CO2NSTRUCT

Funded by the European Union

Οι αντιλήψεις των εμπειρογνωμόνων ως προς τα εμπόδια και τα κίνητρα για την προώθηση της κυκλικής οικονομίας στον κατασκευαστικό τομέα

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Ημερίδα Κυκλική Οικονομία στον Κατασκευαστικό Τομέα - Το Ευρωπαϊκό Πρόγραμμα CO2NSTRUCT, 12 Ιουνίου 2026, Αθήνα

DTU RUB Università di Pisa The University Of Sheffield. LNEG Gobierno de España Ministerio de Ciencia e Innovación Ciemat Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas ΚΑΠΕ CRES

CO_2NSTRUCT objectives

- Creation of a **dataset** for construction materials, including Circular Economy (**CE**) **measures**.
- **Developing a strategy to quantify citizen behaviour and key stakeholder opinion toward CE and climate mitigation.**
- Mapping CE practices in the supply and value chains in the construction sector.
- Identification of potential **rebound effects** and **social impacts** of CE measures implementation.
- Developing CO_2NSTRUCT Circular Climate Mitigation Modelling **Framework** and **Scenarios**.
- Integrating CE into climate action, policies, and externalities.

Objective

- To develop a strategy, engaging key stakeholders, on the needed actions to integrate circular economy into climate mitigation actions
- To explore stakeholder perceptions on the barriers and the drivers for the enhancement of circular economy in the construction sector, both in buildings and the offshore wind sector

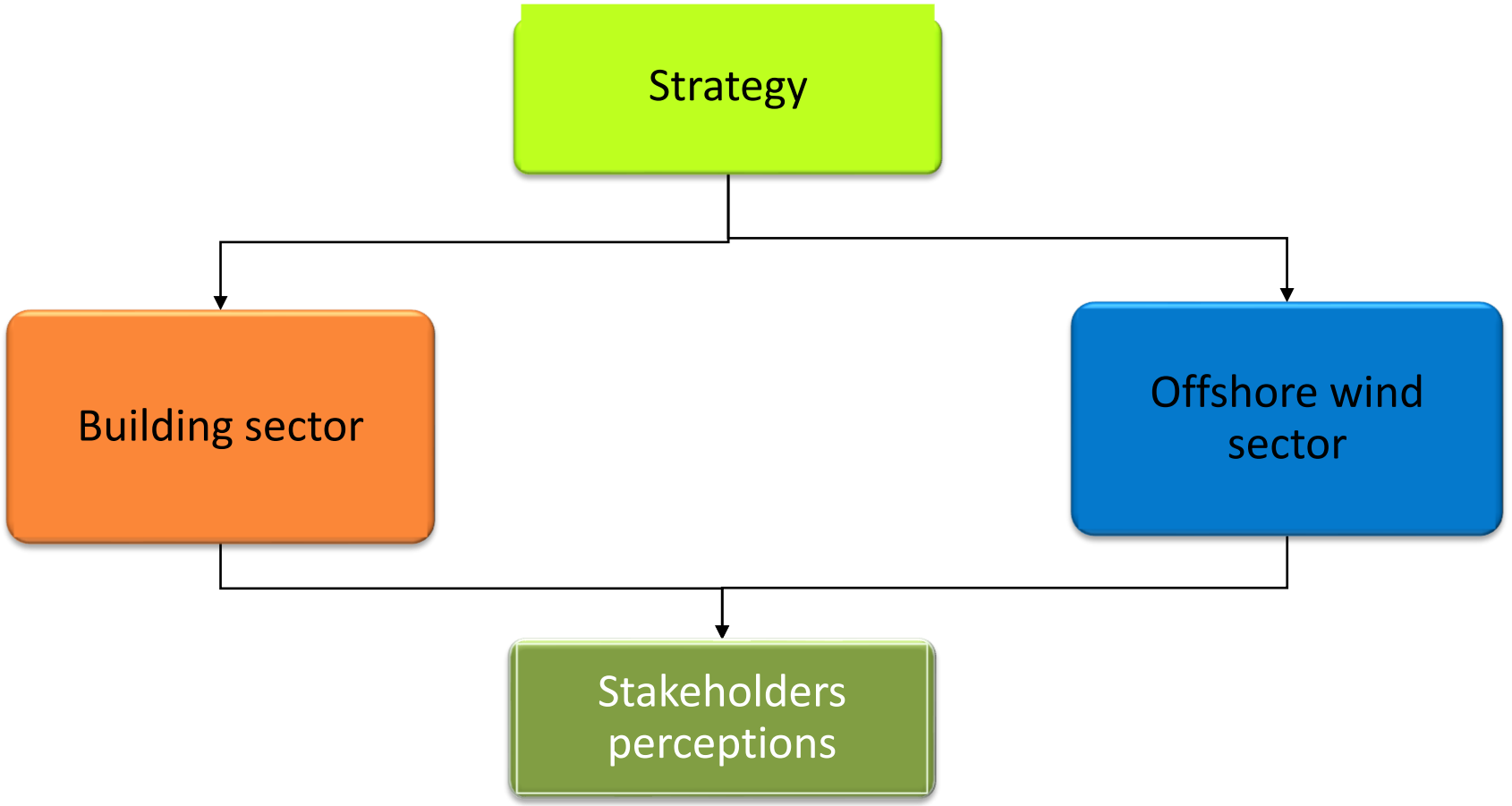
Circular Economy and the construction sector

- The construction sector is one of the major CO_2 emissions contributors, consumers of energy and raw materials, and waste producers.
- Circular Economy model in the construction sector:
  - Aims to maintain materials, products, and components at their maximum technical, economic, and environmental values.
  - Implies that waste becomes a resource itself, thus minimizing the actual amount of waste.
  - Opposes to the traditional, linear economic model, which is based on the "take-make-consume-throw away" model.
- Circular Economy practices in the construction sector - 10 “R” practices:
  - Refuse, Rethink, Reduce, Reuse, Repair, Refurbish, Remanufacture, Repurpose, Recycle, Recover.

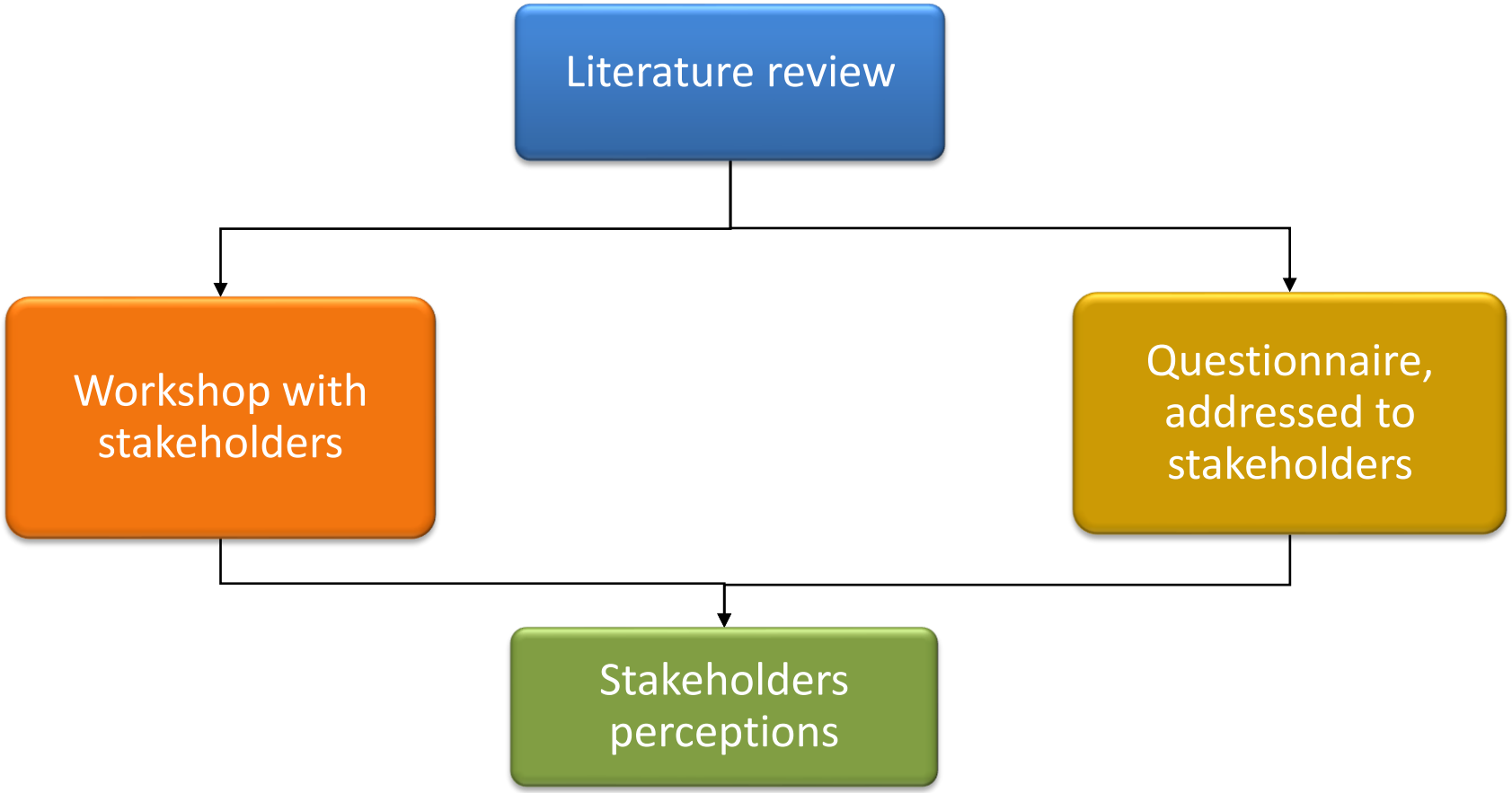
Strategy, engaging key stakeholders, on the needed actions to integrate CE into climate mitigation actions

- Explore key stakeholders' perceptions of CE construction materials/ components about:
  - Financial,
  - Environmental,
  - Social, and
  - Policy aspects.
- Identify existing barriers and drivers of circular economy for climate change mitigation in the construction sector.

Methodology



Methodology: Building Sector



Workshop with stakeholders

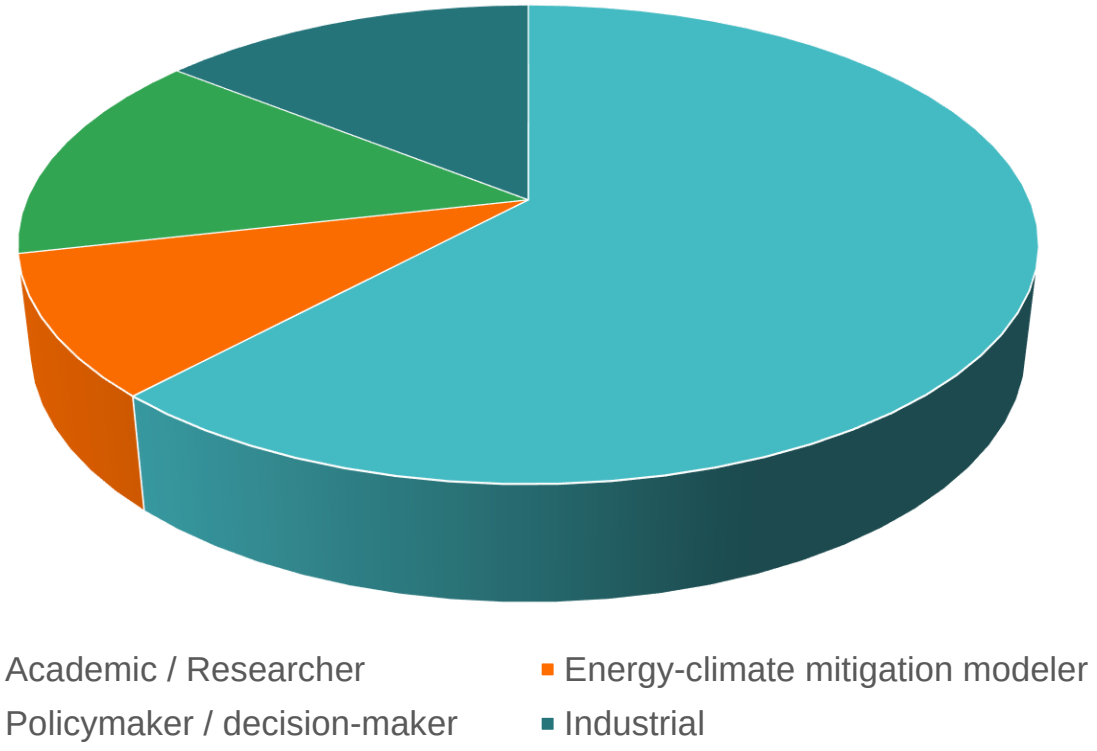
Working with stakeholders on CE practices enhancement:

World-café on financial, policy, environmental, social, and technical aspects of CE practices

Workshop - Table Fact Sheet

Event Title	Workshop: “Working with stakeholders on CE practices enhancement”		
Date	27th of June 2024	Duration	2 hours
Place	In person		
City	Thon Hotel EU, Brussels	Country	Belgium
No. Attendees	24		

Workshop - Participants



World café - Topics per Table

Topics per Table:

Table 1: ***Economic*** and ***technological*** aspects of CE practices

Table 2: ***Political*** and ***environmental*** aspects of CE practices

Table 3: ***Social*** (socio-culture) and ***informational*** aspects of CE practices

World café - Questions per Table

Questions for all tables:

Question 1: Which CE construction products' ***specifications/requirements*** do you consider important for their adoption?

Question 2: What are the main ***barriers*** against the adoption of CE practices in the construction sector?

Question 3: How could we overcome these barriers?/What are the ***strategies/drivers*** that would help transition towards a circular economy in the construction sector?

World café - Summary of results

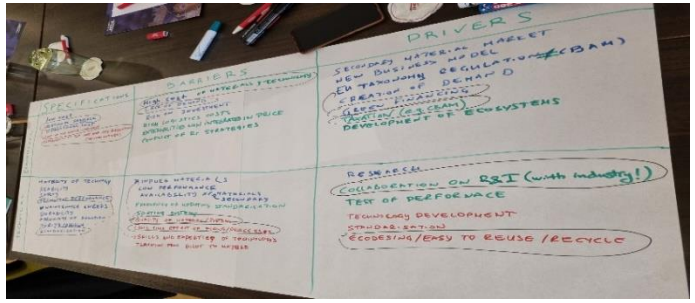
Results of World Café discussions:

Result 1: List of the important construction material/component ***specifications*** to adopt CE practices per topic.

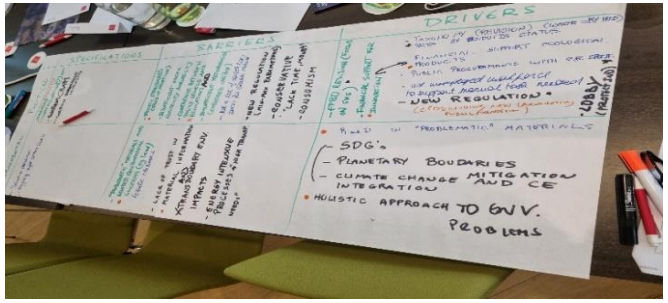
Result 2: List of the main ***barriers*** against the adoption of CE practices per topic.

Result 3: List of the main ***strategies/drivers*** that would help transition towards CE per topic.

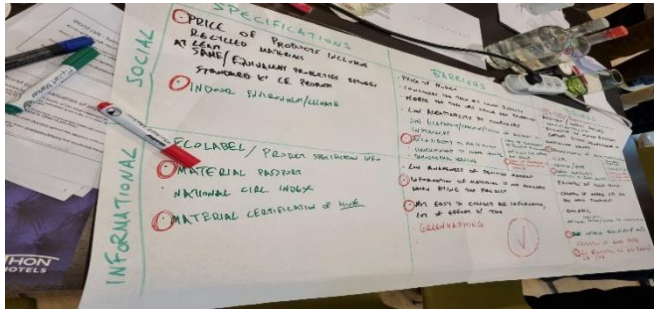
Discussion and selection of the **two** most important per table topic.



Topic: **Economic and technological** aspects



Topic: **Political and environmental** aspects



Topic: **Social and informational** aspects

Workshop - Summary of results

Evaluation by the participants of the most important ones per list of results:

Result 1: List of the important construction material/component ***specifications*** to adopt CE practices

Result 2: List of the main ***barriers*** against the adoption of CE practices

Result 3: List of the main ***strategies/drivers*** that would help transition towards CE

Workshop - Summary of results

Results from the evaluation by the participants

The highest rating results per category:

Result 1: Construction ***specifications*** to adopt CE practices

1. Price of products, including recycled materials;
2. Standardization;
3. Material passport.

Result 2: ***Barriers*** against the adoption of CE practices

1. High cost of material & technology;
2. Lack of demand;
3. Accessibility to materials.

Result 3: ***Strategies/drivers*** that would help transition towards CE

1. Green financing -financing support to innovation/implementation (eco-products);
2. Eco-design /easy to reuse/recycle;
3. New regulation (EPBD, new taxonomy, public procurement).

Questionnaire, addressed to **Key stakeholders**

Questionnaire:

Barriers and drivers for the enhancement of circular economy practices in the construction sector

Survey characteristics & structure

- Online questionnaire (Google Form) & printed version distributed in conferences/workshops/exhibitions
- Approx. 65 questions
- Date of survey: **June 2024 – April 2025**
- Stakeholders from 29 European countries
- European sample for the analyses:
  114 questionnaires in total
  - 194 questionnaires in total
  - 100 questionnaires from Greece
    (20 used for having a balanced sample)

Introduction

A. Background information

Information Box

B. Circular economy construction products specifications/requirements

C. Barriers to the circular economy in the construction sector

D. Drivers towards circular economy in the construction sector

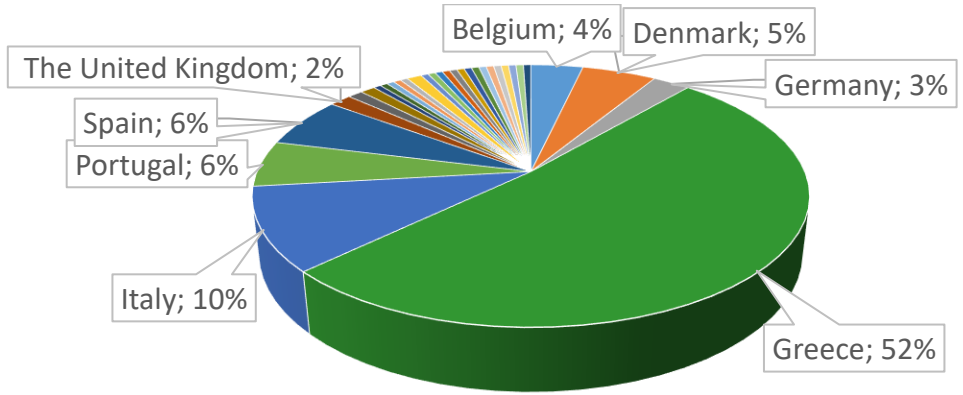
Questionnaire, addressed to **European stakeholders**

Analysis of the European sample

Questionnaire - Responses

Responses

- Total number: 194
- From Greece: 100

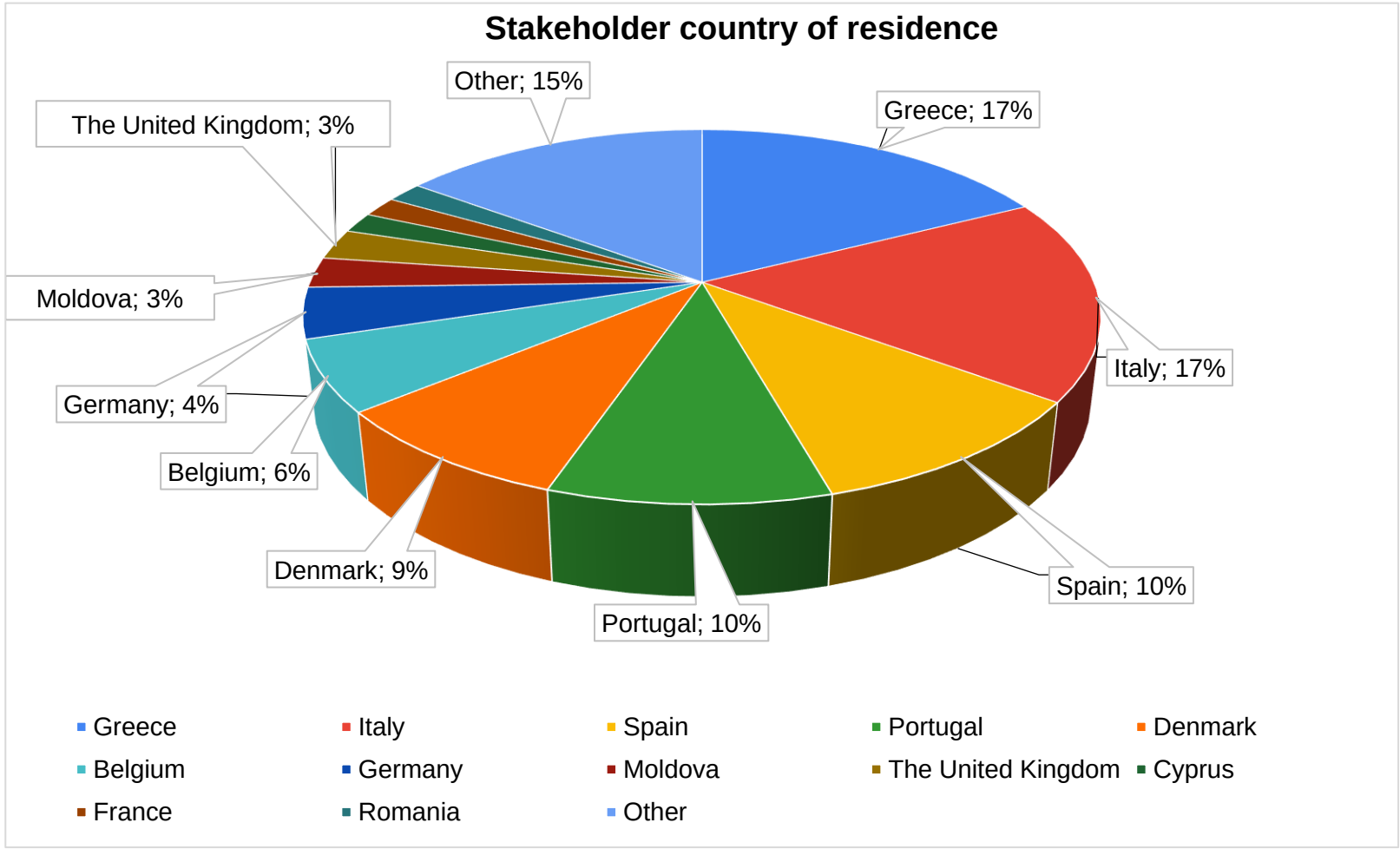


Belgium, Denmark, Germany, Greece, Italy, Portugal, Spain, The United Kingdom, France, Romania, Albania, Latvia, Armenia, Sweden, Canada, Cyprus, Czech Republic, Netherlands, Moldova, Hungary, Moldova, Norway, Republic of Moldova, Montenegro, ISRAEL, Serbia, Switzerland, Poland, Turkiye, Iceland, Macedonia

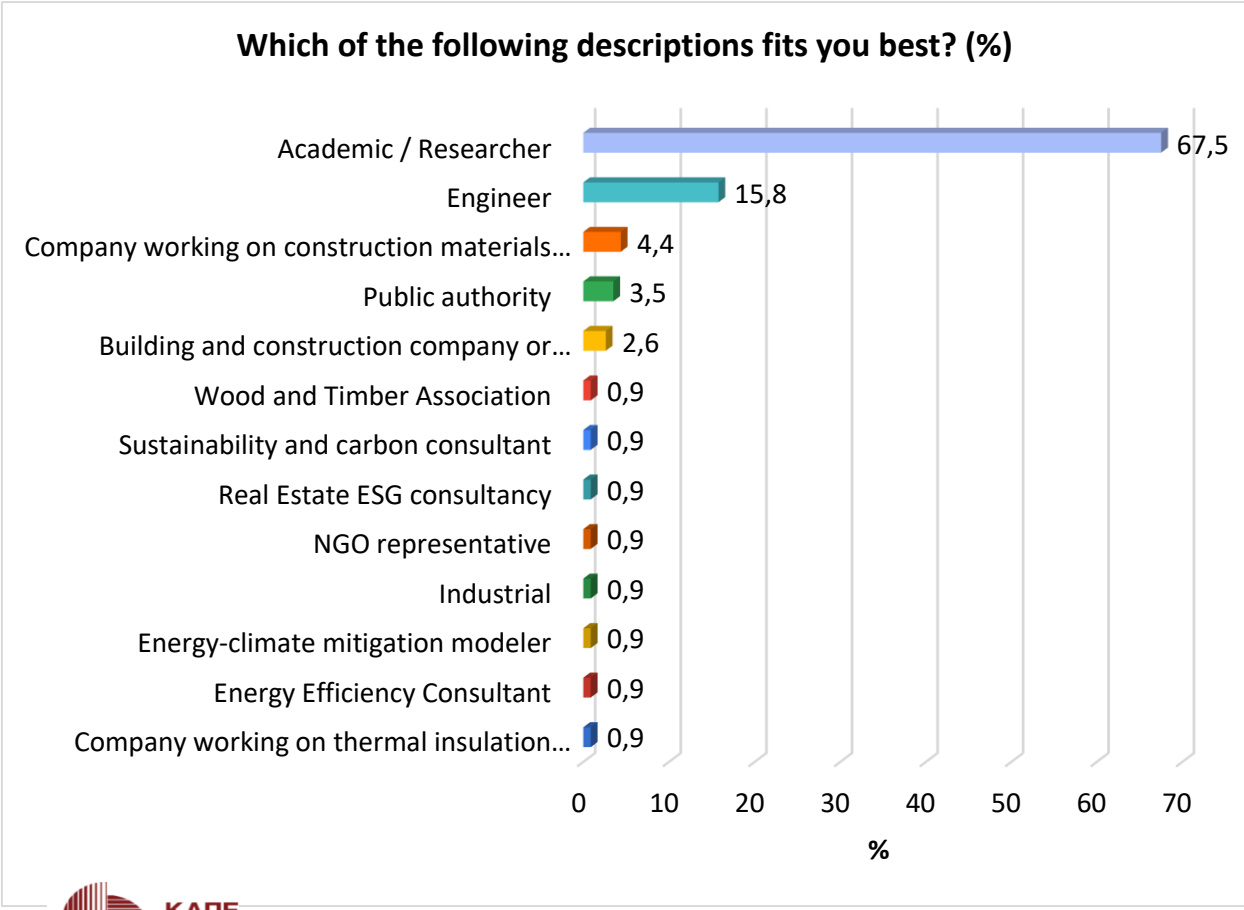
Questionnaire - Responses

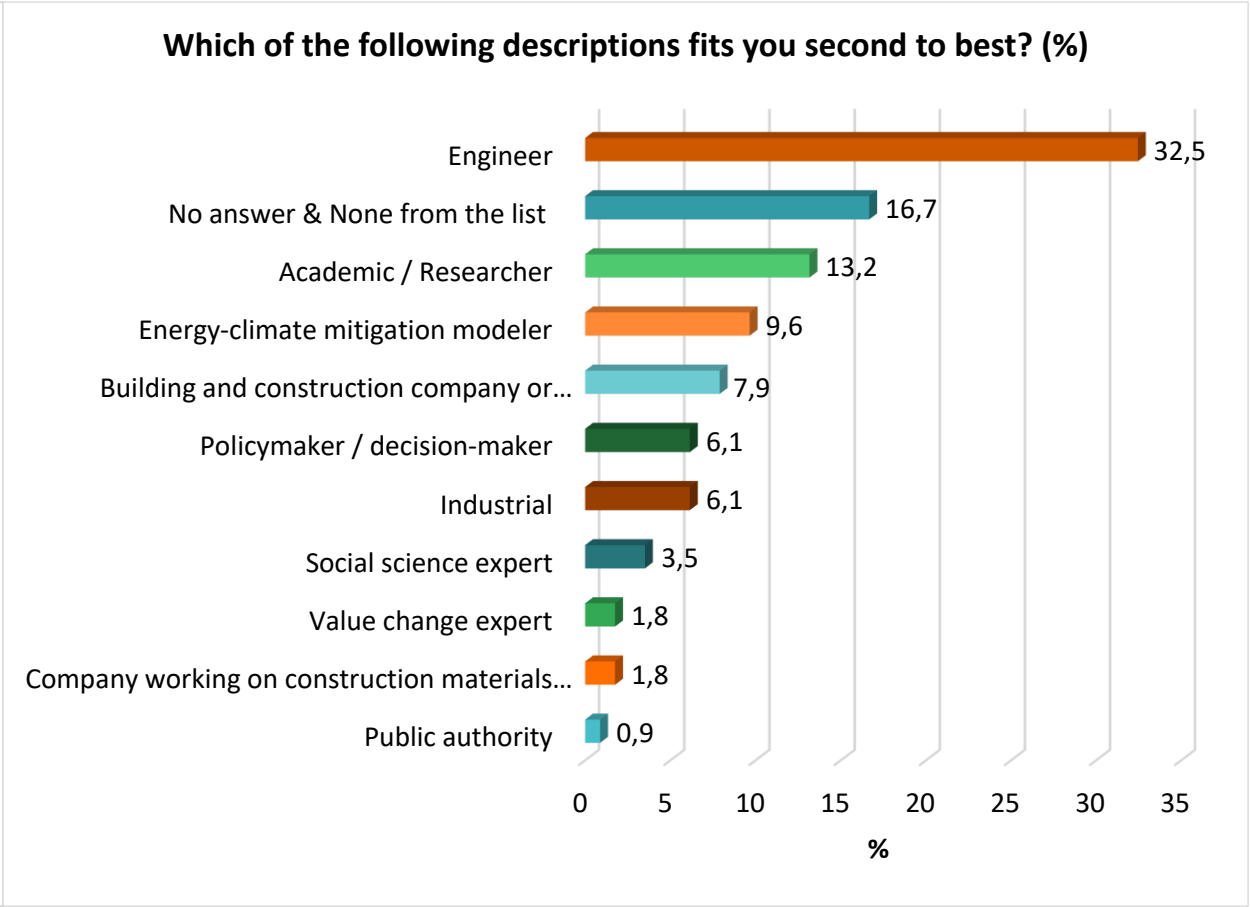
Responses

- Total number: 114

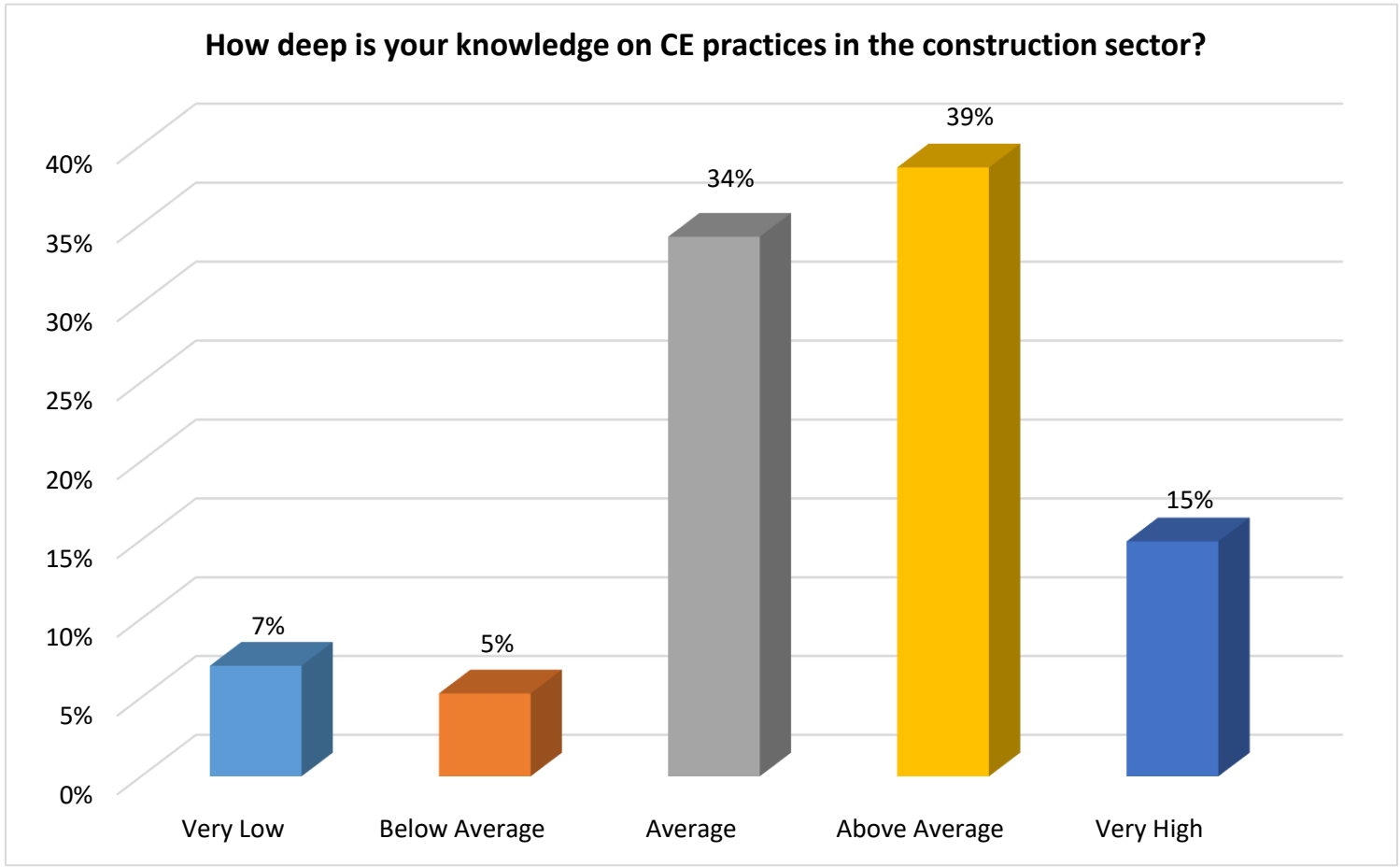


Stakeholder categories

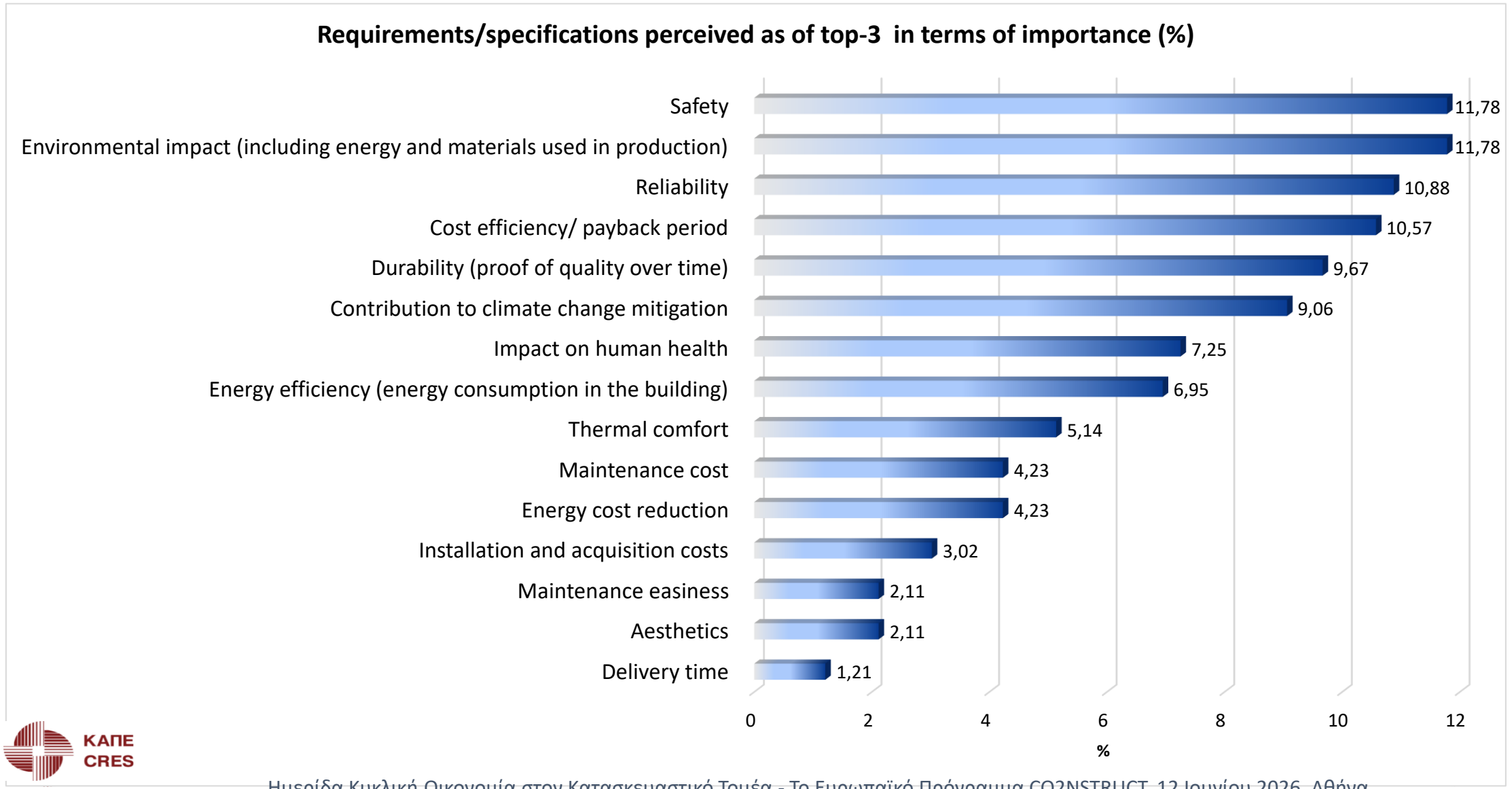




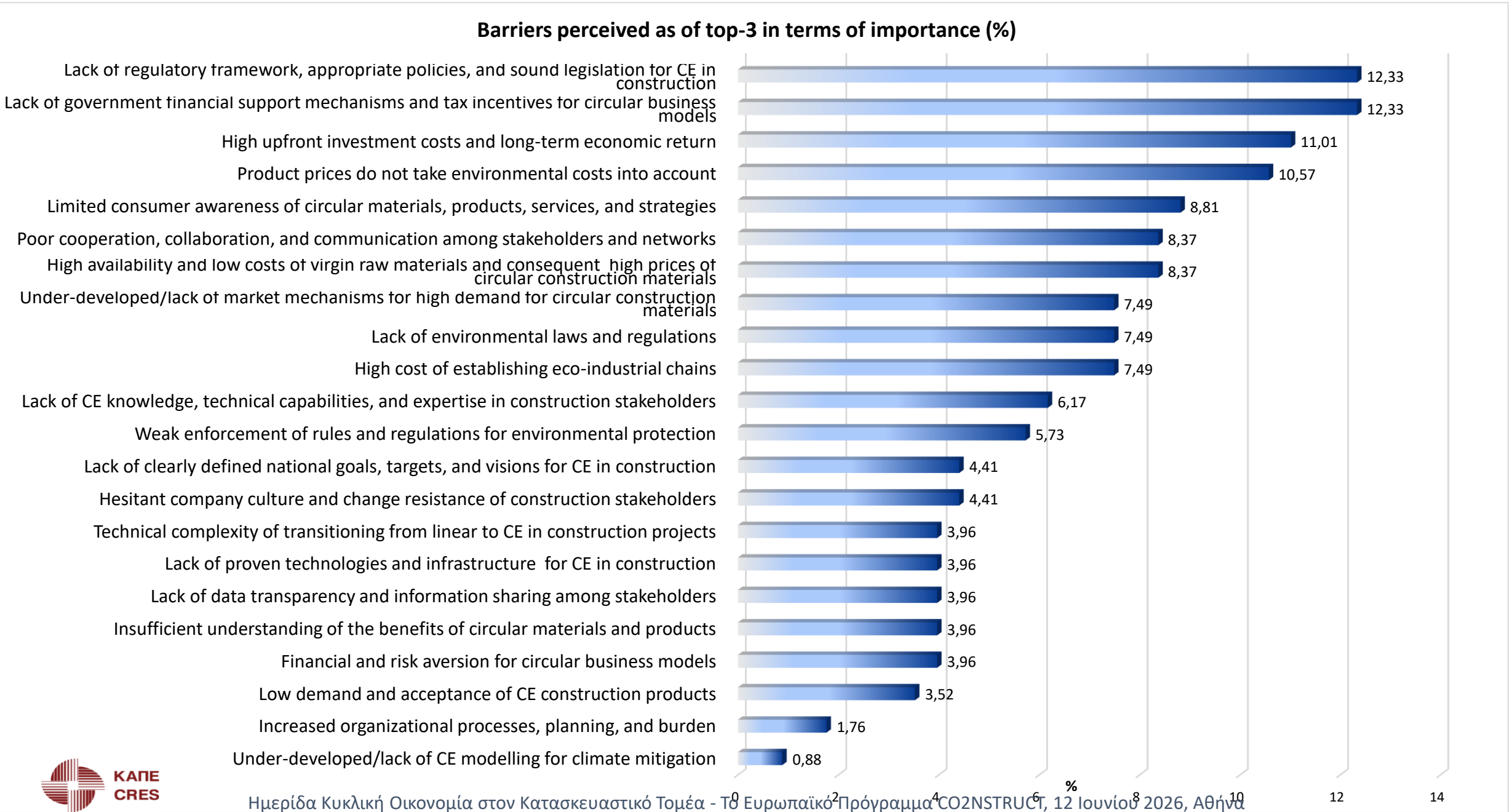
Stakeholder perceived knowledge



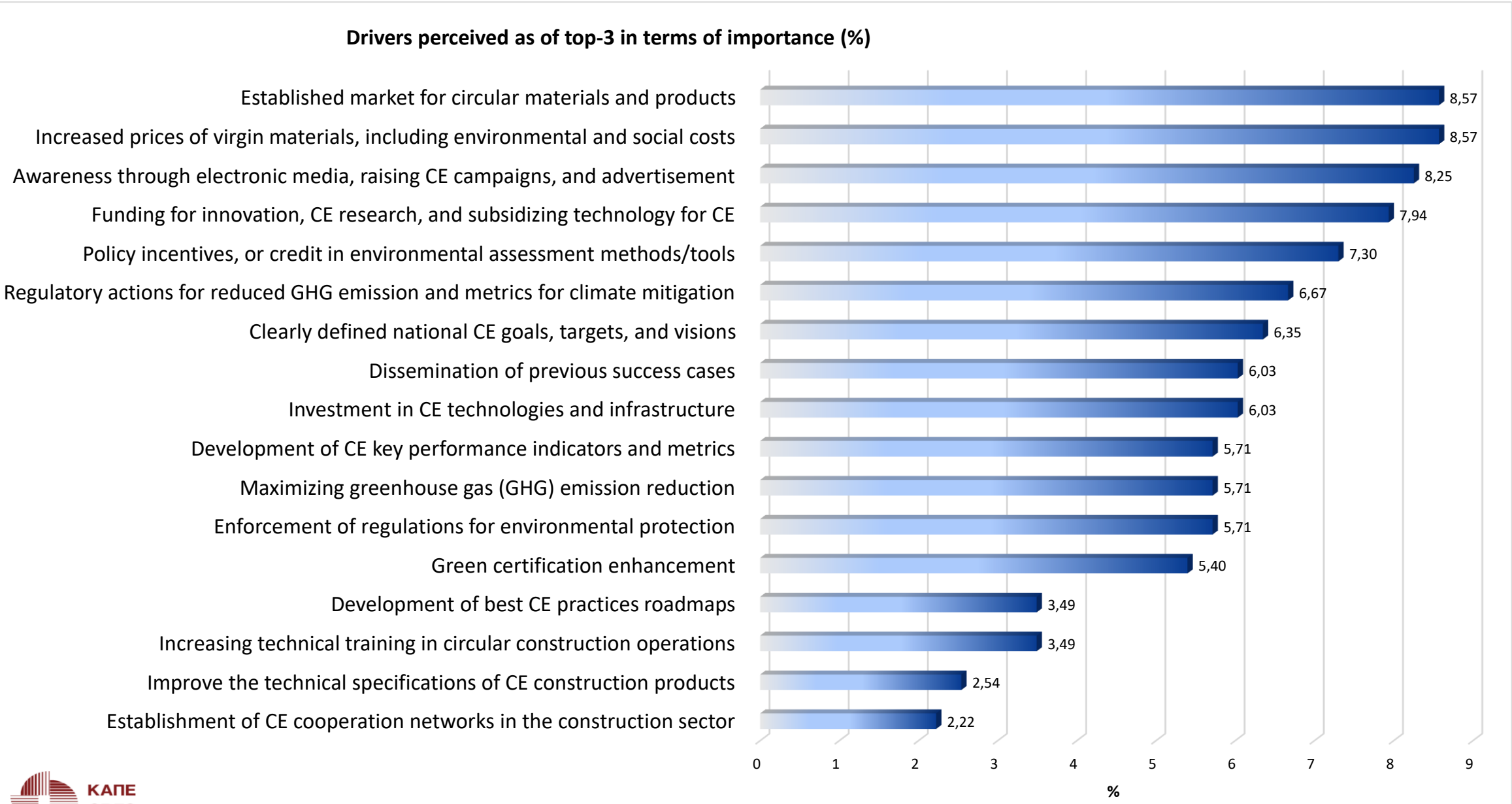
Perceived importance of CE construction products requirements/specifications



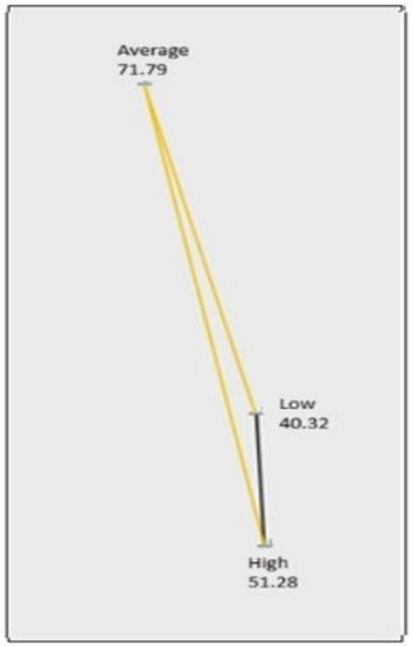
Perceived importance of different barriers



Perceived importance of different drivers

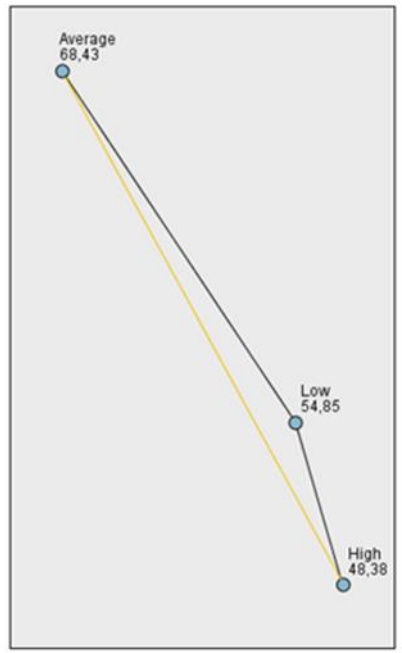


Comparison between different levels of stakeholder knowledge (Kruskal-Wallis H tests)



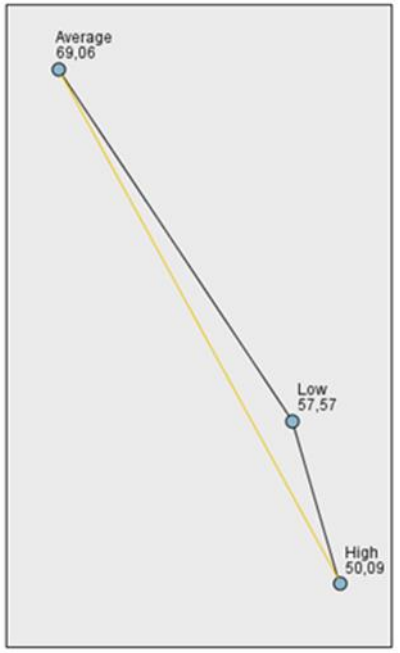
Pairwise comparison of the importance of **energy cost reduction** as a specification/ requirement of CE products

- The average-level knowledge group perceived **energy cost reduction** as more important in comparison to the other two groups
- **Energy efficiency** (energy consumption in the building) was perceived as less important by the high-level knowledge group in comparison to the average-level knowledge group



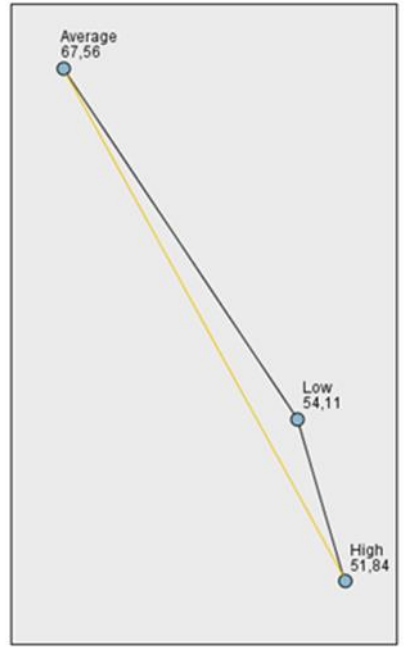
Pairwise comparison of the importance of **energy efficiency** (energy consumption in the building) as a specification/ requirement of CE products

Comparison between different levels of stakeholder knowledge (Kruskal-Wallis H tests)



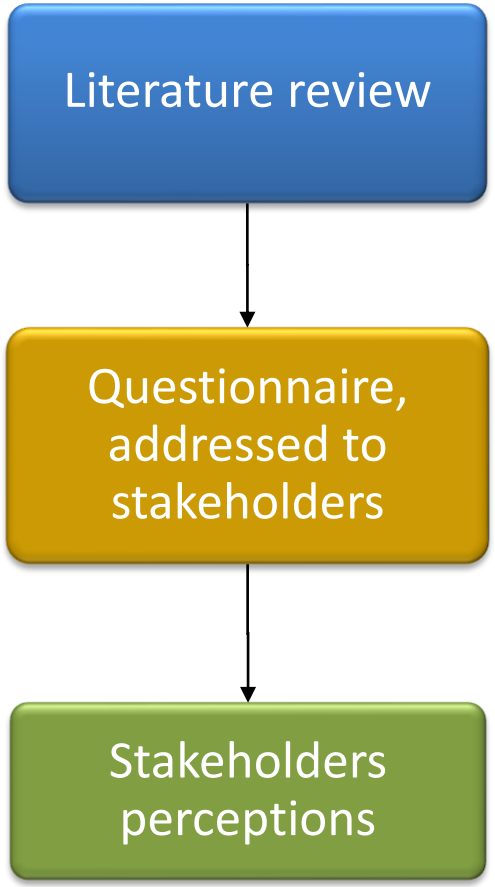
Pairwise comparison of the importance of **high upfront investment costs and long-term economic return** as a barrier

- The high-level knowledge group perceived **high upfront investment costs and long-term economic return** as a less important barrier compared to the average-level knowledge group
- The average-level group perceived the **establishment of CE cooperation networks in the construction sector** as a more important driver in comparison to the high-level knowledge group



Pairwise comparison of the **establishment of CE cooperation networks in the construction sector** as a driver

Methodology: Offshore wind sector



Offshore wind sector – Survey on offshore circular practices

Stakeholder survey targeting key actors in the offshore wind value chain

Capture perceptions of **current and future implementation of selected circular strategies**, among most commons, and the factors influencing them (economic, social and environmental, political and technical).

Background information: Profile (Academic, Industrial, Policymaker, local authorities…) & Level of expertise

Perception on the current level of implementation for each CE practice (5 Likert scale + I don't know)

Perception of the main factors for the implementation of each CE practice: a total sum of 100 points to allocate among these factors (Economic, Political, Social and environmental, and Technical).

Perception on the future level of implementation for each CE practice by 2050

Offshore wind sector – Survey on offshore circular practices

Duration

November 2025 – January 2026

Responses

- Total responses: 68
- Full responses: 23
- Responses for only the first part on "Current level of implementation per practice": 12
- Not completed questionnaire: 30

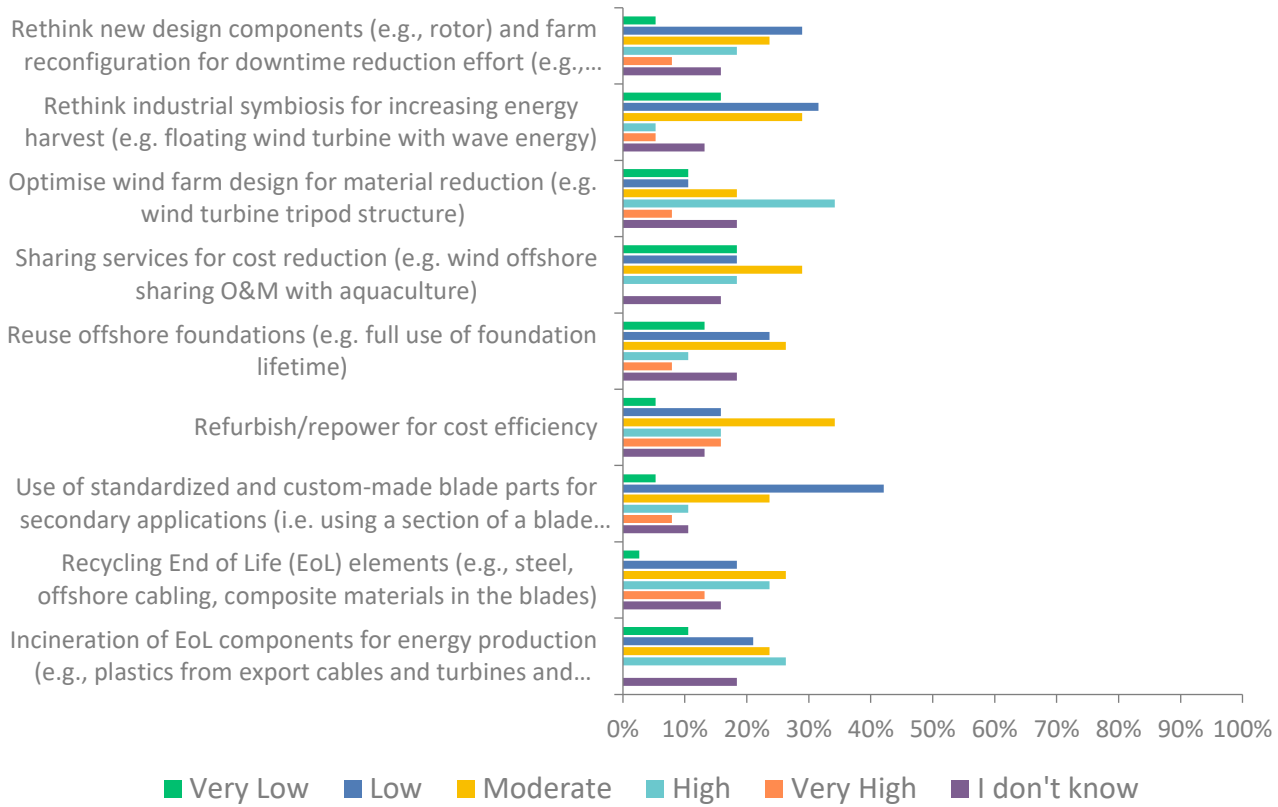
	Denmark	Germany	Greece	Italy	Portugal	Spain	UK	Other	Total
Total number of full responses	2	2	9	5	0	4	0	1	**23**
Total number of responses for the first part on the current level of implementation of R practices	3	4	12	6	1	6	0	3	**35**

Offshore wind sector – Survey on offshore circular practices

- **Rethink new design components** (e.g., rotor) and farm reconfiguration for downtime reduction effort (e.g., automatic configuration for reduced wind turbine downtime)
- **Rethink industrial symbiosis** for increasing energy harvest (e.g. floating wind turbine with wave energy)
- **Optimise** wind farm **design for material reduction** (e.g. wind turbine tripod structure)
- **Sharing services** for cost reduction (e.g. wind offshore sharing O&M with aquaculture)
- **Reuse offshore foundations** (e.g. full use of foundation lifetime)
- **Refurbish/repower** for cost efficiency
- Use of standardized and custom-made **blade parts for secondary applications** (i.e. using a section of a blade to construct a bridge, bike shelters, etc.)
- **Recycling** End of Life (EoL) elements (e.g., steel, offshore cabling, composite materials in the blades)
- **Incineration** of EoL components for energy production (e.g., plastics from export cables and turbines and epoxy from blades after partial or full decommissioning)

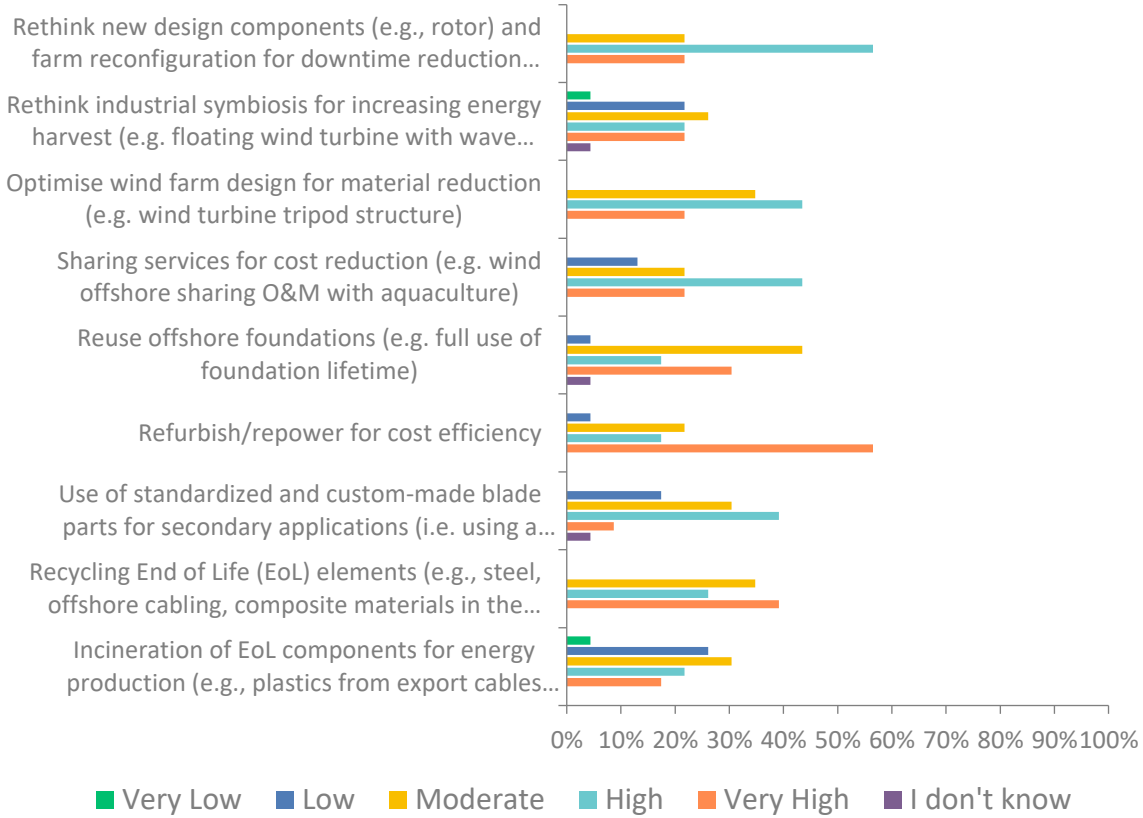
Offshore wind sector – Survey results

Current level of implementation per CE practice



Sample: 38

Future level of implementation per CE practice



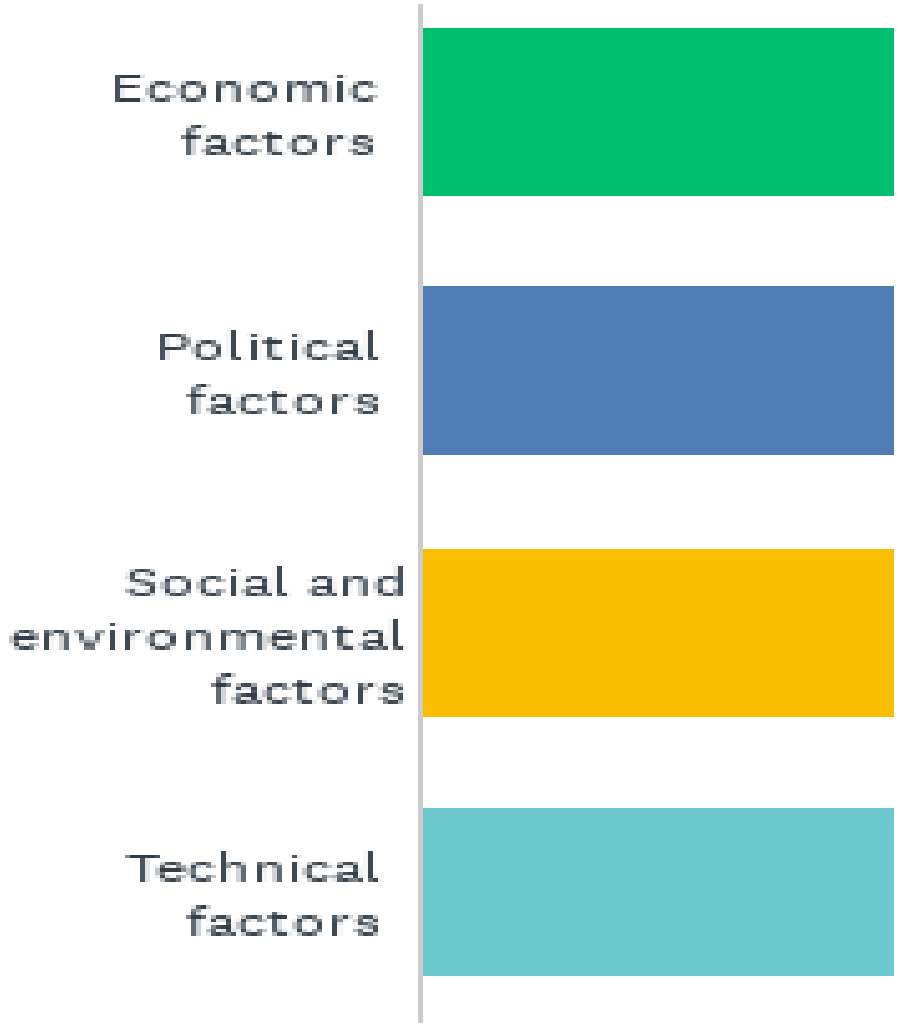
Sample: 23

Offshore wind sector – Survey results

		Current		Future	
		Mean	Rank	Mean	Rank
1	**Rethink new design components**	**2,94**	**4**	**4,00**	**3**
2	Rethink industrial symbiosis	2,45	9	3,36	8
3	**Optimise wind farm design for material reduction**	**3,23**	**3**	**3,87**	**4**
4	Sharing services for cost reduction	2,56	8	3,74	6
5	**Reuse offshore foundations**	2,71	6	**3,77**	**5**
6	**Refurbish/repower for cost efficiency**	**3,24**	**2**	**4,26**	**1**
7	Use of blade parts for secondary applications	2,71	7	3,41	7
8	**Recycling End of Life (EoL) elements**	**3,31**	**1**	**4,04**	**2**
9	**Incineration of EoL components**	**2,81**	**5**	3,22	9

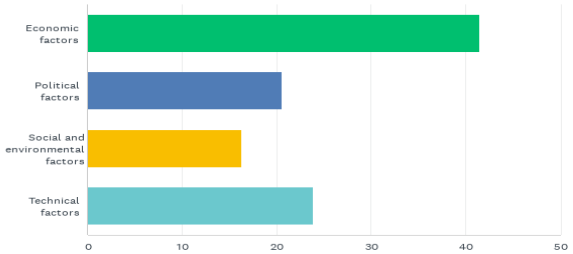
Offshore wind sector – Survey results

Rethink new design components
Rethink industrial symbiosis
Optimise wind farm design for material reduction
Sharing services for cost reduction
Reuse offshore foundations
Refurbish/repower for cost efficiency
Use of blade parts for secondary applications
Recycling End of Life (EoL) elements
Incineration of EoL components

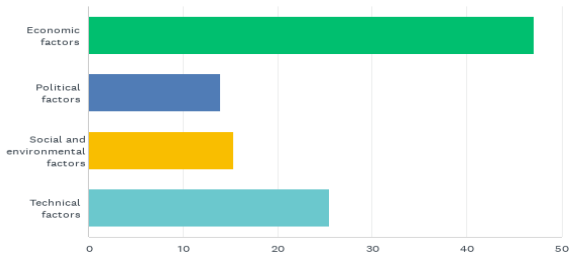


Offshore wind sector – Survey results

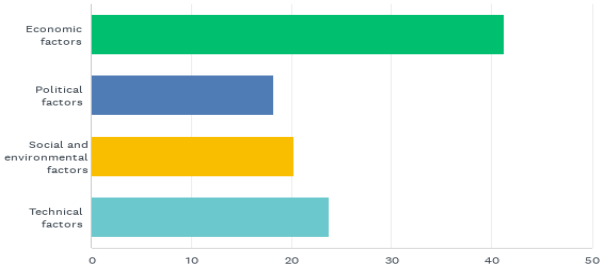
Rethink new design components



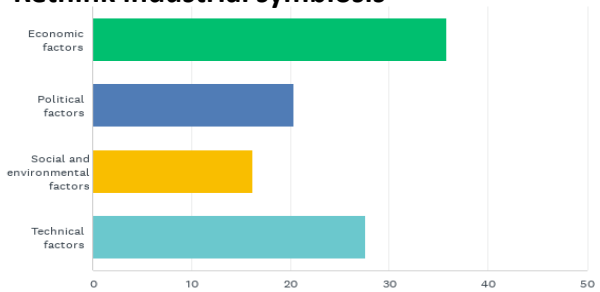
Sharing services for cost reduction



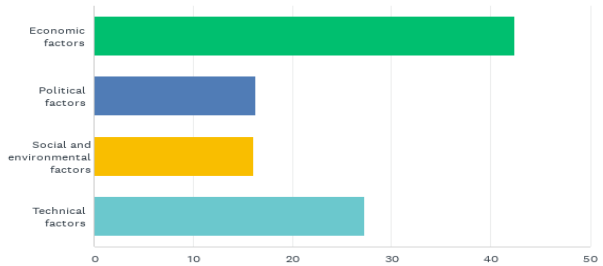
Use blade parts for secondary applications



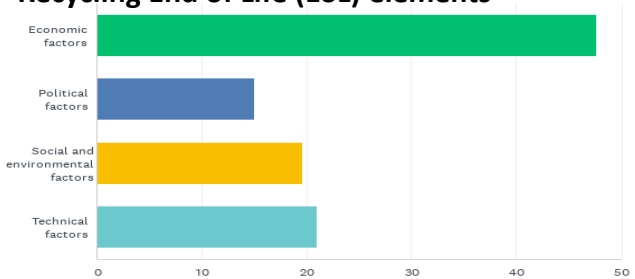
Rethink industrial symbiosis



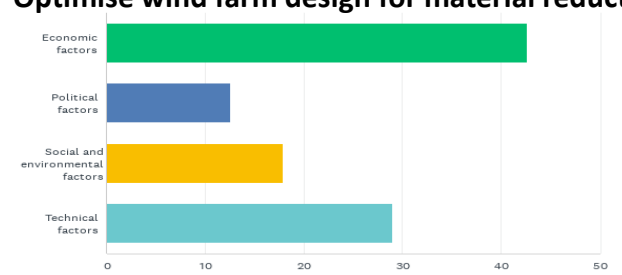
Reuse offshore foundations



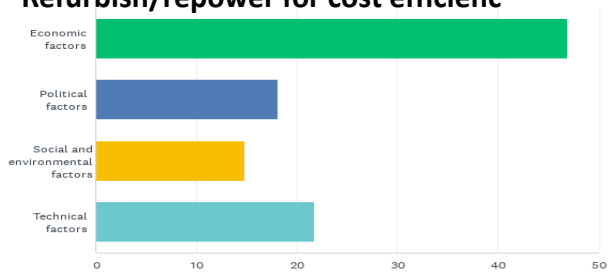
Recycling End of Life (EoL) elements



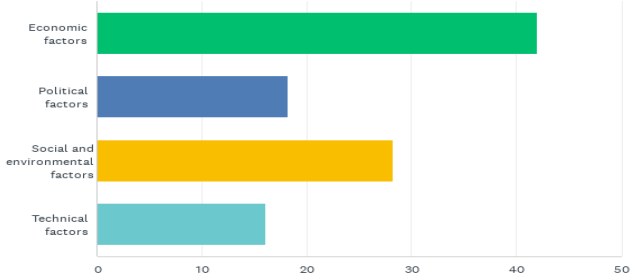
Optimise wind farm design for material reduction



Refurbish/repower for cost efficienc



Incineration of EoL components for energy production



Conclusions

Innovative aspects

- Use of empirical qualitative methods (workshop) and quantitative survey (questionnaire) to explore stakeholders' perceptions;
- Identification of key stakeholders' perceptions towards circular economy enhancement in the construction sector;
- Transnational survey in European countries, through a common questionnaire.

Key Findings

- Certain CE specifications/requirements - particularly safety, contribution to climate mitigation, and environmental impact - are prioritised over aesthetic and implementation-related factors;
- Barriers such as cost-related aspects, lack of government support and regulatory framework are perceived as the most significant obstacles. At the same time, drivers like established markets for circular materials and innovation funding are considered key enablers;
- Variations in perceptions based on stakeholders' knowledge levels point to the need for targeted educational and policy interventions to bridge knowledge gaps.

Next steps

- Development of a set of recommendations to enhance the implementation of CE principles in order to achieve climate change mitigation in the construction sector, based on the above analysis.

Acknowledgements

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