

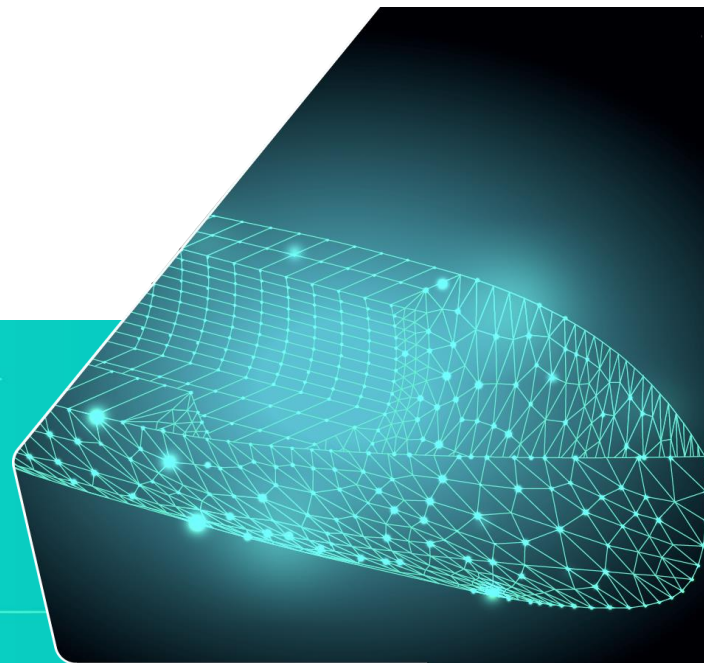
# FIBRE4YARDS

## CURRENT STATE & INTERESTS OF EU SHIPYARDS IN COMPOSITE PRODUCTION PROCESSES

**Montserrat Dolz (CIMNE)**

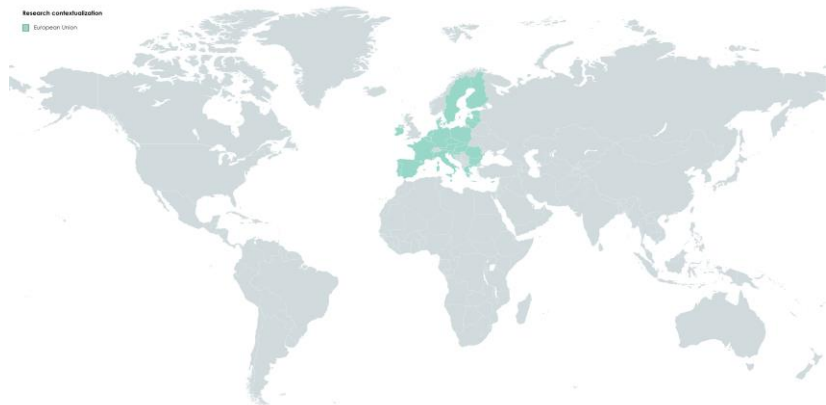


This project has received funding from European Union's Horizon 2020 research and innovation programme under grant agreement n° 101006860



# RESEARCH CONTEXTUALIZATION

## 1. European Project

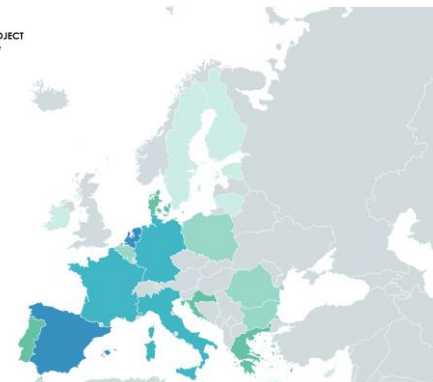


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## 2. European Shipyards Database

426 Shipyards

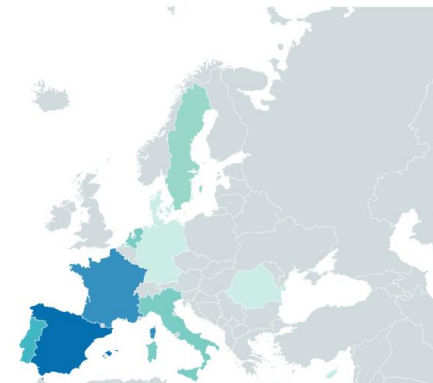
FIBRE4YARDS EU PROJECT  
Shipyards database



## 3. European Shipyards Responses

39 Shipyards (9.2%)

FIBRE4YARDS EU PROJECT  
Survey participation



# SURVEY DESCRIPTION

1. Use of Composite Materials
2. Processes and materials
  1. Composites' manufacturing processes used in the shipyard
  2. Field that Shipyards applies Composite Materials
  3. Reinforcement materials used
  4. Resins used
3. Manufacturing and production
  1. Boat types produced
  2. Number of boats built
  3. Displacement of the built boats

Current shipyards situation

4. Technologies
5. Design and Engineering
6. Shipyard 4.0

Shipyards interests



## FIBRE4YARDS

FIBRE COMPOSITE MANUFACTURING TECHNOLOGIES FOR THE AUTOMATION AND MODULAR CONSTRUCTION IN SHIPYARDS

The European Union has launched the FIBRE4YARDS project, which we believe it may be of your interest.

The main objective of the FIBRE4YARDS project is to maintain the European global leadership in ship building and ship maintenance, through the implementation of the Shipyard 4.0 concept in which advanced and innovative FRP manufacturing technologies are successfully introduced.

This survey aims to find out the present use of composite technologies in European shipyards, and the most interesting technologies that could be applied in the future.

We appreciate your help.

\*Required

Do you use composite materials in your shipyard? \*

- Yes
- Yes, by buying composite parts
- No

The purpose of the research is related to the objectives of the project 'FIBRE4YARDS - FIBRE composite manufacturing technologies FOR the automation and modular construction in shipYARDS'. This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement no 101006860.

Personal data will be treated in accordance with the General Data Protection Regulation 2016/679. The information will be used only for the purposes of the above-mentioned project. Responding to this questionnaire confirms that your participation is voluntary and you have been informed about the treatment of your data by the FIBRE4YARDS consortium and you authorize their use. You are entitled to exercise your rights of access, rectification, elimination, limitation, opposition, portability and to not be subject to a decision based solely on automated processing by contacting the corresponding Data Protection Officer of CIMNE via email at the e-mail: [fibre4yards@cimne.upc.edu](mailto:fibre4yards@cimne.upc.edu) and consult the privacy policies at <http://www.fibre4yards.eu>.

As permitted by law, you have the right to be provided at any time with information free of charge about any of your personal data that is stored as well as its origin, the recipient and the purpose for which it has been processed. You can contact us at any time using the address given herein if you have further questions on the topic of personal data.

You are also entitled to lodge a complaint with the competent Data Protection Agencies.

# SURVEY DESCRIPTION



## Technologies

- Use of Adaptive molds
- Automatic Tape Laying (ATP) technology
- Automated Fibre Placement (AFP) Technology
- Incorporation of Curved pultruded profiles
- 3D Printing / Additive Manufacturing processes
- Hot stamping for thermoplastics
- Modular and serialized shipbuilding in composites
- Digitalization of the production (Industry4.0 concepts)



## Design and Engineering

- Resources for design/engineering
- Use of calculation tools
- Use of composites calculations tools



## Shipyard 4.0

## F4Y interests

- Real time monitoring of the shipyard's production
- Real time monitoring of machinery condition (health)
- Real time asset tracking within the shipyard
- Automated quality control practices
- Digital twin model of the shipyard to control processes and maintenance
- Real time monitoring applied to logistics and providers

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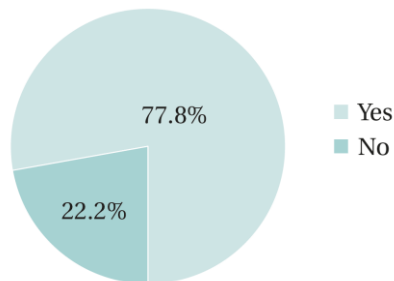
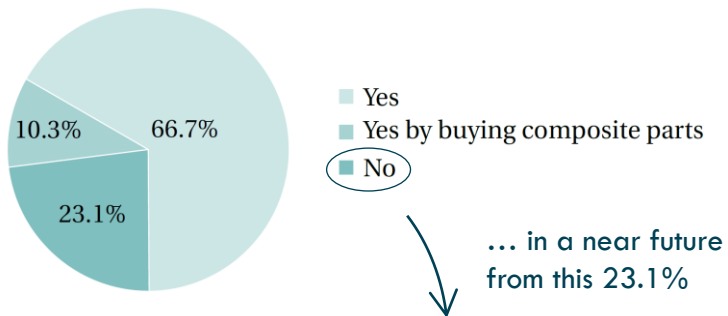
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# SURVEY RESULTS

## 1. Use of composites

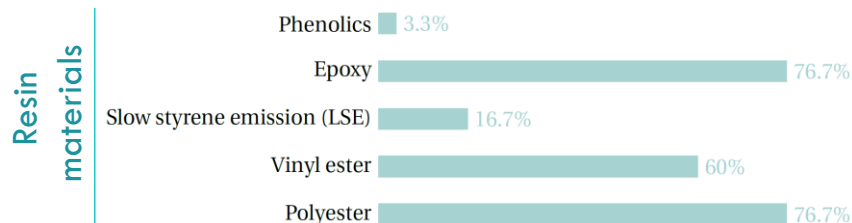
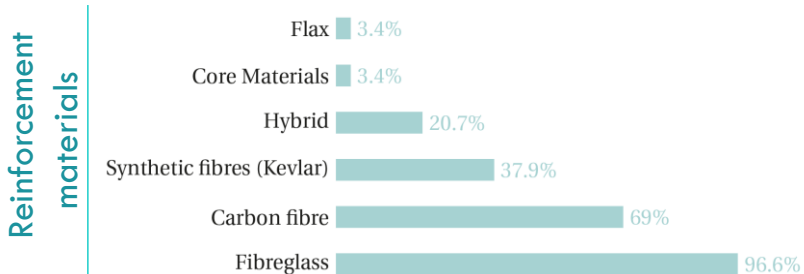
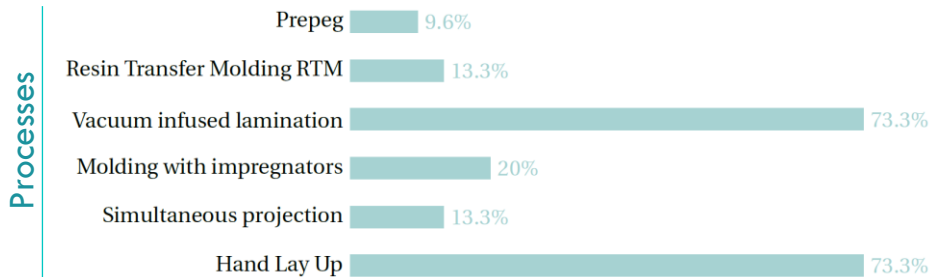


FIBRE4YARDS EU PROJECT  
Survey participation



# SURVEY RESULTS

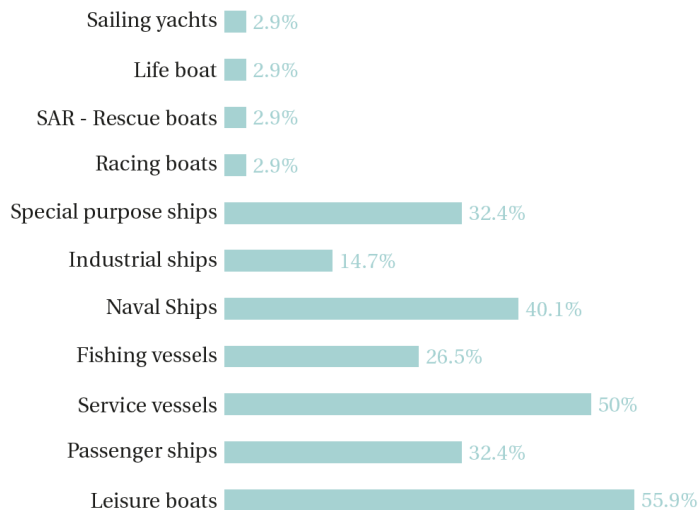
## 2. Processes and materials



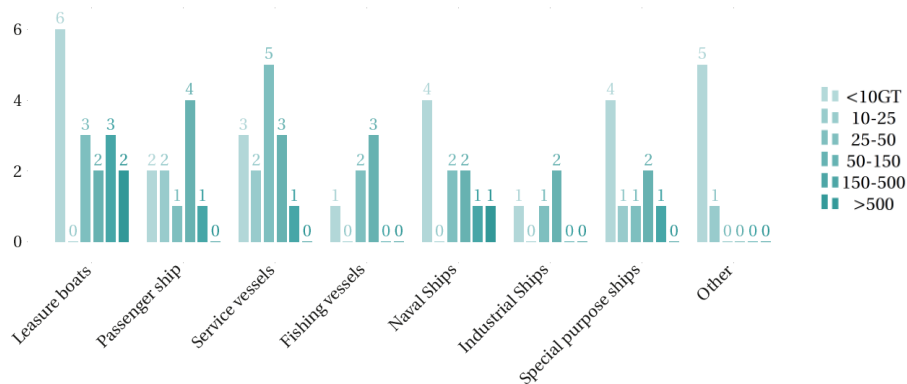
# SURVEY RESULTS

## 3. Manufacturing and production

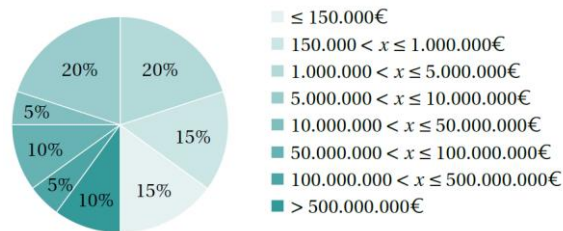
### Types of vessels manufactured



Average displacement of ships manufactured at the shipyard in the last 4 years per vessel type



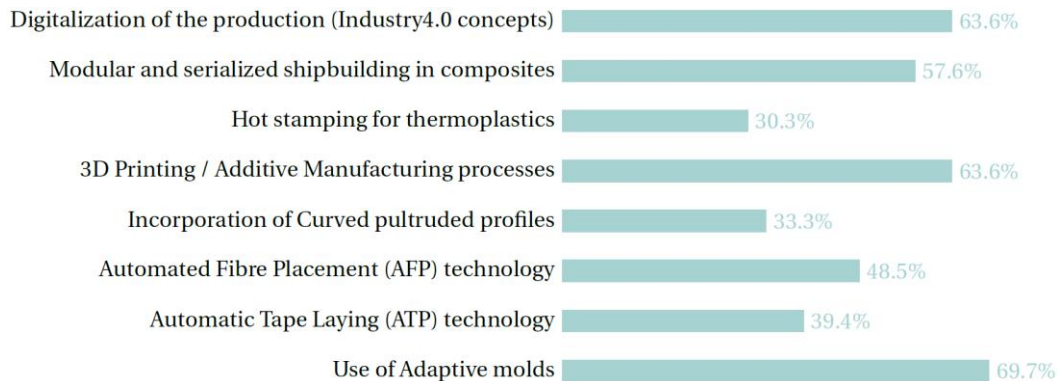
Total Turnover in EUR in 2020



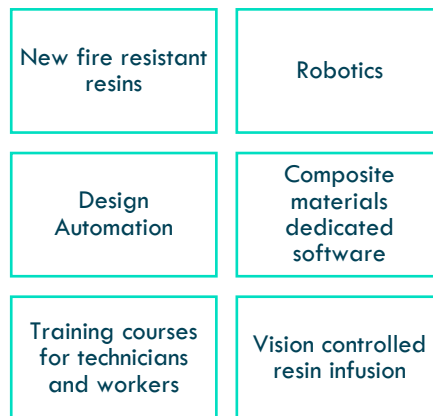
# SURVEY RESULTS

## 4. Technologies

### Technologies of interest



### Additional technologies

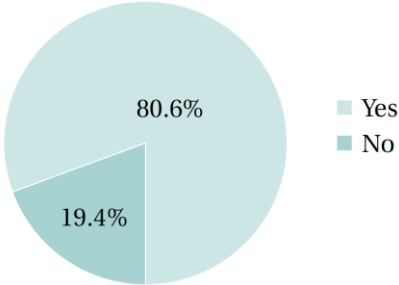




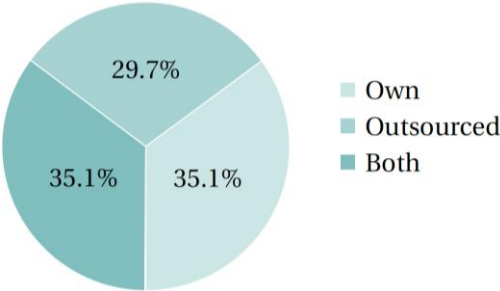
# SURVEY RESULTS

## 5. Design and Engineering

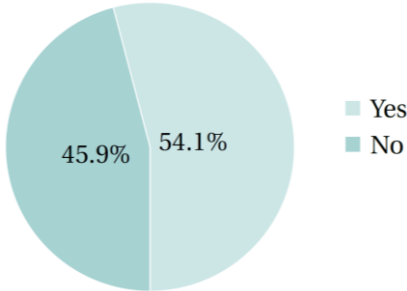
Interested in the design/engineering aspects



Resources for design/engineering



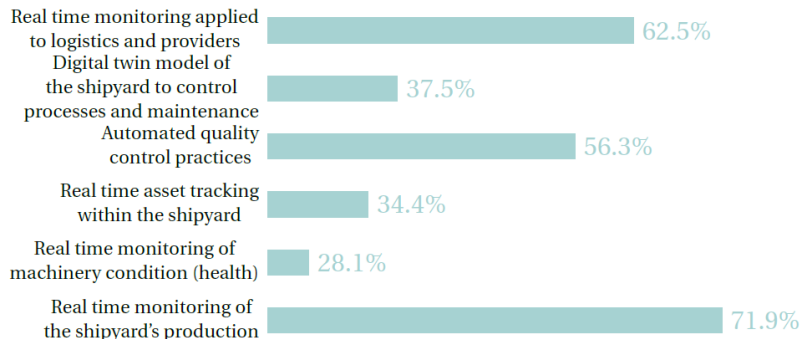
Use of specific analysis tools for composites calculations



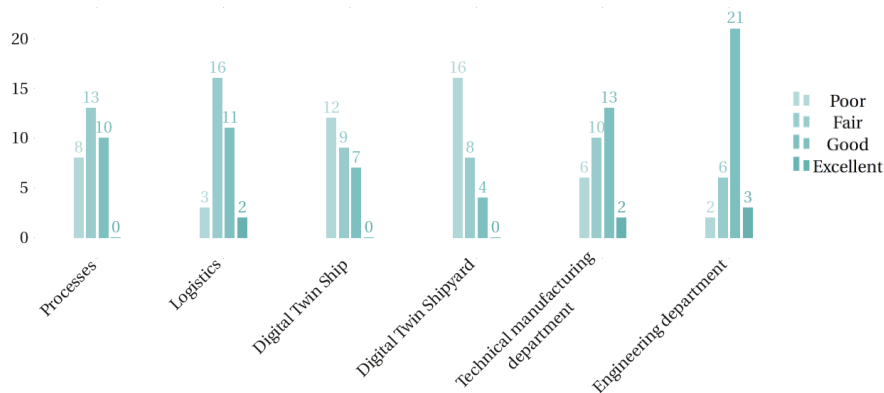
# SURVEY RESULTS

## 6. Shipyard 4.0

### Shipyards interests



### Digitization Shipyards level



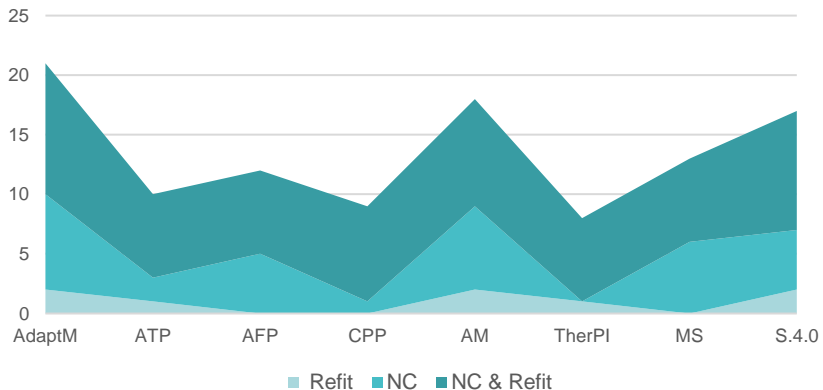
# SURVEY ANALYSIS

ANALYSIS OF THE RESULTS IN ORDER TO SEE INTERESTS ON SHIPYARD 4.0  
CONCEPTS AND TECHNOLOGIES DEPENDING ON THE TYPE OF SHIPYARD

# SURVEY ANALYSIS

## Interest in Fibre4Yards Technologies

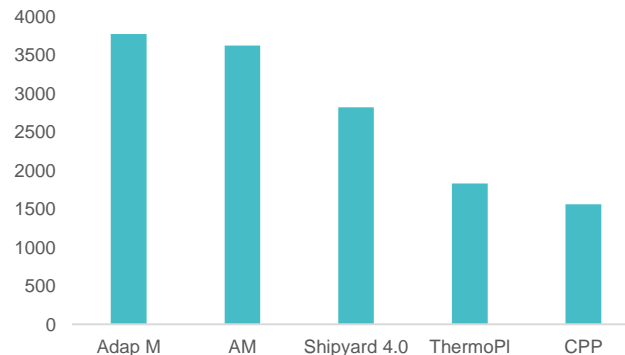
Based on shipyard's types



AdapM: AdaptiveMolds  
 ATP: Automatic Tape Placement  
 AFP: Automated Fibre Placement  
 CCP: Curved Pultruded Profiles

AM: Additive Manufacturing  
 ThermPI: Hot Stamping of Thermoplastics  
 MS: Modular and Serialized Shipbuilding  
 S.4.0: Digitalization of the production

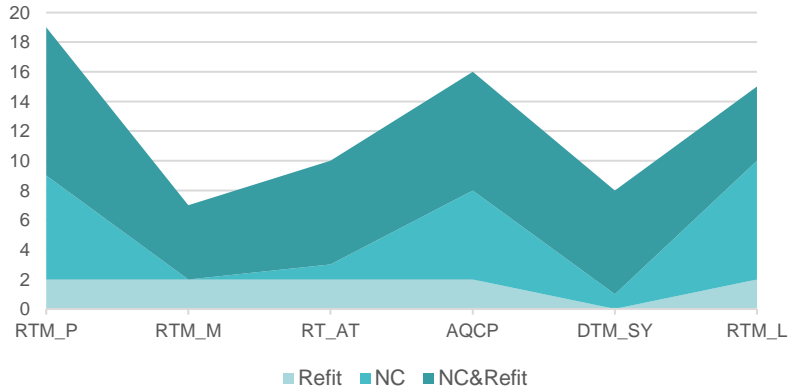
	GT	GT %
<b>Adap M</b>	3770	72%
<b>AM</b>	3620	69%
<b>Shipyards 4.0</b>	2820	54%
<b>ThermoPI</b>	1830	35%
<b>CPP</b>	1560	30%
<b>total GT</b>	5230	100%



# SURVEY ANALYSIS

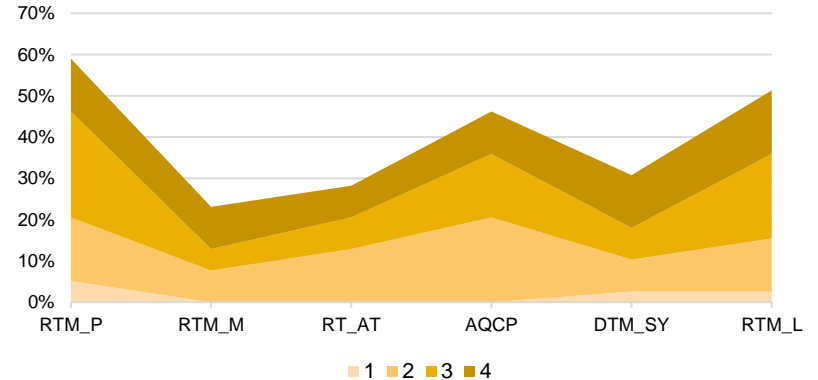
## Interest in Fibre4Yards Shipyard 4.0 concept

Shipyard 4.0 technologies based on shipyard's types



RTM\_P: Real time monitoring production      AQCP: Automated quality control practices  
 RTM\_M: Real Time monitoring Machinery      DTM\_SY: Digital Twin Model  
 RT\_AT: Real Time Asset Tracking              RTM\_L: Real time monitoring logistics

Interest on Shipyard 4.0 technologies based on the shipyard digitalization index



Digitalization index:  
 1. Shipyards that currently have very few digitalization features implemented in their production process  
 ↓  
 4. Shipyards with a large amount of digitalization features implemented in their production

# CONCLUSIONS

- ❑ **94.9%** of the shipyards use or plan to use **composite materials**.
- ❑ The **significant presence of manual lamination** proves right the hypothesis made FIBRE4YARDS project stating that automatized procedures are not the common rule in EU shipyards nowadays.
- ❑ The **limitations** that hinder the implementation of new processes are: the **equipment cost**, the need for **trained operators** and the daily **maintenance** of the machinery.
- ❑ The billing data confirms that **70%** of the revenues come from ships that are priced under the 10 million euro mark and, specifically, a **50%** from the total of the revenues come from the ships that cost less than 5 million euros. The **important presence of small and medium-sized vessels**, is an **opportunity to promote the transition of new technologies, processes and materials**.

# CONCLUSIONS

- ❑ The technologies of major interest are: **Use of Adaptive Molds, Additive Manufacturing Processes and Digitization of production.** There is also considerable interest in modular and serialized shipbuilding using composite materials and automated fibre placement (AFP) technologies.
- ❑ Most shipyards are attentive to the results of the Fibre4Yards project. Almost **90% of the shipyards wants to outsource or to have engineering resources** and are looking to be able to assume it with guarantees.
- ❑ Shipyard interests are **real-time monitoring of both production and logistics** and for the **automation of quality control practices.**
- ❑ The current digitization level is good in the **engineering department** and in the **technical manufacturing department**, but insufficient in the processes, logistics, digital twin ship, and digital twin shipyard.

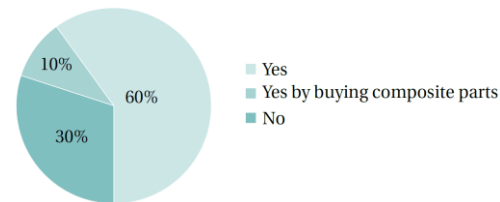
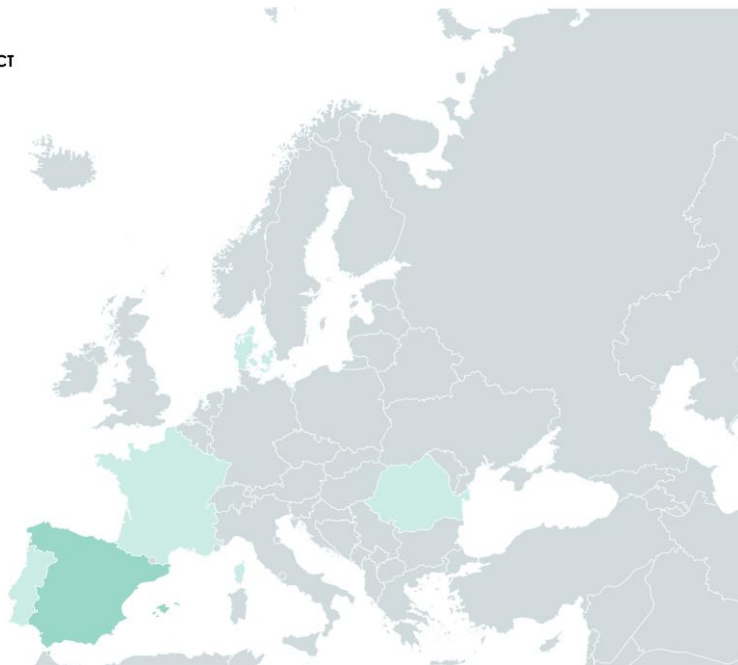
# CONCLUSIONS

- ❑ The survey analysis shows that **shipyards with more diverse procedures**, or with larger digitalization features, **have more interest in all the technologies targeted by the project** than those shipyards that have less procedures implemented. These last ones are interested only in few project developments.
- ❑ This conclusions suggests that the lack of interest in some technologies can be because a **lack of knowledge** on them. Therefore, as important as the developments by themselves, will be the dissemination and the training.
- ❑ Finally, the interest shown by EU shipyards in FIBRE4YARDS project and in the different technologies to be developed in it, proves the need for such research and the willingness of EU shipyards to transform their actual yard into a new **shipyard for the future**.



# FOLLOW UP: SHIPYARDS INTERVIEWS

FIBRE4YARDS EU PROJECT  
Shipyards interviewed



1. USE OF COMPOSITE MATERIALS
2. PROCESSES AND MATERIALS
3. MANUFACTURING AND PRODUCTION
4. MANUFACTURING TECHNOLOGIES
5. DESIGN AND ENGINEERING
6. SHIPYARD 4.0
7. BUSINESS AND ECONOMICS
8. COVID – 19
9. ADDITIONAL COMMENTS



FIBREGY & FIBRE4YARDS  
**1<sup>ST</sup> INFORMATION DAY**

**Thank you !**

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