC
- OPAL
- SOILTWIN
- Supersized 4.0
- RAINBOW

RENEWABLE ENERGY FRAMEWORK

Immediate surroundings	Scarcity	Regulations & services
<p><i>Initiatives promoting the multiple use of space occupied by wind farms and contributing to efficient and safe exploitation for concessions to be built as well as the use of spaces already occupied by extending the lifespan incl. new business models. Research and innovations concerning the interaction with the marine ecosystem.</i></p>	<p><i>Innovative initiatives that help alleviate the scarcity of staff by providing adequate, targeted training of staff and the transition of staff from other fields. Promotion of initiatives relating to the logistics chain for the use of renewable materials (ecological, biodegradable).</i></p>	<p><i>Investment in the internationalisation strategy to increase the visibility of Flemish know-how about the construction of wind farms worldwide. For the Belgian part of the North Sea and within the scope of the development of new technologies, the necessary regulations to address these trends and create support.</i></p>

- MFiland
- D4PV@Sea
- ELBE+
- Inn2Power

EMERGING TECHNOLOGIES & SERVICES Horizon 2020-2040

Energy management (grid balancing, Power to 'X', storage)	Emerging production technologies
<p><i>New necessary concepts for energy transport, grid balancing, storage and system integration for the benefit of the long-term stability of the offshore net and facilitation of interconnections.</i></p> <p><i>Offshore energy to "X": offshore production, storage and transport of H2 (and/or after conversion as feedstock, including CO2 captation at sea) and freshwater production</i></p>	<p><i>Emerging production technologies such as floating energy production (wind, photovoltaic (PV) ...). Development of wave and tidal energy converters and other developments still in their infancy (airborne, OTEC, salinity gradient, algae).</i></p>

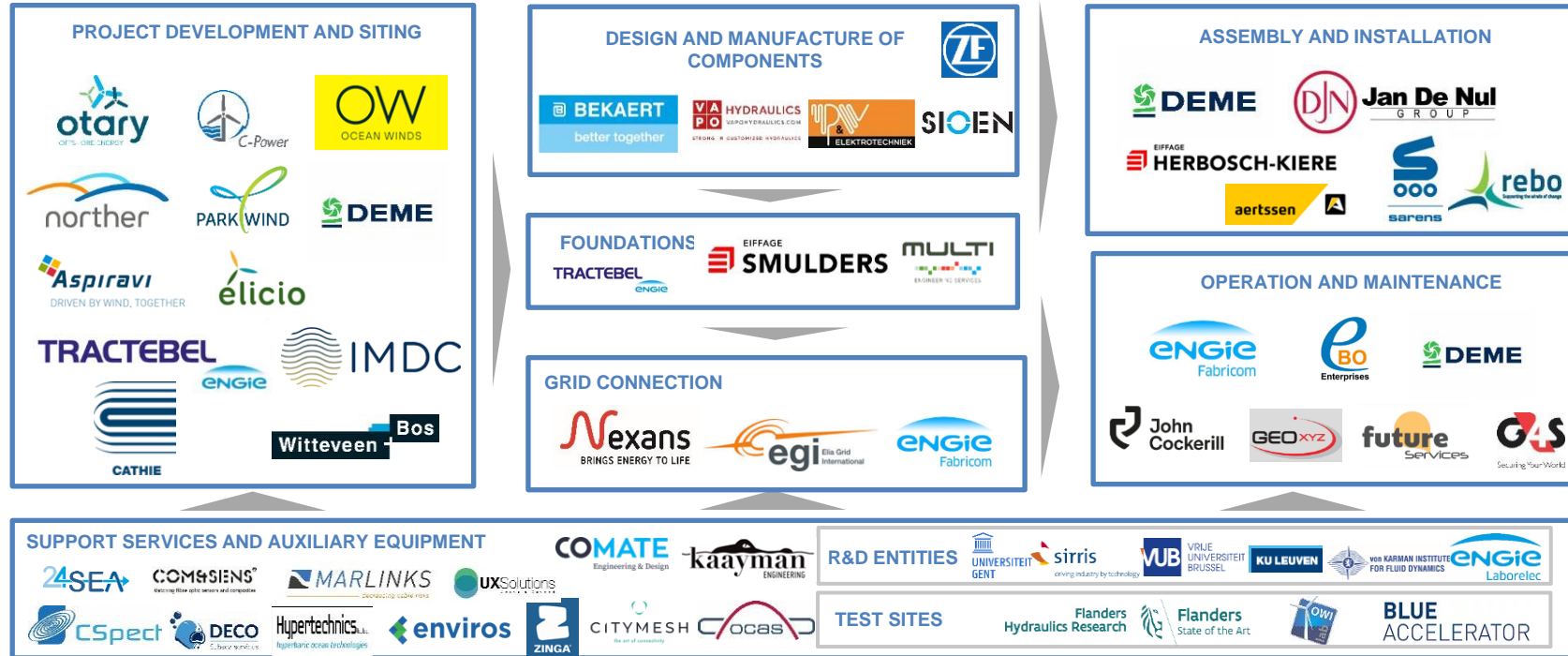
- Cordoba
- SWEET H2(O)
- MPVAQUA
- H2MYTHIC
- BLuERA





- Construction of Transition Pieces: 30%
- Turbine installation: 30%
- Offshore High Voltage Ssubstations: 50%
- Export cables > 700 km
- Inter-array cables > 400 km

BELGIAN VALUE CHAIN IN (FLOATING) OFFSHORE WIND



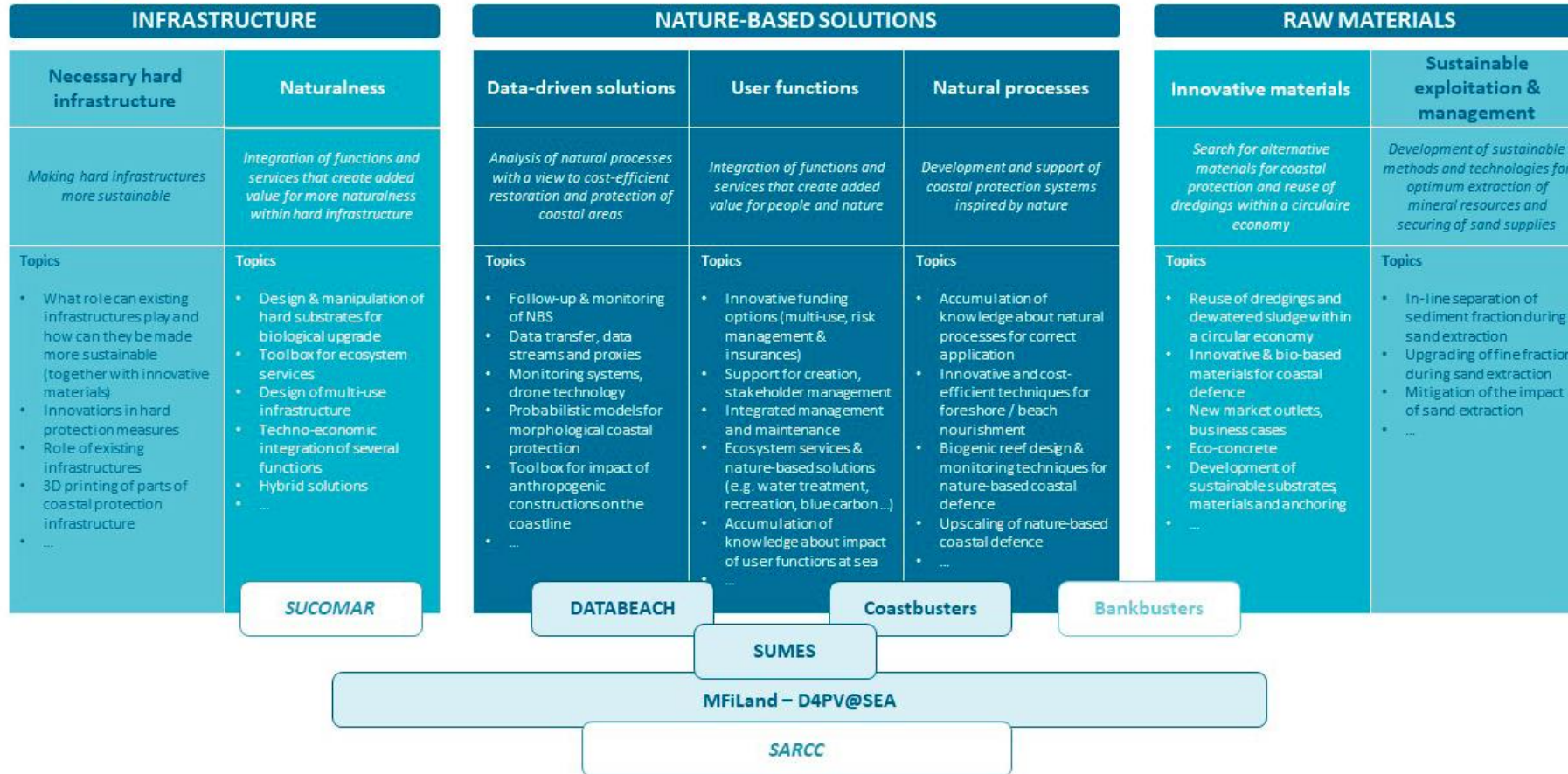
Note: This graph is for illustrative purposes only and does not include the logos of all the Belgian companies participating in the offshore wind value chain



COASTAL PROTECTION & MINERAL RESOURCES

Improving the resilience, sustainability and economy of coastal protection

Version of November
20





MARITIME CONNECTIONS

Elimination of obstacles to innovative shipping and facilitation of a modal shift in transport



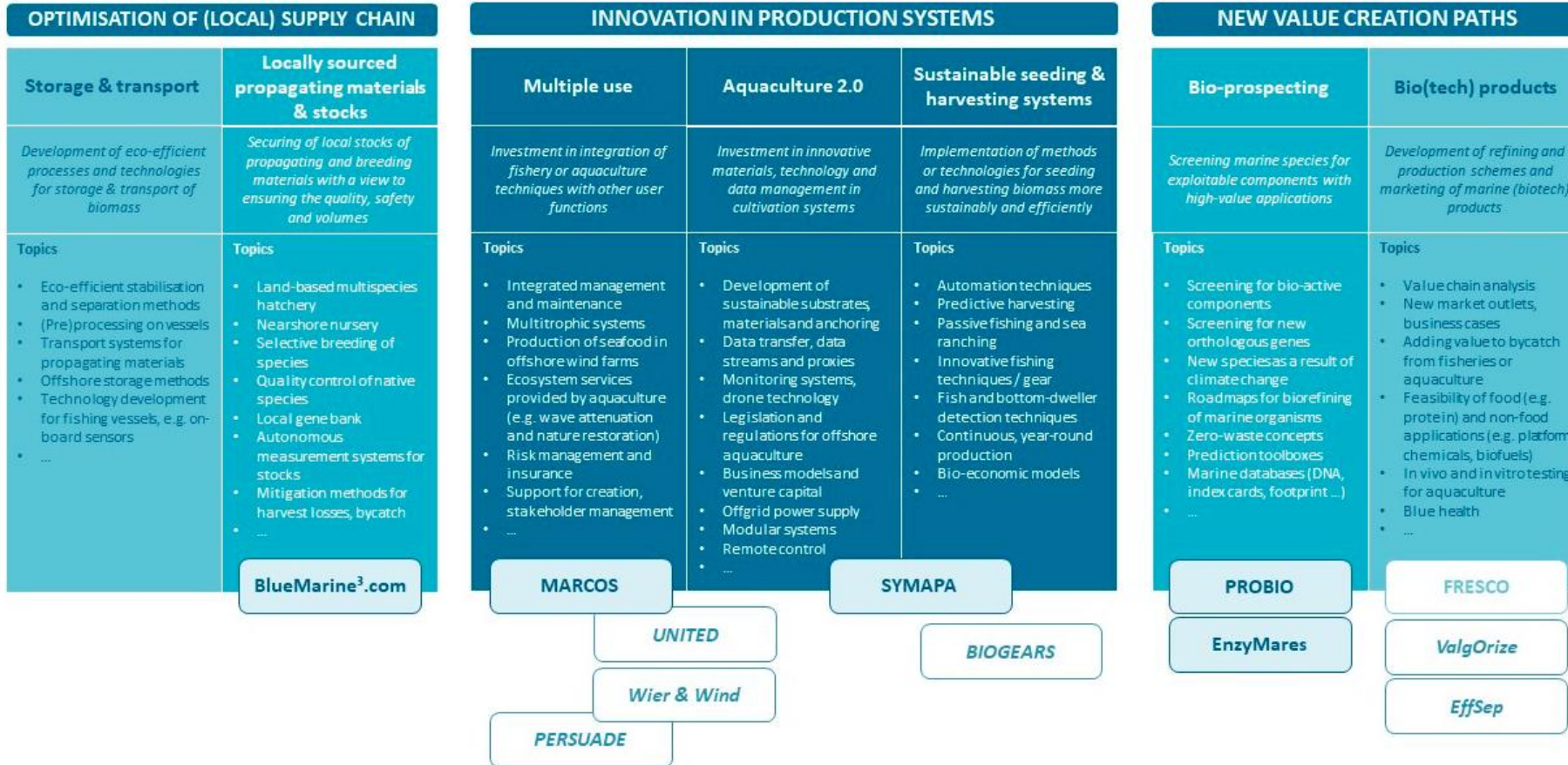
CLEAN SHIPPING		SMART SHIPPING	SEA RIVER SHIPPING	
Offshore energy to "X"	Acceleration of competence development in environment-friendly and low-carbon shipping		Acceleration of competence development in environment-friendly and low-carbon shipping	
<ul style="list-style-type: none"> Demo of offshore hydrogen production from renewable energy combined with storage & bunkering 	<p>Sustainable fuels (SF)</p> <ul style="list-style-type: none"> Pilot projects regarding the use of hydrogen in combustion engines. Logistics, incl. offshore storage and bunkering of SF for shipping. R&D and pilot projects regarding the use of SF (excl. hydrogen) in fuel cells Fully electric or hybrid propulsion in shipping; Exploring the potential of wind energy for fishing vessels. 	<p>Making shipping more sustainable (incl. nautical aspects in harbours)</p> <ul style="list-style-type: none"> System for compensating peak power consumption R&D and pilot projects regarding optimisation of the design (incl. hull) of vessels. Pilot projects regarding Carbon Capture on vessels Piloting shore power Reducing the spread of invasive species. Supporting the market uptake of fouling release coatings; exploration of sound-based systems 	<p>(Semi-)autonomous shipping:</p> <ul style="list-style-type: none"> R&D and pilot project regarding (semi-)autonomous inland shipping and maritime operations (incl. offshore wind farms) Demonstration of shore control capabilities <p>Advanced, nautical aspects for harbours, islands and offshore installations:</p> <ul style="list-style-type: none"> Mitigation of the impact of offshore wind farms on radar systems Offshore mooring & transshipment 	<ul style="list-style-type: none"> Detailing of shipping routes and conditions for sea river shipping Economic and environmental decision model for vessel guidance Optimisation of the design of estuary vessels
		<p>SMARAGD</p> <p>SSAVE</p> <p>SSN</p>		



SUSTAINABLE SEAFOOD & MARINE BIOTECHNOLOGY

Increasing the national consumption of marine seafood and unlocking the potential of marine biorefining

Version of January
'22





ROADMAP BLEU TOURISM

Shift from more to better tourism



SIMULATING AND SUPPORTING HOSPITALITY

Innovative ideas or products that can give the maritime life in Ostend an ecological and sustainable boost.

STRENGTHENING INFRASTRUCTURAL, INTANGIBLE AND SYSTEMIC ENABLERS FOR BLUE TOURISM

Enable companies to address their water- and drought-related risks and thereby create a become a water-conscious company that is smarter with their water management.

Facilitating the introduction of circular entrepreneurship in the tourism & recreation sector

Wavepool demonstrator

Optimizing the design processes of an MMLI by integrating these different forms of risk is an innovative way to increase the success rate of such projects.

Improving the understanding of nature-based solutions in coastal cities

Co-creation of evidence-based business roadmaps and policy solutions to improve coastal-rural cooperation and synergies

Better understanding of the impact that natural changes on the one hand and historical human interventions in the landscape on the other have had on coastal morphology and the vulnerability of the coast to erosion and flooding

FUTURE PROOFING THE COAST



EURONAV



OCEAN POLLUTION & WASTE SOLUTIONS

Providing solutions to ocean pollution
One of the main challenges/threats to the oceans

Version of November

'21



MULTI-USE

Expertise of cluster members to realize multi-use



PROJECT EXAMPLES



COASTBUSTERS 2.0

Coastbusters 2.0 will analyze best designs for optimal reef growth and create tailor-made sustainable concepts, best-practice standards and sustainable products for nature-inspired coastal protective systems.

Duration: February 2020 – September 2022

Focus area: coastal protection

Partners:



DATABEACH

DataBeach aims to provide disruptive improvements for soft coastal defense infrastructures that will enable a more efficient, sustainable design, as well as a quantitative basis for (re-)insurance solutions to storm-induced sand losses.

Duration: June 2019 – May 2021

Focus area: coastal protection

Partners:





OPAL

The OPAL project aims to achieve a better planning of the maintenance work by gaining more insight into the environmental factors. In this research project an algorithm is developed that can be used to predict when offshore structures will be accessible. This takes into account elements such as the weather, the type of vessel, the profile of the captain, the topology of the wind farm, the landing location and the sailing routes.

Duration: April 2021 – March 2023

Focus area: offshore renewable energy

Partners:



SMARAGD

The SMARAGD (“SMart Autonomous Reliable Aquatic Goods Drone”) project aims to develop an unmanned vessel with which parts or tools can be autonomously sent to offshore locations. This allows technicians to be deployed more efficiently and the number of trips limited.

Duration: April 2021 – March 2023

Focus area: offshore renewable energy

Partners:





SSN (Shore Supported Navigation)

SSN is a stepping stone to autonomous navigation. The purpose of this pilot is remote control of an estuary vessel sailing between Antwerp and Zeebrugge with a reduced crew on board and a Master in a control centre ashore.

Duration: January 2020 – July 2021

Focus area: maritime connection

Partners: Deseo, Seafar and Citymesh



SSAVE

SSAVE (Shared Situational Awareness for Vessels) improves interconnectivity and interoperability between assets in the maritime and inland waterway environment by allowing (in)direct communication between assets and providing inter-connectivity through distributed maritime digital twins (MDT).

Duration: October 2019 – December 2021

Focus area: maritime connection

Partners:





SYMAPA

SYMAPA investigates possible synergies between mariculture of mussels, oysters & seaweeds and passive fishery. The experimental research design, with its analysis of the possibilities of multiple spatial use, is quite unique.

Duration: October 2019 – September 2022

Focus area: sustainable seafood & blue biotech

Partners:



MARCOS

The MARCOS project examines the potential of large-scale offshore aquaculture in the Belgian North Sea for 3 scenarios: (1) as a “stand-alone” activity in designated areas; (2) integrated in new areas to be developed according to the multi-use principle; and (3) integrated into operational wind farms. On the basis of this, an innovation roadmap will be developed.

Duration: September 2020 - March 2021

Focus area: sustainable seafood & blue biotech

Partners:





Wavelake

The Wavelake project strives to develop and validate a new high-tech concept for a safe underwater wave generator for surfers. The eventual goal is to make it possible to enjoy surfing throughout the year.

Duration: July 2020 – December 2022

Focus area: blue tourism

Partners:



FACET

The Interreg 2 Seas Project FACET aims to encourage entrepreneurs in the tourism industry to apply circular solutions in their practices so as to generate new sustainable business models. The focus areas are tourist accommodations, waste reduction and circular entrepreneurship

Duration: January 2020 – March 2023

Focus area: blue tourism

Partners:





PLUXIN (Plastic Flux For Innovation and Business opportunities in Flanders)

Plastics are increasingly found in the ocean. That's a problem as plastics degrade very slowly. It is therefore important to ensure that no more plastics end up in our rivers and seas. The PLUXIN project examines the amount of plastics in rivers and oceans, the exact location of these plastics and the time of arrival.

Duration: September 2020 – September 2023

Focus area: ocean pollution & waste solutions

Partners:



INNOVATION PROJECTS



CORDOBA (January 2021 – December 2023)

CORDOBA aims at developing an optimisation model for designing offshore grids, drawing up a coordinated control model for **hybrid offshore connections** and assessing the impact of system design on grid support services. The eventual goal is to arrive at a holistic and sustainable design & operation of hybrid offshore connections and offshore grids.

Partners: Elicio, Marlinks, Yuso, Enersynt and KU Leuven.



MPVAQUA (July 2019 – July 2022)

Blue Cluster's Marine Floating PV project aims to develop an innovative technology or product concept as well as know-how for **offshore marine floating PV** (MFP) technology to generate electricity for aquaculture in the nearshore area of the Belgian North Sea.

Partners: Tractebel, DEME, Jan de Nul, Soltech and Ghent University

INNOVATION PROJECTS



- **SOIL-TWIN** (November 2019 – September 2022)
- This project aims to **improve soil-structure interaction models** by updating them based on finite element analysis and lab experiments at Ghent University and the Coastal and Ocean Basin (COB) as well as measurements on Belgian offshore wind turbines. The goal is to **optimise the design of offshore monopiles** and potentially expand the application of large-diameter monopile foundations.
- Partners: Vrije Universiteit Brussel and Ghent University



Supersized 4.0 (January 2020 – December 2022)

This project's main focus is the 8MW and new 9.5MW MHIVOW wind turbines of the Norther and Northwester 2 wind farms in Flanders. Scalable IoT sensor networks, 5G and scalable data storage and processing will result in **better understanding of machine behaviour** and make it easier to **predict performance and health degradation**.

Partners: VUB, 24SEA, Citymesh, Norther, Parkwind and Sirris
Subcontractor: Vestas



H2MHYTIC – cluster SBO

H2-MHytic is targeting the development of a Hydroxyl Exchange Membrane (HEM) for water electrolysis combining the best of the state-of-the-art PEM and alkaline electrolyzers by deployment of nanomaterials and thin-film technology. The HEM electrolyzer will exhibit a better conversion efficiency of 89% (Higher Heating Value (HHV) basis), while operating without the need of non-sustainable noble metal catalysts.

Duration: January 2021 – December 2023

Focus area: offshore renewable energy

Partners: VITO, IMEC, UGent

Advisory board: WaterstofNet, Agfa-Gevaert, Bekaert, Colruyt, DEME, Engie-Laborelec, Inovyn, John Cockerill, REBO



HYVE

Hyve is a Belgian consortium to enable cost efficient production of hydrogen on a gigawatt scale.

Partners: VITO, IMEC, Bekaert, Colruyt, DEME, John Cockerill





INTENSSE-H2

Intense-H2 feasibility study

Hydrogen is the energy carrier of the future and can serve to store the energy surpluses of offshore wind farms. The intense H2 project examines whether it is possible to produce hydrogen from seawater by introducing an innovative concept in which water treatment and electrolysis are integrated.

Duration: November 2021 – October 2022

Focus area: renewable energy and fresh water supply

Partners: Agfa-Gevaert, MULTI.Engineering, Euraqua-Europe (Pollet Water Group) and VITO





CHyPS - intercluster SBO

In order to provide the shipping industry with a better understanding of the impact and the technical challenges related to clean shipping, the CHyPS project – Clean Hydrogen Propulsion for Ships – was launched. CHyPS aims at paving the way to a full-fledged numerical toolbox, simulating different components of a ship propulsion system operated with clean fuels such as (liquid) hydrogen, e-methane or methanol.

Duration: May 2022 – April 2024

Focus area: maritime connection

Partners: Ghent University, von Karman Institute, VIL

Advisory board: ABC Motoren, DEME, GEO xyz, Herbosch-Kiere, Jan De Nul, Multi Engineering, E. Van Wingen, Victrol Chartering, Vlaamse Waterweg, WaterstofNet



R&D INFRASTRUCTURE



- **OWI-lab climate chamber (Antwerp)**
- Dimensions: 10.6 m x 7 m x 8 m
- Capability to test >150-ton machinery
- Temperature range: -60°C to +60°C



- **Coastal & Ocean Wave Basin (Ostend)**
- 30 m x 30 m x 1.4 m deep (variable)
- Wave-current interaction in any direction
- Wind up to 15 m/s in 2 x 2 m flow section



- **Blue Accelerator (Ostend)**
- Nearshore test platform
- First user: NEMOS Wave Energy

BLUE
ACCELERATOR



INTERNATIONAL OUTREACH

International outreach

- Partner in G-STIC (www.gstic.org)
- Strategic cluster partnership “European Leaders of Blue Energy” (ELBE)
- MoU with Forum Oceano (Portugal), Basque Energy Cluster (Spain), New Bedford Ocean Cluster (US)
- Norwegian Energy Solutions
- Cluster Tunésien (draught)
- Esbjerg Manifesto



International collaboration

Inn2POWER	Europe Leading Blue Energy	FACET
<ul style="list-style-type: none"> • Development of innovative collaboration partnerships in the North Sea region • Focus on offshore wind • Target group: SMEs • Activities: company directory, networking tool, B2B meetings, MBA modules, etc. 	<ul style="list-style-type: none"> • Promotion of European know-how in blue energy (OW, Wave, Tidal) • Preparation of market reports for developing markets • Fact finding and direct missions to developing markets: Japan, South Korea, USA, Canada 	<ul style="list-style-type: none"> • Cooperative models for the value chain of the circular economy (CE) • CE toolkit • New and improved financial mechanism • Pilots and demonstrations of CE solutions in the tourism industry



International collaboration

eMSP-NBSR	Prep4Blue	Blue Bio Clusters
<p>eMSP enables maritime spatial planners and policymakers from the North and Baltic Sea Regions to reflect:</p> <ul style="list-style-type: none"> on current MSP practices, <ul style="list-style-type: none"> to learn effectively from each other, to collectively identify future problems and solutions. on ambitions and challenges for MSP related to policy developments under the EU Green Deal. 	<p>PREP4BLUE's overarching objective is to develop the R&I implementation modalities required to achieve the objectives of the Mission "Ocean, seas and waters" and to facilitate a successful first phase (2022-2025) of the Mission.</p>	<p>BlueBioClusters overarching objective is to support and increase the uptake of sustainable blue bioeconomy business opportunities by European (coastal) regions, companies and citizens (incl. low-income populations), to contribute to regional development and the EU Green Deal by improving the services of blue bioeconomy clusters throughout Europe to both public as well as private actors.</p>

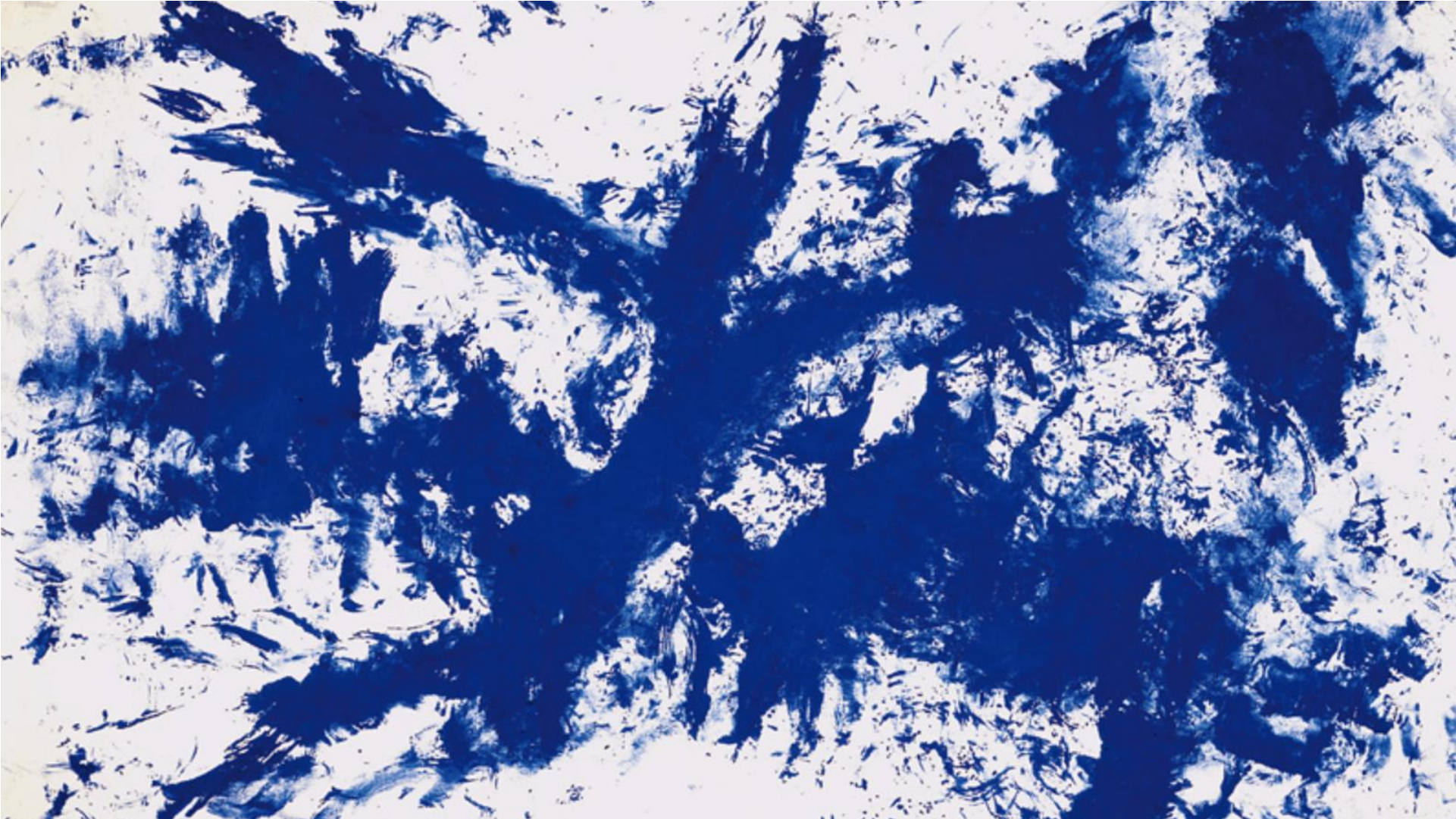




- Purpose:
- 1. Mapping of the Naval & Aero Naval Defence value chain to better understand the European ecosystem and possible transnational synergies and complementarities
- 2. Upskilling actions to support SMEs towards strategic technological innovations (e.g. information and communication, energy, cognitive aspects, etc.)
- 3. Support of internationalization for SMEs to new markets (skills training and business development)
-

Partners:

- Ligurian Cluster of Marine/Maritime Technologies (DLTM): 140 companies, University of Genoa, 3 public research organisations (CNR, ENEA, INGV) and large companies (Fincantieri, LEONARDO, Intermarine, Tremomeccanica)
- Toulon Var Technologies (TVT): 2 business units: TVT Innovation and Mediterranean Sea Pole + TVT/Sytem Factory (Cluster Defence Division or TVT)
- Navigo: Strategic support center for the pleasure yacht industry (certification, design, training, innovation, financing, internationalization and promotion + Penta Innovation Center.
- Blue Cluster
- Croatian defense industry competitiveness cluster ([HKKOI](#))
- Riviera di Liguria



- Blue has no dimensions, it is beyond dimensions, whereas the other colours are not....All colours arouse specific associative ideas, psychologically material or tangible, while blue suggests at most the sea and sky, and they, after all, are in actual, visible nature what is most abstract.
 - (Yves Klein)

We are Blue Cluster



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