Interreg Atlantic Area
European Regional Development Fund

EUROPEAN UNION

IN 4.0

# IN 4.0

## ADAPTATION OF INDUSTRY 4.0 MODEL TO THE NAVAL SECTOR

***Main conclusions achieved through the deployment of WP4 "IN CONTEXT"***

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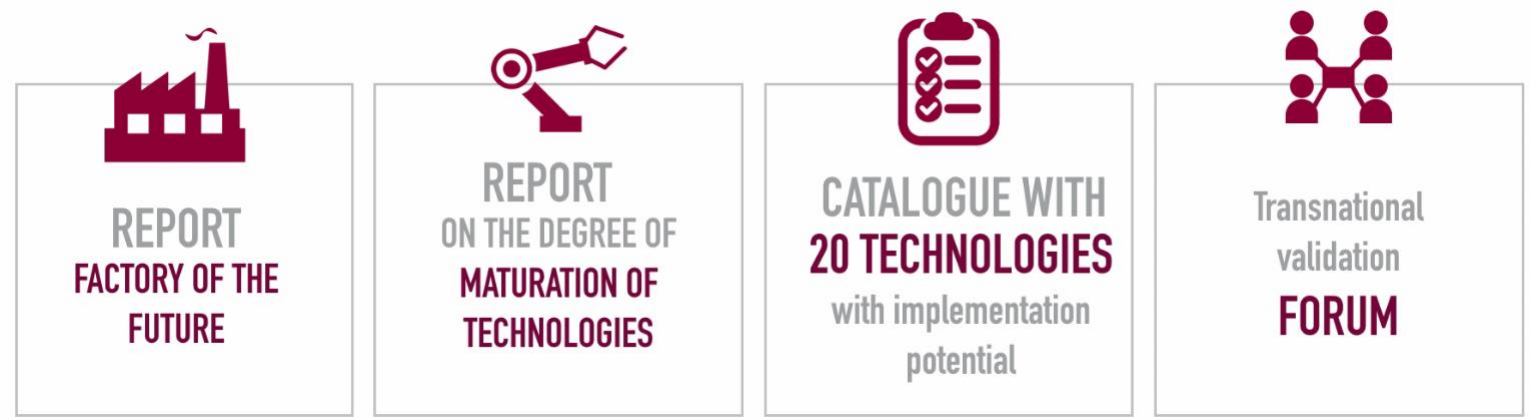
# 1. IN CONTEXT

**This activity is the starting point towards the adaptation** to the 4.0 productive model, and includes the following task:

- ✓ **Diagnosing of the current** situation of the implementation of industry 4.0 model across the Atlantic Area (achieved)
- ✓ Identifying of **existing technologies that can be adapted** to the companies in the maritime sector (achieved)
- ✓ **Analysing the level of readiness** of the identified technologies for their implementation in maritime SMEs (achieved)
- ✓ Validation forum, with the participation of experts and key agents (achieved)

# 1. IN CONTEXT

## Expected results



# Main findings achieved through WP4 IN Context


"The Report on the analysis of the current situation of the implementation of the factory of the future model in the maritime sector across the Atlantic area", consisted in:

1. The compilation and validation of previous studies about the current situation of companies in the maritime sector across the Atlantic Area (identifying the main sector actors and promotion programmes across the Atlantic Area, economic magnitudes, etc.)

2. The implementation of surveys with companies and main sector actors to identify:
   - ❑ The level of implementation of 4.0 technologies across the AA
   - ❑ The main drivers and barriers for the implementation of 4.0 technologies through a survey

# Level of 4.0 technology adoption per type of technology (average according to survey implemented in Portugal, Spain, France, UK and Ireland)

REPORT
FACTORY OF THE FUTURE

| Engineering & conception industries | |
|---|---|
| **Technologies** | **Level of adoption** |
| ▶ Design and simulation software | 2. Partially deployed |
| ▶ Rapid prototyping | 1. Some experiments |
| ▶ PLM Tool (Product Lifecycle Management) | 1. Some experiments |
| ▶ Digital mock-up | 2. Partially deployed |
| ▶ Project management software | 2. Partially deployed |
| ▶ Virtual reality | 2. Partially deployed |
| ▶ Augmented reality | 2. Partially deployed |
| ▶ Additive manufacturing | 1. Some experiments |
| ▶ Internet of things | 1. Some experiments |
| ▶ Collaborative design environment | 1. Some experiments |
| ▶ Mobile solution (application/remote access) | 2. Partially deployed |
| ▶ Cyber security | 1. Some experiments |

Table 5 - Level of adoption of 4.0 technologies in the engineering and conception industries

| Production and maintenance industries | |
|---|---|
| **Technologies** | **Level of adoption** |
| ▶ Machine tools | 2. Partially deployed |
| ▶ Computer-Assisted Maintenance Management and traceability solution | 2. Partially deployed |
| ▶ Manufacturing Execution System | 1. Some experiments |
| ▶ Logistic flow simulation | 2. Partially deployed |
| ▶ PLM Tool (Product Lifecycle Management) | 2. Partially deployed |
| ▶ Digital mock-up | 2. Partially deployed |
| ▶ Project management software | 2. Partially deployed |
| ▶ Electronic document management & document sharing | 2. Partially deployed |
| ▶ Enterprise Resource Planning | 2. Partially deployed |
| ▶ Augmented reality | 1. Some experiments |
| ▶ Collaborative robot | 1. Some experiments |
| ▶ Additive manufacturing | 1. Some experiments |
| ▶ Predictive maintenance | 1. Some experiments |
| ▶ Internet of things | 1. Some experiments |
| ▶ Mobile solution (application/remote access) | 2. Partially deployed |
| ▶ Cyber security | 1. Some experiments |
| ▶ Factory/ yard digital twin | 1. Some experiments |

Table 6 - Level of adoption of 4.0 technologies in production and maintenance industries

REPORT
FACTORY OF THE FUTURE

## Main drivers identified

- Companies see in 4.0 technologies a mechanism to add value to their products and **becoming more competitive**
- **New products and innovative businesses are attractive to clients**: high quality, environmentally friendly, maintenance as a service, etc.


- **Improving efficiency and productivity** by shortening production and delivery times; and improving communication supplier-client
- **Workers' increased safety and security** (robot, cobot, exoskeleton, etc.)
- **Product increased safety and security** (quality control, warnings, traceability…)
- **Capacity to comply with new regulations** (compliance, traceability, etc.)

## Main barriers identified

- Most shipyards and suppliers across the maritime sector are **SMEs, who struggle to invest in expensive 4.0 technologies and do not see a clear return on investment**
- Workers across the value chain **lack qualifications and show resistance to change**
- Lack of confidence related to cyber security, and intellectual property when using new technologies
- Most companies, **currently show a very low level of digitalisation**, which conflicts with industry 4.0 paradigms.
- The sector **struggles to attract new talent and skilled workers**
- **The sector is very fragmented** and lacks cooperation vocation

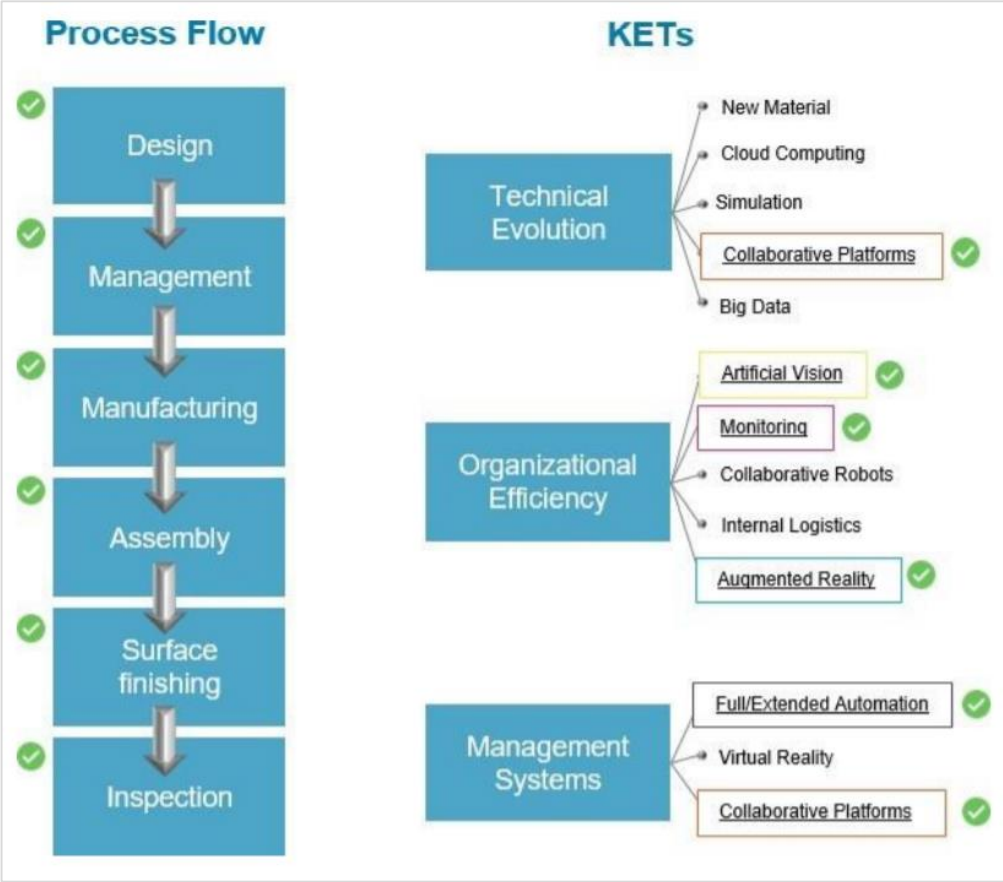
## Study on the degree of maturation and the compilation of the main exiting technologies with potential for implementation in maritime companies and SMEs, consisted in:

- Identifying the priority link of the maritime/shipbuilding value chain, which resulted to be **manufacturing**
- **Analysing the 4.0 technologies with greatest potential to improve production processes,** funneled according to their expected impact in terms of:
  - **Required resources for their implementation** (technical resources, H.R, company structure and investment)
  - **Expected impact after their implementation** (benefits, results and ROI)

REPORT
ON THE DEGREE OF
**MATURATION OF TECHNOLOGIES**

CATALOGUE WITH
**20 TECHNOLOGIES**
with implementation potential

Research resulted in the selection of the following priority 4.0 technologies across the manufacturing process flow, according to 3 Key Enabling Technologies (KETs)




1. **Collaborative platforms**
2. **Monitoring**
3. **Augmented Reality (AR)**
4. **Automation & Robotics**
5. **Artificial Vision (AV)**

** Full study includes in depth analysis per technology (impact rate according to company's level of technology readiness, practical cases, success cases, etc.)

# Collaborative platforms

A collaborative platform is a **virtual space where a set of relevant functionalities of one single or several enterprises are integrated**.

These relevant functionalities are, for instance, projects or information management, as well as organization management, especially in those cases where the global process implies several sub-processes which are undertaken by different stakeholders, that need to be coordinated and synchronized.

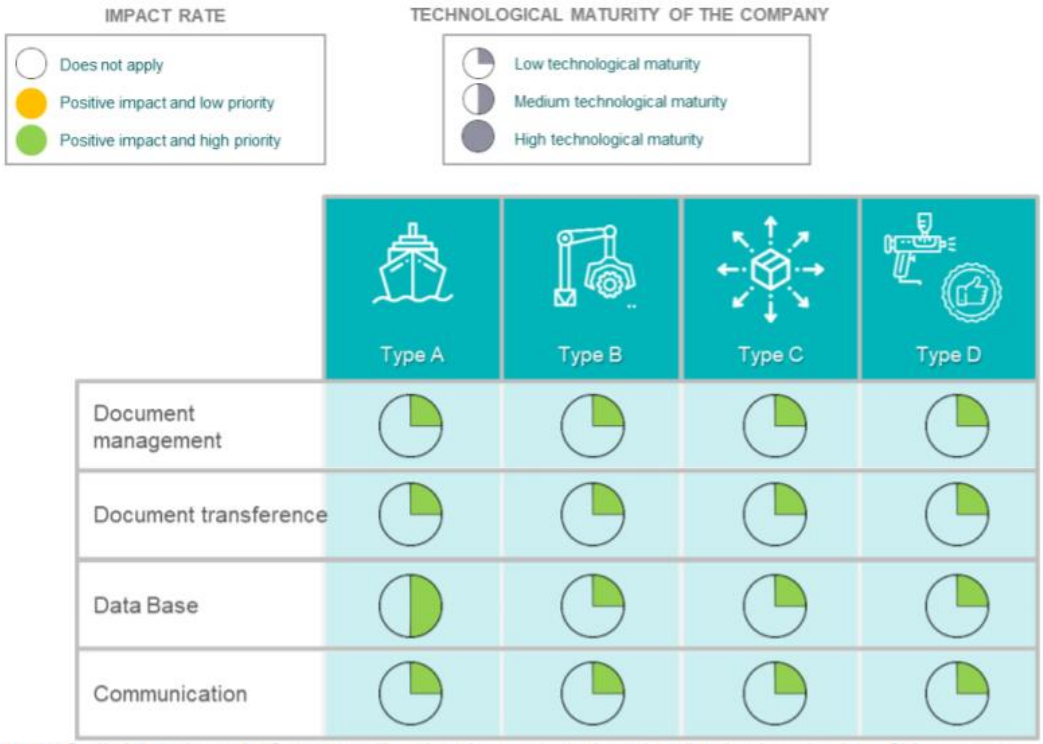



*Chart 7. Collaborative platform application impact and technological maturity of the companies.*

**Type A**: shipyards (building and reparation)
**Type B**: parts and component suppliers (mechanics, engines, propulsion systems, electricity and electronics, piping, hydraulics and pneumatics, equipment, etc…)
**Type C**: Logistic companies
**Type D:** Other specialised services (painting, surface treatment and coatings; quality control; etc.)

# Technology 1. Monitoring

Monitoring is the process of **periodic observation and control of the manufacturing processes** to ensure its effectiveness. Two significant technologies are involved to carry out monitoring is taken into account:

- **Industrial Traceability:** implies using different technologies that allow to know where the product is, the processes it has been through (welding, cutting… ), etc.

- **Industrial Information Systems**: This kind of systems helps to ensure data integration and uniformity, allowing to the company to manage the information.

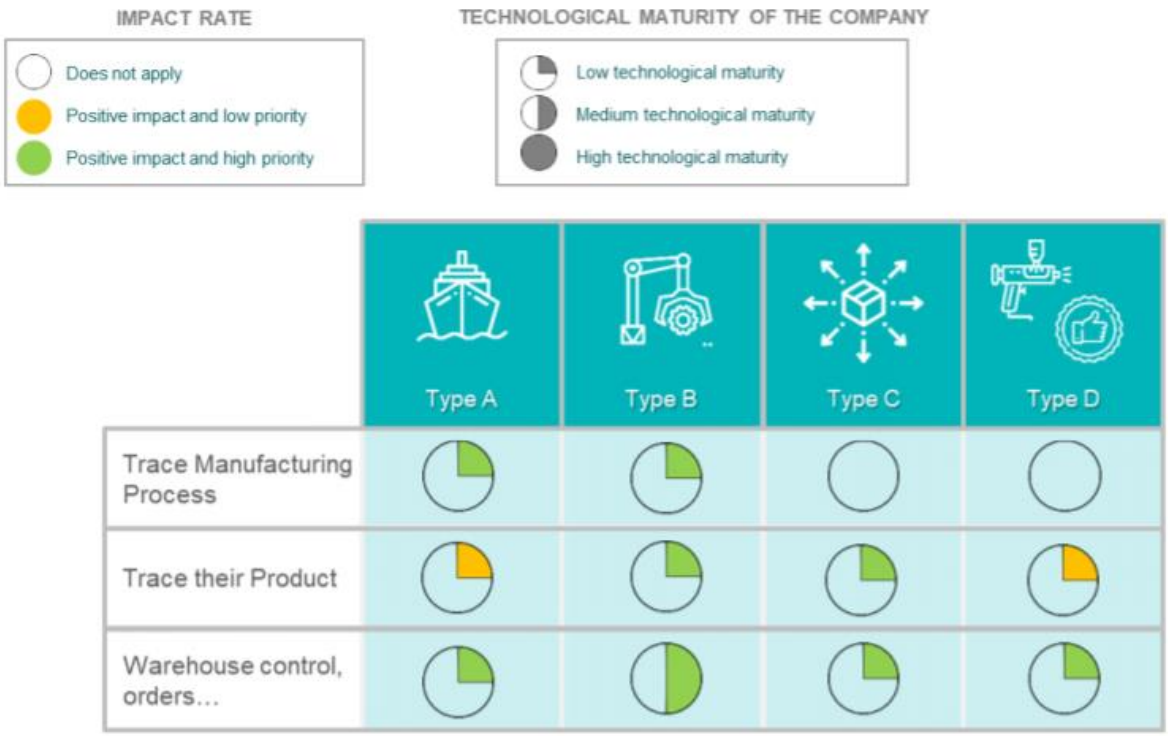
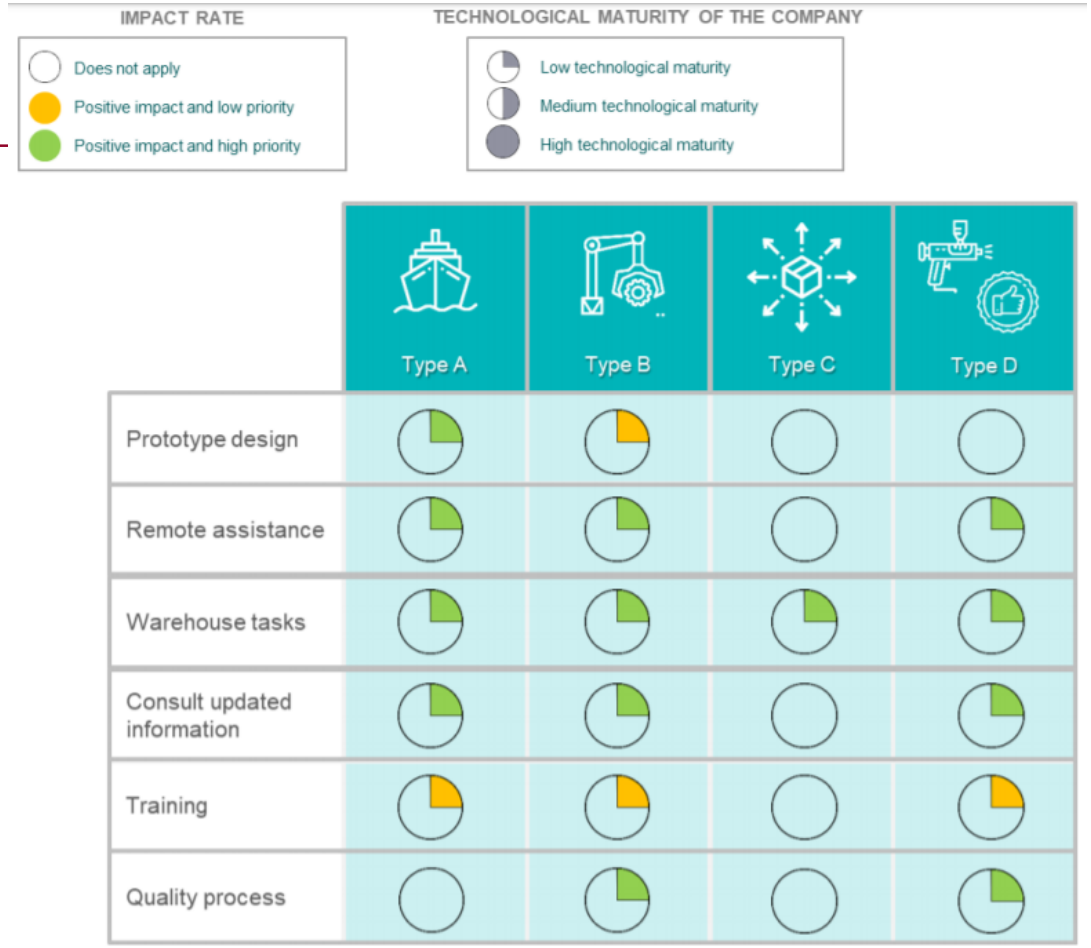



*Chart 2: Traceability application impact and technological maturity of the companies.*

**Type A**: shipyards (building and reparation)
**Type B**: parts and component suppliers (mechanics, engines, propulsion systems, electricity and electronics, piping, hydraulics and pneumatics, equipment, etc…)
**Type C**: Logistic companies
**Type D:** Other specialised services (painting, surface treatment and coatings; quality control; etc.)

# Augmented Reality (AR)

Augmented reality is the technology **that expands the physical world, adding layers of digital information onto it.** Unlike Virtual Reality (VR), AR does not create the whole artificial environments to replace a real element with a virtual one. AR appears in direct view of an existing environment and adds sounds, videos, and graphics to it.




*art 9. Augmented Reality application impact and technological maturity of the companies*

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# Full/extended automation and robotics

The concept of Automation refers to a **process that implies no human supervision**. There are two main types of automation: IT automation and OT automation.

**IT (information technology) refers to those technologies aimed at the information processing**, which includes software, hardware or communications. In general, IT does not include technologies that are not information providers.

On the other hand, **OT (operational technologies) are those technologies that are not specifically aimed at providing information**. Thus, these technologies include hardware and software specialized in change detection and generation by means of direct monitoring.

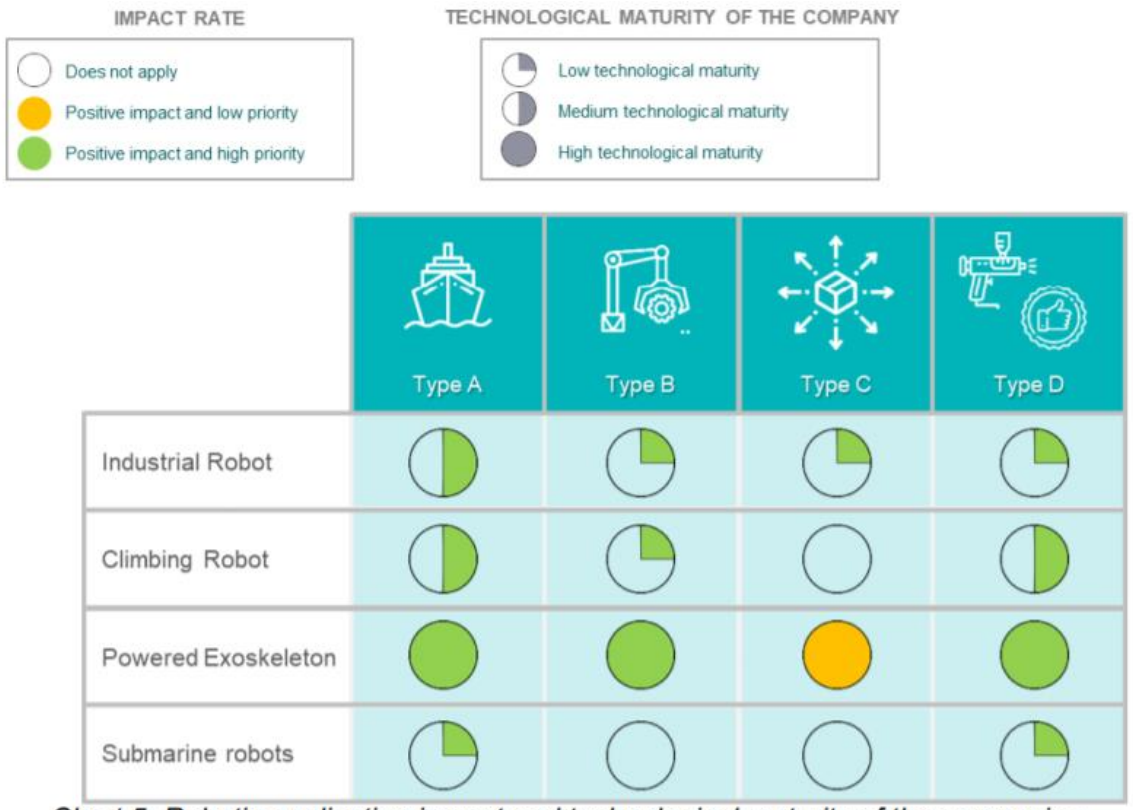


*Chart 5. Robotic application impact and technological maturity of the companies.*

**Type A**: shipyards (building and reparation)
**Type B**: parts and component suppliers (mechanics, engines, propulsion systems, electricity and electronics, piping, hydraulics and pneumatics, equipment, etc…)
**Type C**: Logistic companies
**Type D:** Other specialised services (painting, surface treatment and coatings; quality control; etc.)

Results were presented, discussed and corroborated with experts at the following validation forum:


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IN 4.0

## IN 4.0 PROGRAM

**09.15** **Recepción de asistentes y entrega de materiales. Café bienvenida**
Reception of attendees and delivery of materials. Welcome coffee

**09.45** **Apertura y presentación por parte de ASIME, ACLUNAGA, Diputación de Pontevedra**
Event opening and presentation by ASIME, ACLUNAGA, Diputación de Pontevedra

- D. Rafael Outeiral Graña, Vicepresidente de ASIME
- Mr. Rafael Outeiral Graña, Vice-President of ASIME
- D. Marcos Freire, Presidente de ACLUNAGA
- Mr. Marcos Freire, President of ACLUNAGA
- D. Benito Núñez Quintanilla, Director General de la Marina Mercante, Ministerio de Fomento
- Mr. Benito Núñez Quintanilla, General Director of the Spanish Merchant Navy, Ministry of Transport and Infrastructure
- Dña. Camela Silva Rego, Presidenta de la diputación Provincial de Pontevedra
- Ms. Camela Silva Rego, President of the Provincial Council of Pontevedra
- D. Abel Caballero, Alcalde de Vigo
- Mr. Abel Caballero, Major of Vigo

**10.15** **Presentación de los resultados del diagnóstico conjunto del estado del arte de la implantación de la industria 4.0 en el sector naval**
Presentation on the "Results of the joint diagnosis of the state of the art of the implementation of industry 4.0 in the shipbuilding sector"

Ponente: Coline Fiquet, EMC2.
Speaker: Coline Fiquet, EMC2

**10.45** **Presentación de las 5 tecnologías con un nivel de maduración óptimo para la adaptación al sector naval resultantes del catálogo de 20 tecnologías**
Presentation of the 5 technologies with an optimal level of readiness for adaptation to the shipbuilding sector, resulting from the catalogue of 20 technologies.

Ponente: Jennifer González, ASIME
Speaker: Jennifer González, ASIME

**11.15** **Primera parte del debate. Debate sobre las 5 tecnologías y validación de los resultados expuestos**
Panel Part 1: Debate on the 5 technologies and validation of the results obtained through the IN 4.0 Project

- **Tecnología 1** Visión Artificial
- **Technology 1** Artificial Vision
- **Tecnología 2** Realidad Aumentada
- **Technology 2** Augmented Reality

**12.00** **Pausa**
Coffee Break

**12.30** **Segunda parte del debate. Debate sobre las 5 tecnologías y validación de los resultados expuestos**
Panel Part 2: Debate on the 5 technologies and validation of the results obtained through the IN 4.0 Project

**Tecnología 3** Monitorización
**Tecnología 4** Robotización
**Tecnología 5** Plataformas colaborativ

**Technology 3** Monitoring
**Technology 4** Full/Extended automation
**Technology 5** Collaboration Platforms

**14.00** **Cierre de la jornada**
Event closing

## *PARTICIPATING EXPERTS*

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- **Technology 2** Augmented Reality

**Panel 1**

| Name | Position | Organisation | Region |
|---|---|---|---|
| **Pablo Fidalgo (moderator)** | Project Manager | ASIME | Galicia |
| **Brais Carballedo** | Technical Lead of Virtual Engineering | HSSMI | United Kingdom |
| **Hochart Matthieu** | Sales partner | SDI SERVICES | France |
| **James Corbett** | CEO | Simvirtua | Ireland |
| **Jorge Torrico** | BIM Subdirector | INECO | Madrid |
| **Seadna Smallwood** | CTO | UtilityAR | Ireland |

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**Technology 3** Monitoring
**Technology 4** Full/Extended automation
**Technology 5** Collaboration Platforms

**Panel 2**

| Name of expert | Position | Organisation | Region |
|---|---|---|---|
| **Hernán del Frade de Blas (moderator)** | Technical Advisor for Safety and the Environment of the Cantabric Coast | Directorate General of the Spanish Merchant Navy, Ministry of Public Works (DGMM) | Madrid |
| **Ángel Hernán** | Technical director | SISTEPLANT | Basque Country |
| **Daniel Gesto** | Senior Project Manager - R&D Area | NAUTILUS AIMEN-NAVANTIA, Joint R&D Centre | Galicia |
| **Fernando Miguelez** | Advanced Manufacturing Technologies Director | Technology Centre, NAVANTIA | Galicia |
| **José Lima** | Professor | Centre for Robotics in Industry and Intelligent Systems (CRIIS)-INES TEC | Portugal |
| **Juan García** | Manager | HGA | Galicia |
| **Francisco Pintos Estévez** | Ingeneer | Coterena | Galicia |

# Main conclusions achieved through WP4 IN Context

## Consulted experts drew the following main conclusions and recommendations to promote the growth and modernisation of maritime enterprises:

- Governments, industry and economic promotion institutions should urgently cooperate to **facilitate the development of a shared 4.0 maritime strategy across the Atlantic area**, including the design of **new financial instruments to enable maritime companies, specifically SMEs, to incorporate the necessary 4.0 technologies** (e.g. public-private partnerships).

- **Stimulating cooperation between key maritime stakeholders to share good practices, success cases and collaborative projects** would considerably open up the horizons of SMEs

- **Industry 4.0 support programs** should be designed, especially aimed at SMEs with less investment capacity.

- Implementing **Industry 4.0 training programs to equip exiting workers with the required technological** skills, as well as programs to attract and engage new talent and young workers, is a priority to guarantee the survival of the sector.

## Consulted experts drew the following main conclusions and recommendations to promote the growth and modernisation of maritime enterprises:

- The manufacturing link of the maritime and shipbuilding value chain seems to have the **most potential for improvement towards competitiveness at global level.**

- Introducing **the five prioritised 4.0 technologies** to production processes would make the difference for companies with an acceptable level of technology readiness, however a series of prior preparation actions are necessary:

***5 priority 4.0 technologies***

1. **Collaborative platforms**
2. **Monitoring**
3. **Augmented Reality (AR)**
4. **Automation & Robotics**
5. **Artificial Vision (AV)**

- ✓ Raising awareness among decision makers at maritime/shipbuilding companies, through pilot and demonstration projects, support for the development of business plans, identification of financial support mechanisms, etc.
- ✓ Raising awareness and training existing workers to acquire the necessary technological skills
- ✓ Attracting new talent to the sector, at all levels of value chain