OPPORTUNITIES

Fisheries and aquaculture

Blue biotechnology

Maritime surveillance

Marine renewable energy

Ship and boat building

VISION

An innovation ecosystem, with knowledge synergies bringing forth ideas, capturing them, testing their viability and commercially realising their potential for the Maritime and Key Enabling Technology communities .

The policy environment will determine the boundaries of the KET-maritime innovation ecosystem. It will restrain the extent to which KETs penetrate into the maritime sector, primarily by providing clarity of what is allowed, and certainty for investors.

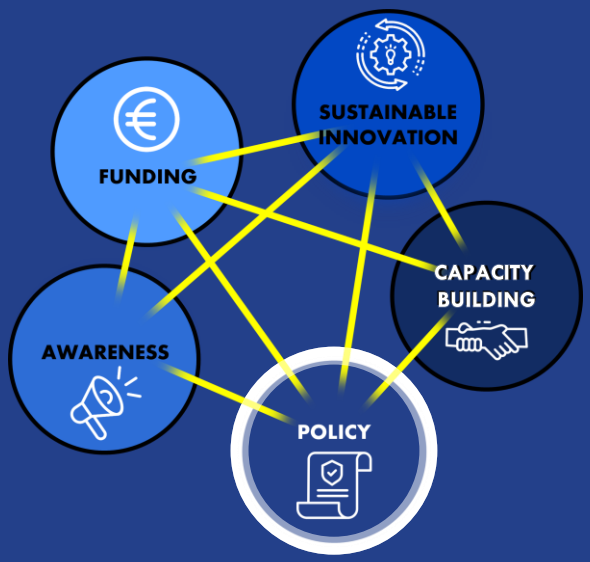
GOAL

Adapting policy frameworks to foster a technology uptake environment

POLICY SUGGESTIONS TO ANIMATE THE MARITIME SECTOR WITH KET INNOVATIONS

Adapting policy frameworks to foster a technology uptake environment

- Ground supports in policy
- Map existing supports and contributory sectors
- Equip and resource public-sector supports
- Ensure policy is responsive to an expanding and rapidly innovating sector



For detailed guidance on specific actions to achieve progress in action areas, see the KETmaritime Roadmap, available at www.ketmaritime.eu

Case study 1 of Marine opportunities with KETs

ADVANCED MANUFACTURING APPLICATIONS FOR SHIPBUILDING

Advanced manufacturing is not exclusive to any nation, nor limited to a specific technology. It incorporates of a range of innovative technologies within the manufacturing process, making an entire operation more agile, flexible and efficient.

Several forms of technology will greatly influence the future of shipbuilding:

- **Digital manufacturing technologies**, involving tools for design, simulation, engineering, manufacturing, 3D scanning and 3D printing.
- **Complementary technologies** including **ICT** infrastructures, technologies and services such as wireless networks, mobile devices, cloud computing, low cost development hardware, cross-platform programming languages and wearables. embraces current innovative technologies.
- Approaches such as **automation**, a key driver towards 'intelligent' robotics, artificial vision and autonomous vehicles.
- **Simulation and immersion technologies**, that are set to have a major impact involving virtual and augmented reality.

Advanced Manufacturing is now of greater relevance and importance than ever before for ship building. It is becoming highly compatible, lending itself to scalable implementation, and is also approaching a point of maturity and affordability which make the technologies and approaches commercially viable.

For further information, see the KETmaritime case study on **Advanced Manufacturing for shipbuilding**, available at www.ketmaritime.eu

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A key tool to realise European Atlantic ambitions is the use of strategic targeted investment. With this they can promote activity in desirable sectors of the economy, and reinforce its perceived importance in the private investment community.

GOALS

Fuelling Innovation

Ensuring Value for Money

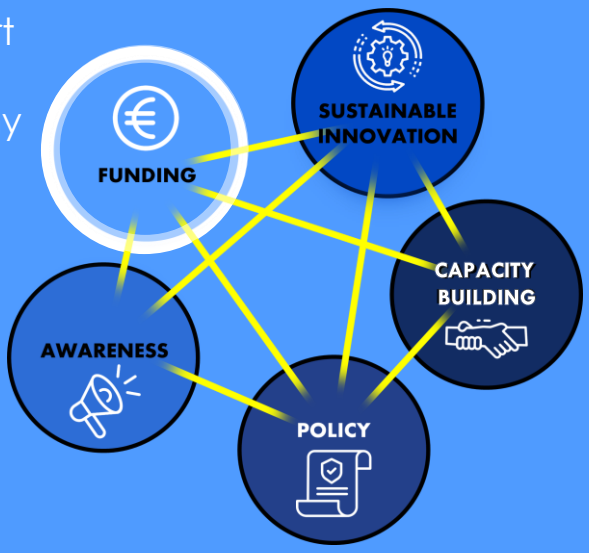
TARGETED FUNDING TO FEUL MARITIME INNOVATION WITH KETS

Fuelling Innovation

- Clarify what is available to support development
- Synergise with the digital economy
- Fund supports to facilitate innovators
- Shape funding initiatives to animate the KET-maritime ecosystem

Ensuring Value for Money

- Monitor an advancing maritime landscape
- Synergise with education
- Ensure supports to adapt to advances
- Monitor strategic demonstrations



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Case study 2 of Marine opportunities with KETs

NANOTECHNOLOGY MARINE APPLICATIONS

There is a growing interest in the pioneering form of technology known as Nanotechnology, which approaches products and processes from the smallest achievable physical scale. It's a broad concept that covers the design, characterization, production and application of structures, devices and systems by controlling shape and size at the molecular or atomic scale.

There are a multitude of ways in which nanotechnology can be applied to the marine sector and maritime environments. Key areas of interest include:

- **Nanocoatings** that protect against **corrosion and biofouling** on ships - two of the largest challenges affecting material exposed to harsh marine conditions
- The implementation of **nanotubes within shipbuilding materials** which significantly increases the strength of raw materials without increasing weight.
- **Nanostructured materials** can be used in the Oil & Gas industry – when used within filtering operations prior to the return of water to the environment, they drive performance by reducing the cost of conditioning operations by having a greater ability to retain contaminants compared to traditional filtering materials.
- The technology is also being used to advance the development of **fuel additives**, **alternative powering systems**, **aquaculture and fisheries**

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Developing trans-sectoral trust, and market-developer partnerships are essential to the Atlantic Area realising ambitious KET-maritime growth, and a thriving innovation ecosystem. It requires targeted effort being dedicated to helping innovators and companies bridge sectoral, societal, and often spatial barriers and obstacles.

GOALS

Fostering Trust

Building an Innovation Ecosystem

Ensuring Strategic Innovation

BUILDING A TRUSTED AND SUSTAINABLE INNOVATION ECOSYSTEM

Fostering Trust

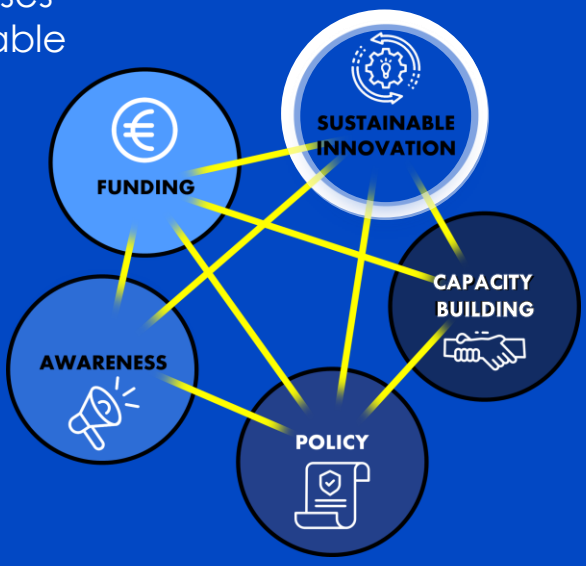
- Demonstrate KET-maritime successes
- Ensure info on KETs is readily available
- Develop and support networks of trust
- Ensure innovators and supporters are rewarded fairly

Innovation Ecosystem

- Build a community of practice
- Facilitate ideas and testing
- Match SMEs with partners and collaborators
- Promote knowledge transfer

Strategic Innovation

- Target short-term priority demonstrators
- Identify niches
- Embrace Responsible Research and Innovation



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Case study 3 of Marine opportunities with KETs

MARINE INDUSTRIAL BIOTECHNOLOGY

Industrial biotechnology is the application of biotechnology for industrial processing and production of chemicals, materials and fuels. Blue Industrial Biotechnology is used within the marine sector to explore and exploit marine resources to develop industrial products and processes. The KETmaritime project identified a number of key applications involving a high level of joint development:

- **Novel Enzymes and Micro-Organisms** - The development of novel bioprocesses demands new enzymes and micro-organisms with **high performance** qualities, which are able to withstand challenging environments such as high temperature and pressure. The marine environment offers an excellent source for these kinds of enzymes and micro-organisms, which have adapted to live in extreme conditions.
- **Marine Biomaterials and Biopolymers** – The marine environment is the source of a variety of components such as proteins and peptides (collagen, gelatine), polysaccharides (alginate, carrageenan, agar, chitin, chitosan), fatty acids (omega-3, DHA, EPA), vitamins and minerals.
- **Bioenergy** - **Biofuels** derived from the marine environment are being used as a potential source of **sustainable energy** contributing to future **global demands**

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The heart of this opportunity lies in people - those with knowledge of KETs meeting and working with others having knowledge of the marine world. The key here is to ensure the environment is in place for disciplines and expertise to meet, knowledge to flow and synergise, and ideas to be captured and carried forward.

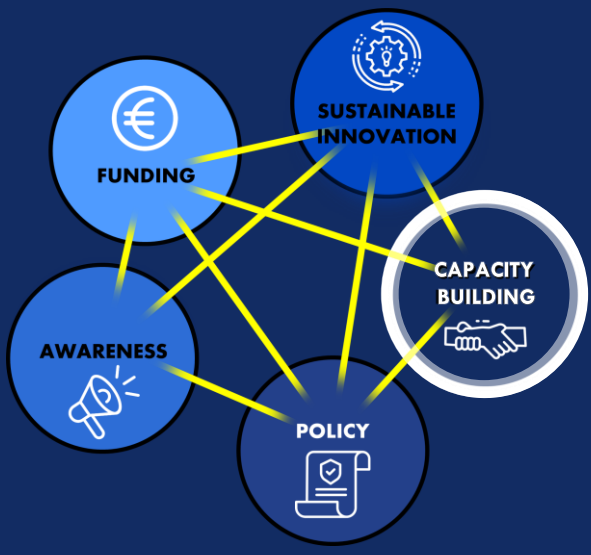
GOAL

Enhancing capacity for knowledge synergies

EQUIPPING AND CAPACITY BUILDING FOR MARITIME INNOVATION

Enhancing capacity for knowledge synergies

- Provide knowledge supports for innovation
- Leverage Europe's education systems
- Provide staff training for innovation



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Case study 4 of Marine opportunities with KETs

PHOTONIC MARINE APPLICATIONS

The global photonics market is estimated to be worth €615billion by 2020. It is one of the most important technologies for the 21st century and can be used to tackle some of the global society's greatest challenges. Photonic science translates into a multitude of applications and can benefit a multitude of industries:

- **Aquaculture & Fisheries** - Photonics have been successful used for monitoring in aquaculture and fisheries where historic detection techniques (such as HPLC) were slow, required sampling and were not in real-time.
- **Seafood industry** - Applications enabling computer vision are found in automated systems for **sorting, grading and processing** fish and fish products. **Computer vision technologies** can objectively measure visual attributes related to seafood quality. This includes inspecting the appearance (size, shape, colour and texture), smell, category, bones and defects, presence of blemishes and textures on the surface of seafood products.
- **Oil & Gas industry** - Photonics can **enhance security** by monitoring plants and hazardous environments. Optical sensors have been used successfully for specific measurements where no replacement technology exists.
- **Marine renewable energy sector** - Photonics can inform new devices and systems for wider and more comprehensive **monitoring of marine environments**.
- **Shipbuilding sector** – Photonics can improve applications used in laser-welding, cutting, mapping and detection systems to improve navigability and to reduce risks.

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Strategic investment in awareness raising involving two primary audiences – the maritime community, and the KET community. Opens the doorway to further engagement, offering windows for the KET community to examine maritime realities, and work with the maritime sector to identify further opportunities and synergies.

GOALS

Raising KET and maritime innovation awareness

Demonstrating KET-maritime potential

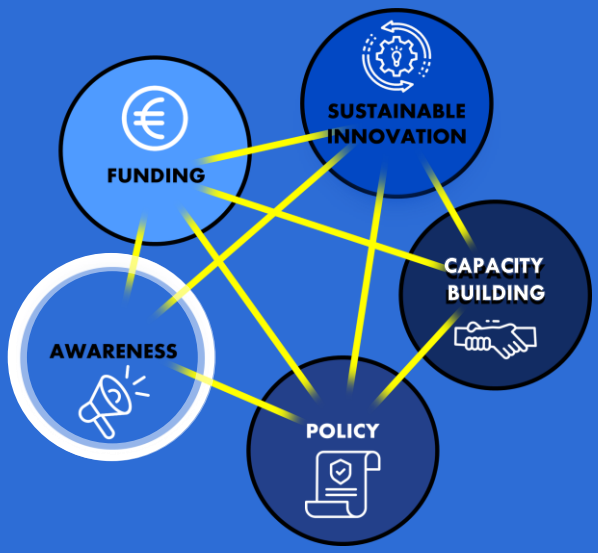
DEMONSTRATING AND ENHANCING MARITIME AWARENESS OF KETS

innovation awareness

- Conduct strategic outreach and animation
- Ensure factual evidence-based awareness raising

Demonstrating KET-maritime potential

- Facilitate rapid testing for accelerated innovation
- Promote long-term innovation
- Demonstrate KETs meeting maritime needs
- Target key demonstrations



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Case study 5 of Marine opportunities with KETs

MEMS (MICRO ELECTROMECHANICAL SYSTEMS) MARINE APPLICATIONS

The processing power of computers has evolved rapidly, and the speed and impact of this impressive advance has been felt across society. The demand for **reduced-scale electronic design and manufacturing**, and the evolution of **electronic architecture** based on silicon have exponentially increased the processing power of chips, reduced electrical consumption and in general given rise to a whole generation of 'microelectronics'. The possibility of **manufacturing mechanical elements at micrometric scales** has opened the doors to the development of multiple marine devices with different **sensory capabilities**:

- Within **navigation**, the development of **MEMS sensors** is key not only for the implementation of location and positioning technologies, but also for the development of complete **mobile platforms (potentially autonomous)** for the collection and distribution of **data** at **open water environments**.
- MEMS are further used for **monitoring water** properties and composition. This is highly valuable for **maximizing aquaculture** activity, identifying **potential pathogenic agents** and unwanted variations of acidity, etc. MEMS technology can also be used to **monitor marine structures**.
- The implementation of MEMS technology in **autonomous or semi-autonomous** operations can further aid **underwater prospecting**, the **discovery** of underwater resources, and marine deposit, and even the **early detection** of earthquakes.

For further information, see the KETmaritime case study on **MEMS Marine Applications**, available at **www.ketmaritime.eu**

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