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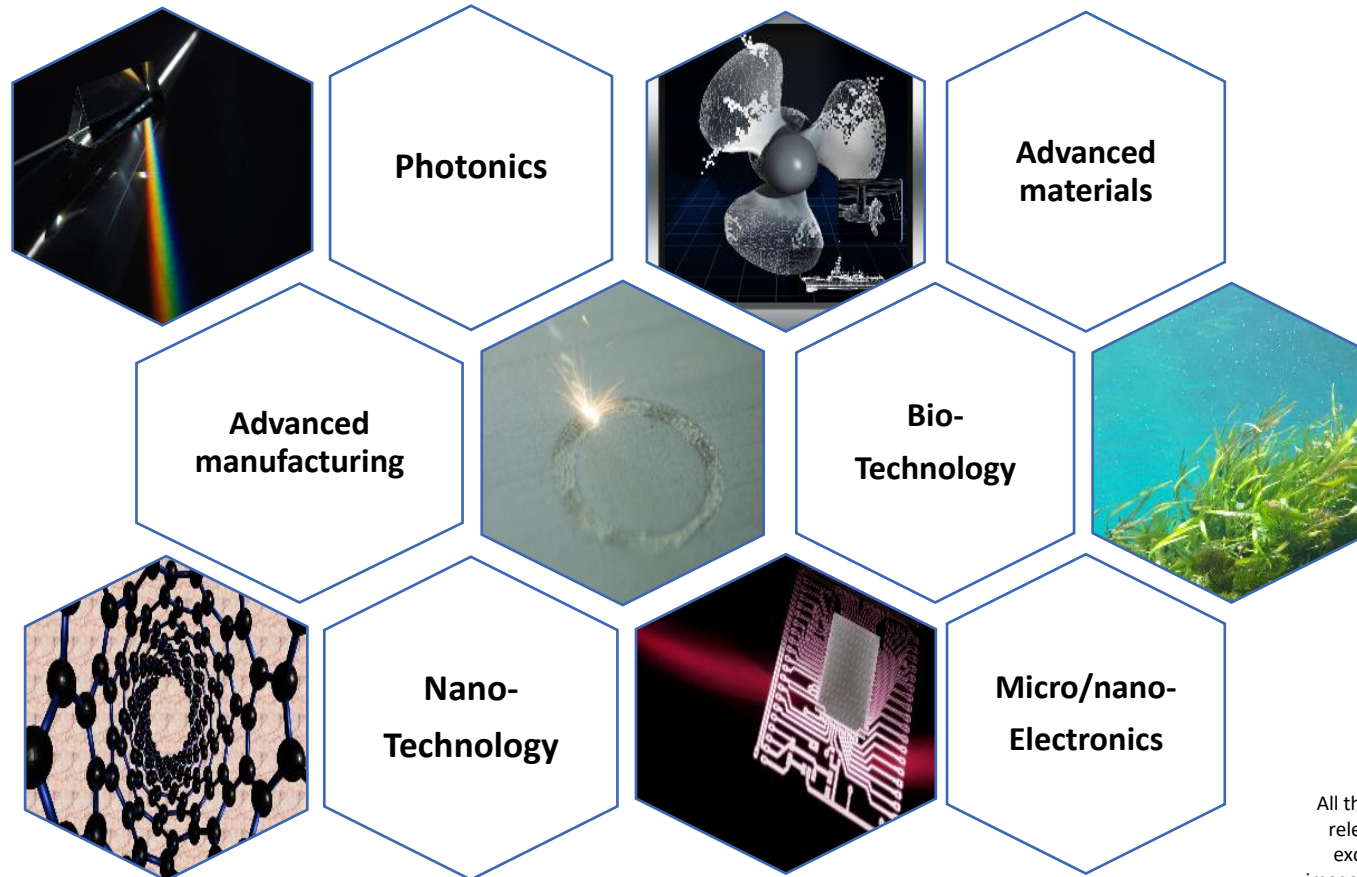


## Case Studies and Future Opportunities for KETs in the Maritime Industry

David Santos González  
Fundación IDONIAL

## What are KETS?

- KETs are “Key Enabling Technologies”, identified as indispensable for the European industry.

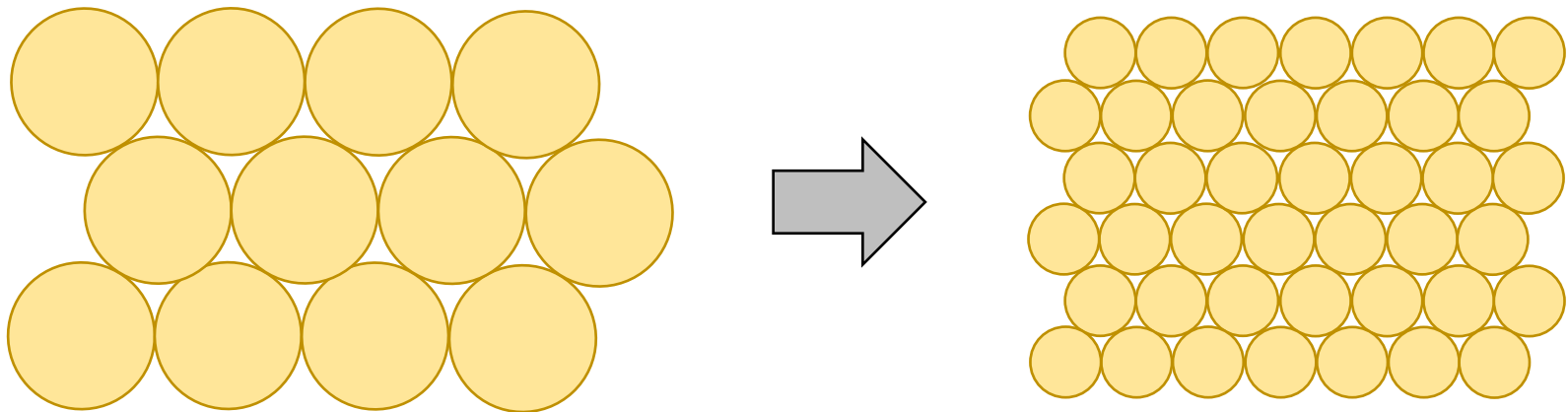


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# 1. Nanotechnology KET: exploiting the benefits of a smaller scale

Example of nanotechnology application: **Why nanoparticles are perfect for coating against corrosion?**

If we think on a coated material, the coating is composed of small “packed” particles; it is easy to understand that **the smaller the particle size, smaller are the interstices that the "packing" leaves free for the action of external elements.**



Exemplification of the reduction of the interstitial space of a 2D “packaged” structure with the decrease in particle size (own creation)

# 1. Nanotechnology KET: exploiting the benefits of a smaller scale

## Other applications of nanotechnology in marine environments:

- **Materials.** With special importance in the field of composites, nano-reinforced fibers are being developed, which provide great advantages in the reduction of weight (and the reduction in fuel consume) of vessels that make extensive use of them.
- **Oil & Gas.** The construction and exploitation of marine structures is also benefited: concrete, structural elements, drilling, water treatment, etc.
- **Food safety:** control of toxic substances in water, the identification/tagging for the monitoring of marine species, supply of food supplements, vaccines and proteins and purification and filtering of waters.
- **Energy systems:** improvement in battery performance.

## 2. Industrial Biotechnology KET: taking advantage of marine biological resources and their commercial potential

In a basic way, **industrial biotechnology** is translated as the application of biotechnology to the **industrial processing of chemical products, materials and fuels, basically through the use of micro-organisms and enzymes.**

Different denominations can be found related to this discipline (white biotechnology, red, green, etc.), but when talking about **exploration and exploitation of marine resources to develop industrial products and processes**, the term **Blue Biotechnology** is commonly used.

Main reasons why marine resources could present some advantages over other kinds of biomass:

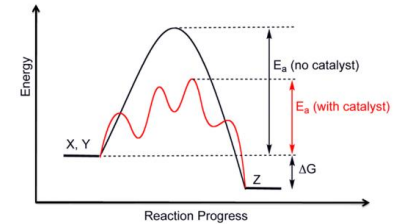
- Greater yields per area of cultivation.
- No competition with arable-land.
- Use of sea water, wastewater or saline water for cultivation.
- Use of CO<sub>2</sub> as carbon source or wastewater as nutrient input.
- No competition with food and feed applications.



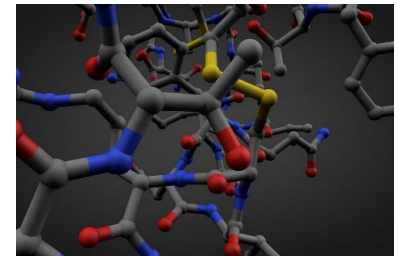
## 2. Industrial Biotechnology KET: taking advantage of marine biological resources and their commercial potential

Within the field of marine biotechnology, three are the fundamental applications:

- Marine derived Enzymes.** Enzymes derived from marine organisms can show significant differences with respect to their terrestrial counterparts, (higher tolerance in high saline concentrations, high pressure, either high thermal or cold adaptivity, etc.).
- Marine bio-based polymers.** Polymers that are totally or partially derived from biomass; they can be produced from different kinds of biomass feedstock.
- Marine bio-based biofuels.** Aquatic biomasses such as macro- and micro-algae and photosynthetic cyanobacteria have the potential to be used as biomass for biofuels production



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### 3. Photonics: light applied to monitoring of marine assets and resources.

The **production and detection of light** (visible and non-visible, lasers, optical fibers, etc.) is a field with a large number of applications:

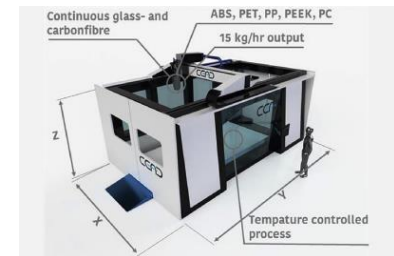
- Fisheries and aquaculture
  - Systems capable of analysing and detecting pollutants in the sea.
  - Monitoring and mapping of marine activity.
  - Light stimulation for the growth of marine products.
  - Sensorization for autonomous operations.
- Processing of fish and seafood
  - Automated systems for classification and processing.
  - Measurement of the visual attributes related to the quality and safety of seafood products.
- Marine prospection
  - Leaks monitoring
  - Resources monitoring
- Energy and Environment
  - Water quality
  - Structural integrity
  - Evolution of biodiversity.
  - LIDAR systems for the management of off-shore energy resources.
- Shipbuilding
  - Advanced cutting and welding systems.
- Security, navigation and logistics
  - Advanced navigation and detection systems



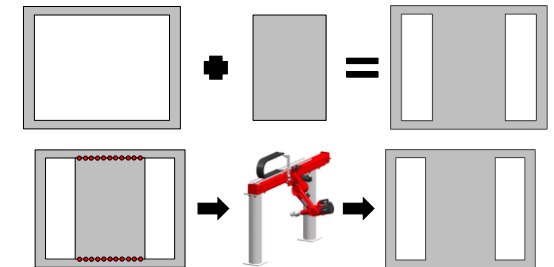
## 4. Advanced manufacturing KET: a new paradigm for industrial processes

Advanced manufacturing is an "umbrella" concept, under which the most modern technologies with commercial / industrial applicability are housed:

- **Digital manufacturing** (3D design, simulation, scanning, 3D printing, etc.). The progressive digitalization of the industry has been greatly improved by the proliferation of technologies capable of reproducing geometries without the need to previously carry out a design and engineering process (scanning) and to manufacture parts only from a 3D file (3D printing).
- **Automation** (sensorics, robotics, artificial intelligence, etc.). The advances in robotics and automation are translated in a fundamental way in an increase of the flexibility and potential applications in the industrial field.
- **Immersion technologies** (3D representation, augmented reality, virtual reality, etc.), thanks to the development of high-realism 3D rendering technologies, as well as the proliferation of powerful and accessible hardware.
- **Hardware, software and communications advances, under concepts such as:** digital industry, industry 4.0, Big Data, Internet of Things, etc.



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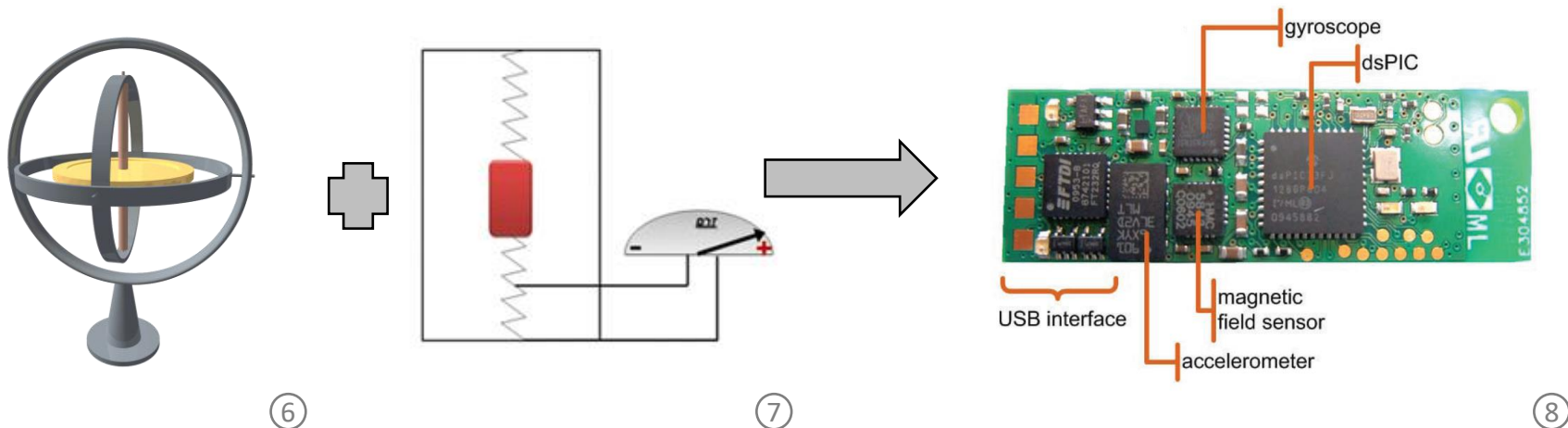


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## 5. Micro & nano-electronics: beyond "mere" computing

These concepts arise as a natural evolution of traditional electronics, which, based on the progressive capacity to increase the density of electronic elements (and not strictly electronic) per unit area, give rise to the addition of the prefixes "micro" and "nano".

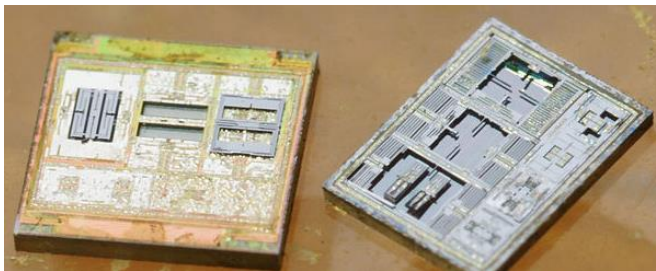
In a very prominent way within the field of electronics, an evolution with great importance has been the possibility of combining electronics with mechanics at micro and nano levels, giving rise to the birth of micro/nano-electromechanics, and by extension of the micro and nanoelectromechanical systems (MEMS and NEMS).



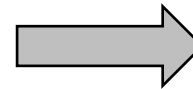
## 5. Micro & nano-electronics: beyond "mere" computing

### Main applications:

- **Inertial navigation systems**, specially useful for autonomous exploration and monitoring devices.



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- **Weather monitoring and forecast** (buoys).



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- **Labs on a chip** for chemical and biological marine studies.

## Where to find further information about KETs applications for maritime industry?

<https://ketmaritime.eu/media/>

- Advance Manufacturing: [direct link](#)
- Nanotechnology Marine Applications: [direct link](#)
- Marine Industrial Biotechnology: [direct link](#)
- Photonics Marine Applications: [direct link](#)
- Microelectromechanical Systems (MEMS): [direct link](#)

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Thanks for your attention!