

User-driven development in MOSES: From stakeholder needs to user requirements

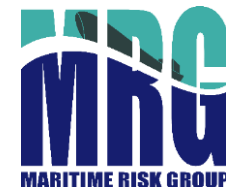
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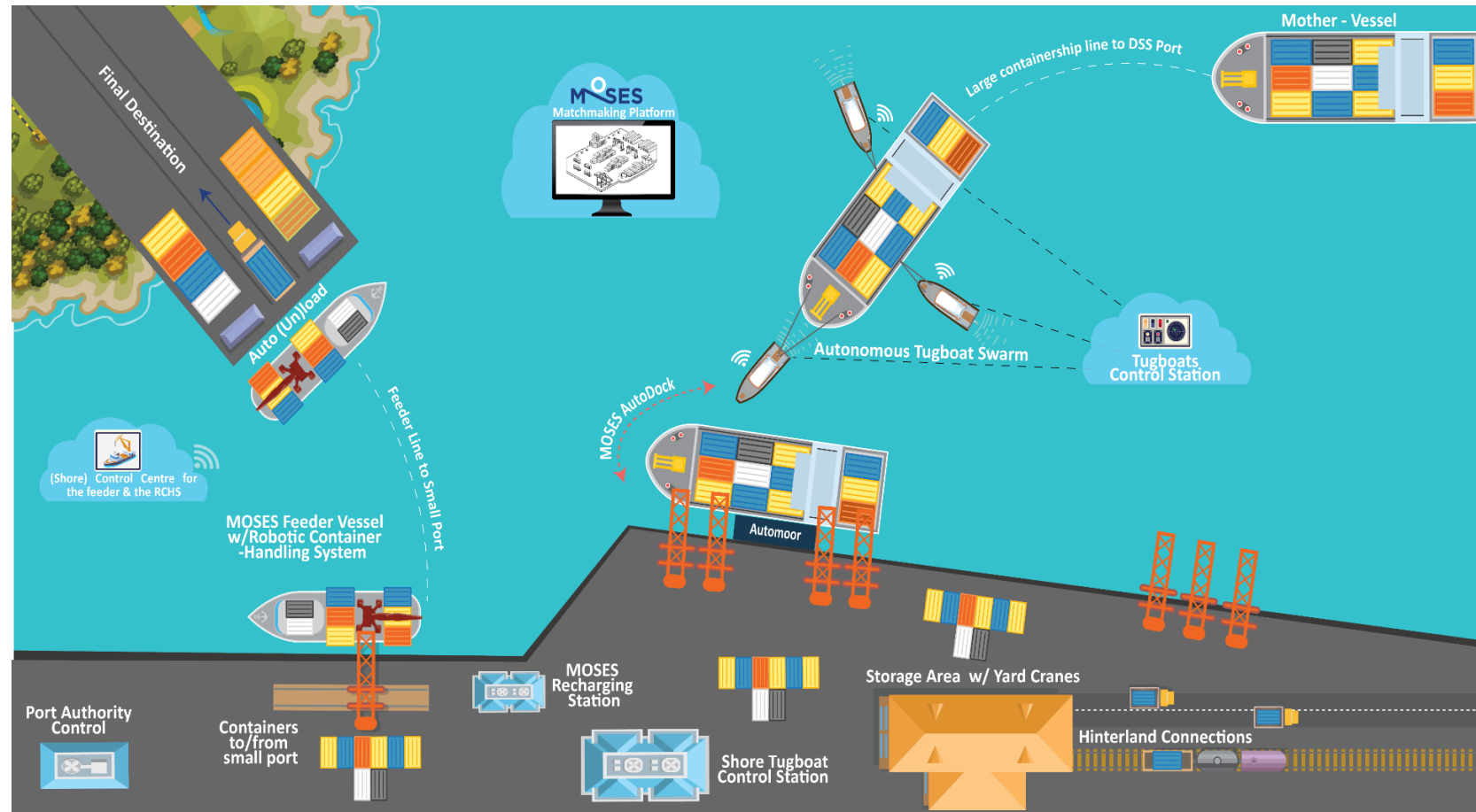
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Introduction

MOSES aims to:

- Enhance the **SSS component** of the European Container Supply Chain
- Address the **vulnerabilities and strains** related to large container ships operation



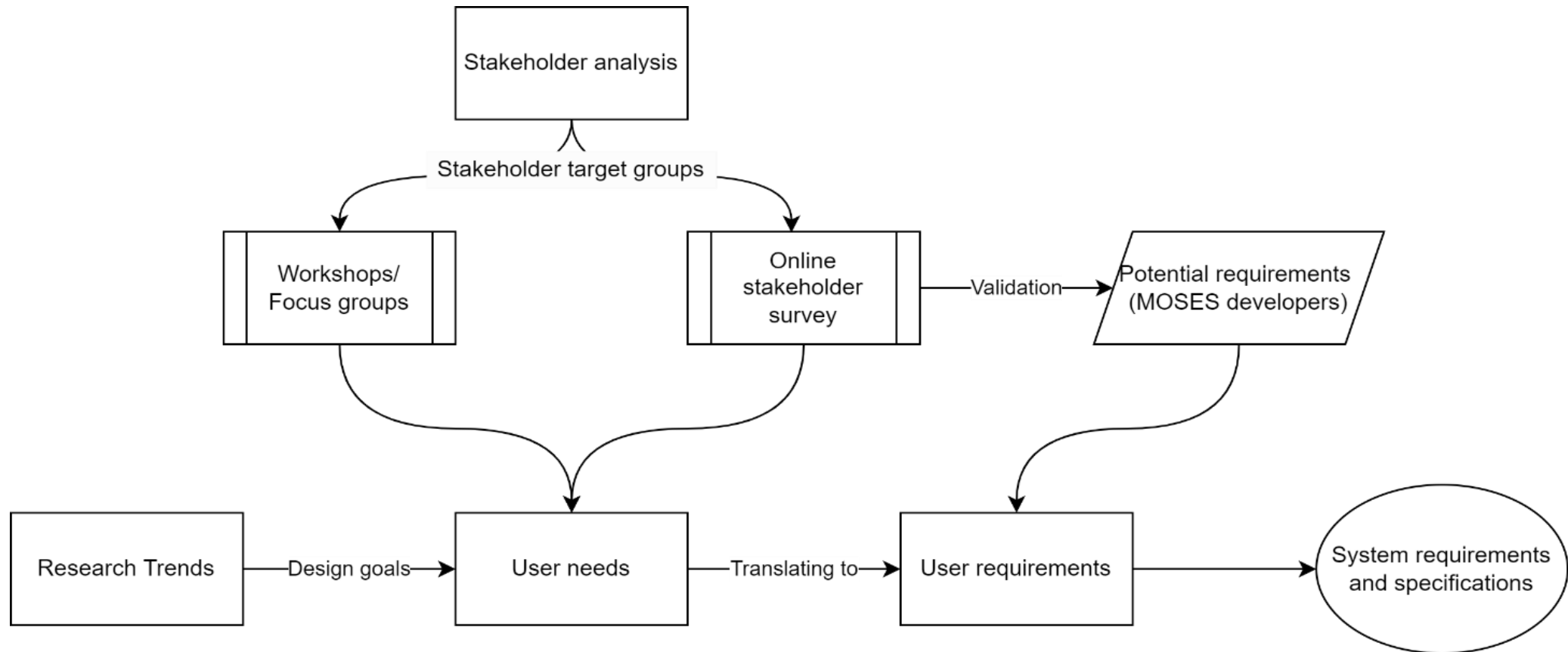
Introduction



Introduction

- EU's Green Paper on Innovation highlights **the importance of involving end-users in the research and development of new technologies**
- Also stressed as a **priority** regarding Societal Challenges in the H2020 – EU framework programme
- **Involving citizens in decision-making processes** contributes to the democratic process and increases their awareness about EU's innovation, research and development.
- For the MOSES consortium, stakeholders' expectations is one of the most important steps in the system engineering process to determine key aspects such as functions, characteristics, behaviour, appearance and performance of the delivered systems

The MOSES User Requirements Extraction Methodology



The MOSES User Requirements Extraction Methodology

Stakeholder analysis

A stakeholder is an individual, group, or organisation that might affect, be affected by or perceive itself as affected by a project's decision, activity, or outcome (PMI, 2017)

Degree of involvement

- **Primary:** Directly affected by the project, its decision or actions
- **Secondary:** Indirectly affected by the project, its decisions or actions

Type of involvement

- **Operational Work Area:** Involved in the operational aspects of the innovations
- **Containing Business:** Benefit without being directly involved in their operation
- **Wider Environment:** Influence or is influenced by MOSES innovations

The MOSES User Requirements Extraction Methodology

Stakeholder engagement

Workshops

- Participated specialists on maritime and port operations, freight transport, ICT, safety and security regions.
- Structured in three sections:
 - ✓ Presentation of the MOSES concept and innovations
 - ✓ Interactive session with input on the refinement of the requirements
 - ✓ Brainstorming session

93 participants from 43 different organisations

Online survey

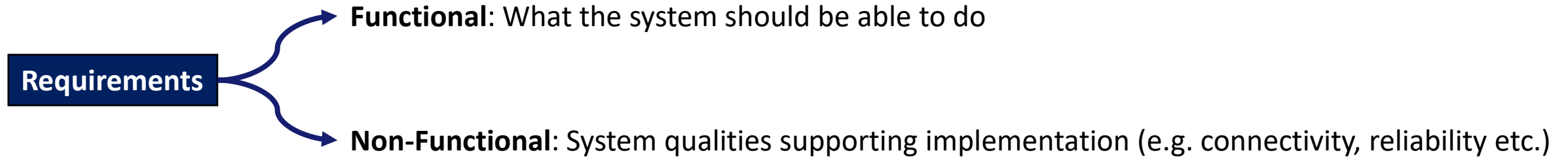
- Objectives:
 - ✓ Evaluation of an initial set of requirements
 - ✓ Identify additional needs that could be translated into requirements
- Structure:
 - ✓ Demographic questions
 - ✓ Design goals and objectives of the MOSES project
 - ✓ Requirements for each innovation
 - ✓ Stakeholders could complete it in 20-30 mins

55 responses

70% Academia/research, shipping, ports, equipment suppl.

51% current occupation involves maritime operations

The MOSES User Requirements Extraction Methodology

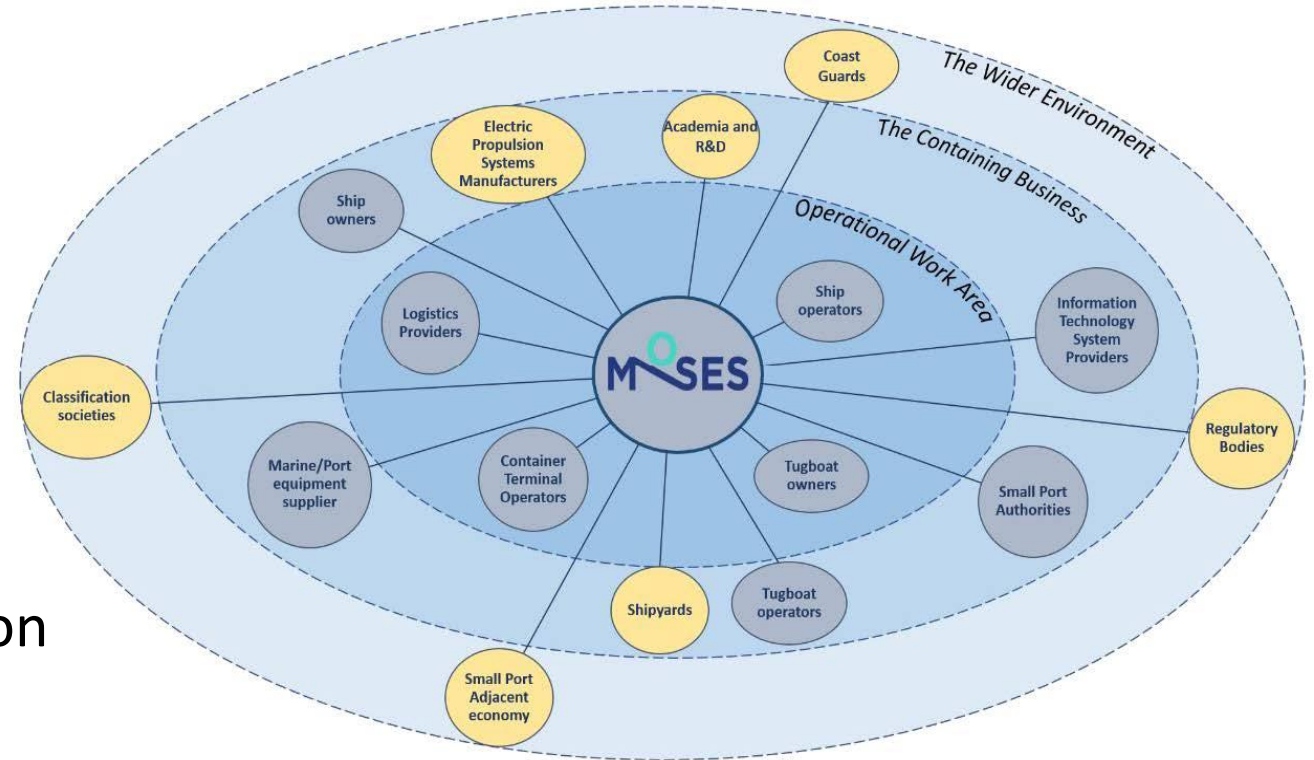


Attribute	Description
User Requirement ID	A unique ID of the requirement, with the following format: <Innovation>_ <ascending enumeration of the requirement>
Requirement type	A classification of the requirement to functional and non-functional (F or NF)
Requirement class	Environmental, technical, safety, environmental, market and societal
Title	Formal statement of the requirement
Description	Short description of the requirement
Priority	“Must”, “Should”, “Could”
Dependency	ID of requirement whose implementation depends on the requirement described

Stakeholder identification and analysis

Primary stakeholders

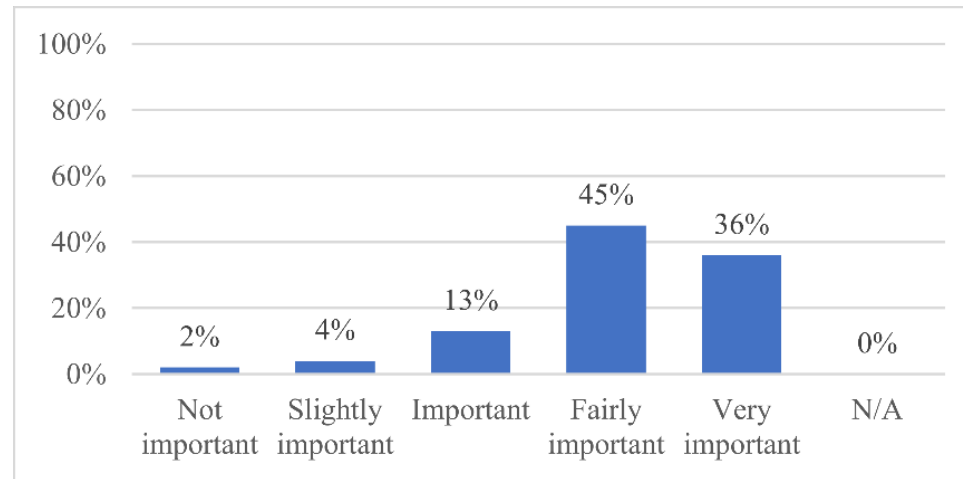
- Container Terminal Operators
- Tugboat Operators
- Tugboat Owners
- Shipowners
- Ship operators
- Logistics providers
- Information and communication technology providers
- Port authorities



MOSES Stakeholder Universe

Identification of Stakeholder needs

- Focus on requirements that evaluated as **fairly** or **very important** by more than **50%** of the respondents
- The following have been evaluated as the most important MOSES design goals:
 - ✓ MOSES innovations will attain a high level of automation (**81%**)



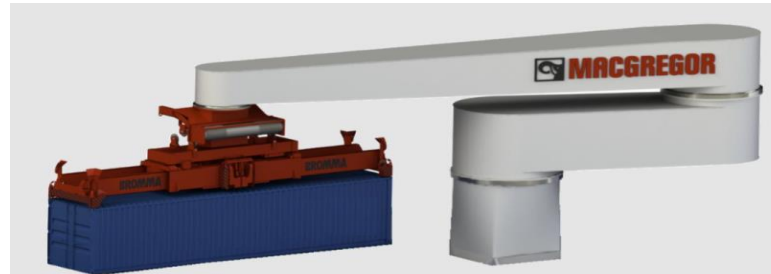
- ✓ Create sustainable SSS lines from DSS to smaller ports (**71%**)
- ✓ MOSES innovations should be cost effective in their implementation, despite the fulfilment level of their full potential (**63%**)

Identification of Stakeholder needs



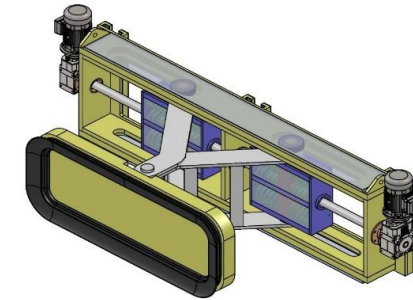
Innovative feeder vessel

- Significant reduction of the environmental footprint (**93%**)
- Safely approach, enter and manoeuvre in smaller ports not offering adequate weather protection (**85%**)
- Be able to operate without requiring any special facility at service ports (**73%**)



Robotic Container Handling System

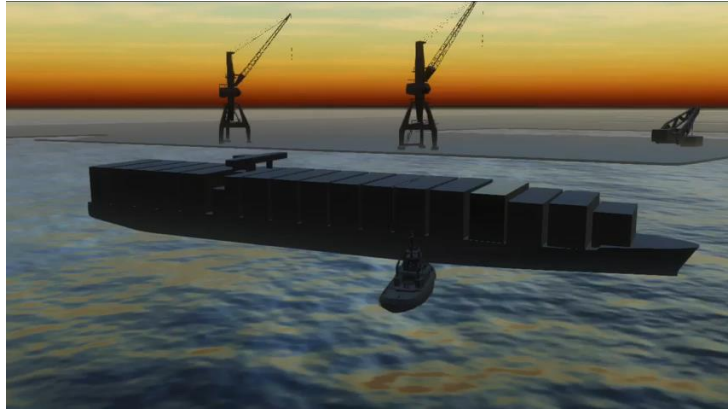
- Operational envelope similar to a manual crane (**86%**)
- Capable of providing the remote operator with a detailed picture of the quay (**76%**)



Automated Mooring System

- Real-time monitoring, identify and report damages (**85%**)
- Communicate with autonomous tugs in case of violated operational parameters (**76%**)

Identification of Stakeholder needs



Autonomous tugboats

- Secure remote control and communication (**93%**)
- Condition monitoring and damage identification (**87%**)
- Retain and transmit logs in real time for positioning and progress of operation (**80%**)
- Return autonomously to the port in case communication is lost (**77%**)



Matchmaking platform

- Information sharing and efficient management of empty containers (**58%**)
- Scenario-building capability to examine different transport mode combinations (**58%**)
- List potential transfer requests defining a turn-around-time target value (**55%**)
- Different user profiles with different roles and access rights to various modules and functionalities of the platform (**64%**)

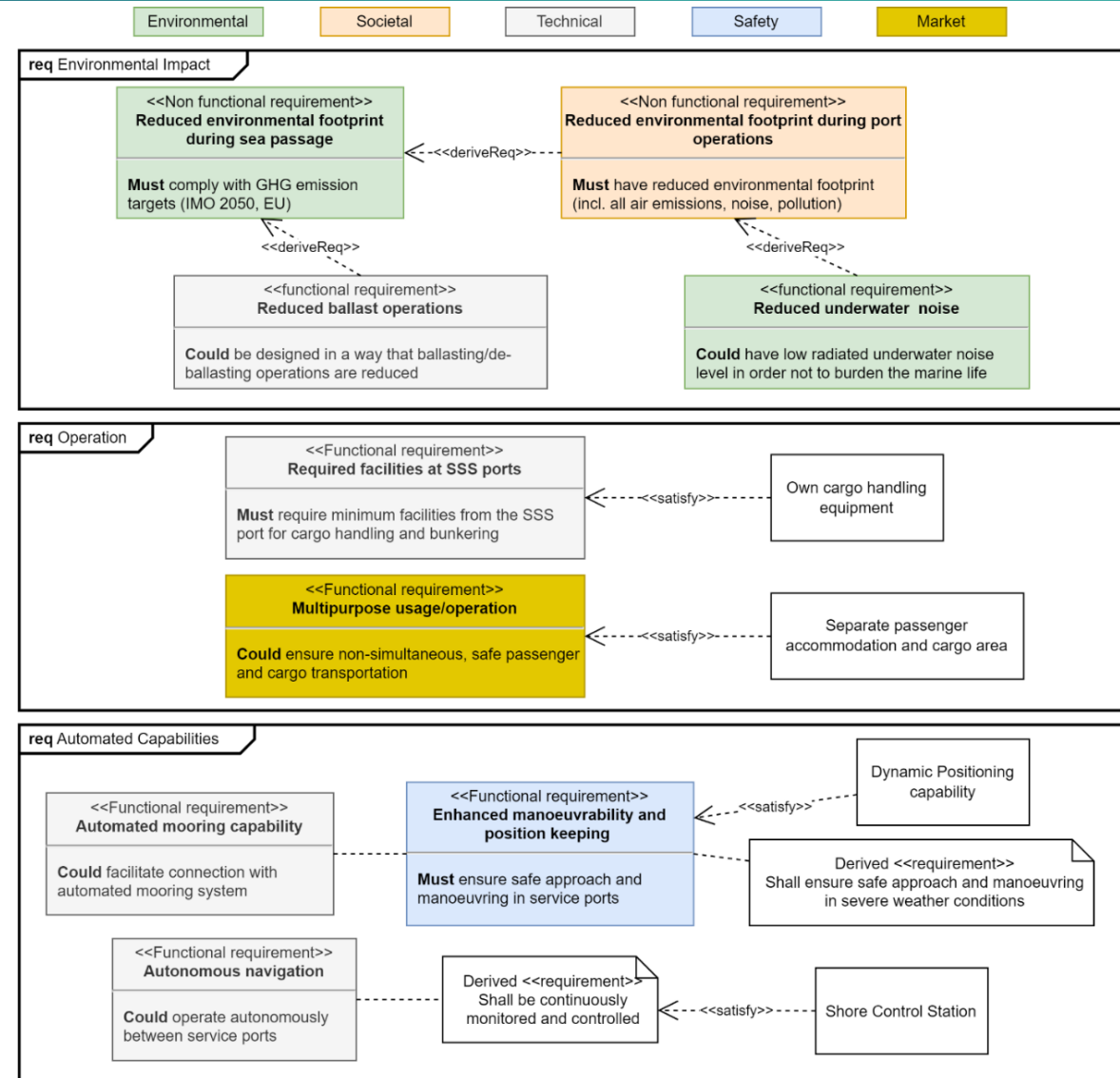
MOSES Innovation User Requirements

Innovative Feeder vessel

7 functional, 2 non-functional

“Must” requirements

- reduced environmental footprint, including air emissions, noise, and pollution, during sea passage and port operations
- require minimum facilities from the SSS port for cargo handling and bunkering
- safely approach and manoeuvre within service ports (SSS and DSS), including in severe weather conditions
- could operate autonomously between service ports with the support of a Shore Control Station (monitoring, control)



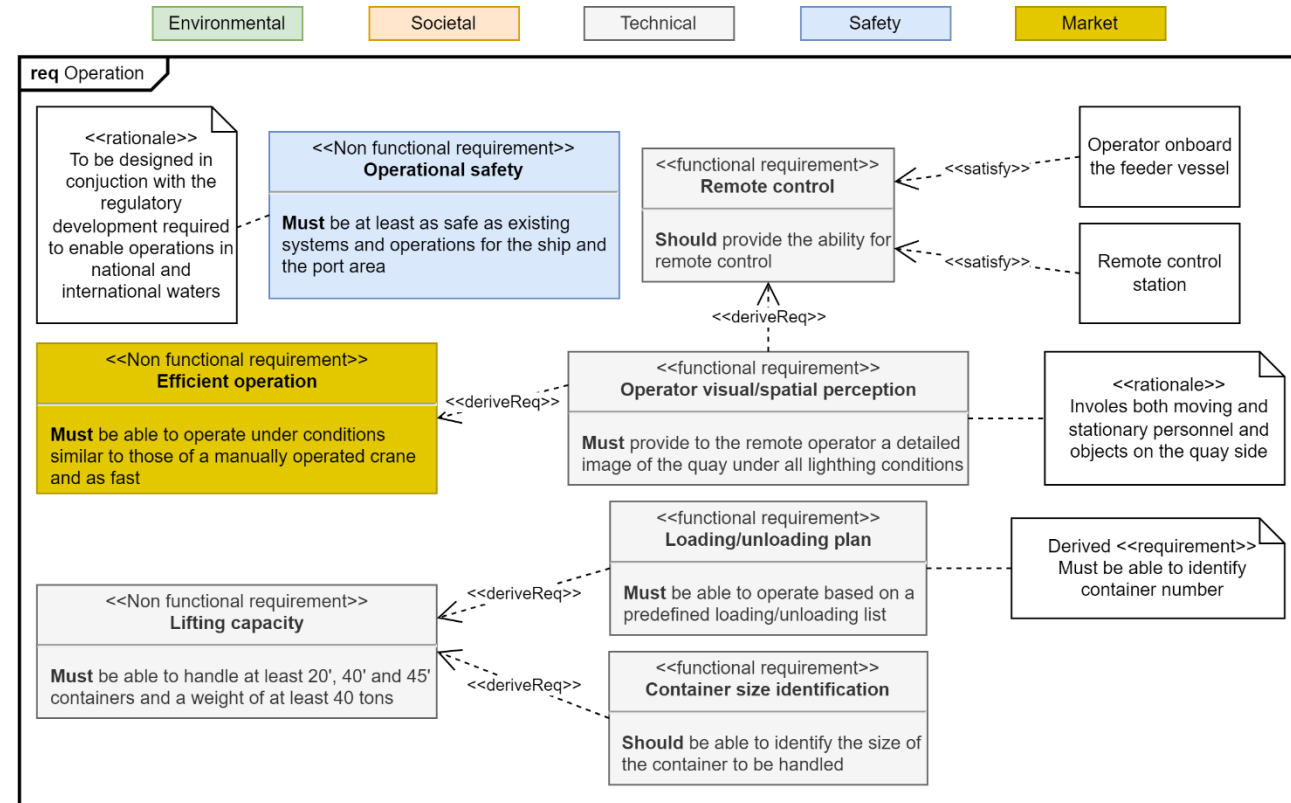
MOSES Innovation User Requirements

Robotic Container-Handling System

4 functional, 3 non-functional

“Must” requirements

- operate at least at the same safety level and in similar conditions as existing, conventional cargo handling systems
- provide the remote operator sufficient situation awareness through a detailed image of the quay under all lighting conditions
- handle at least 20’, 40’, and 45’ containers and a weight of at least 40 tons



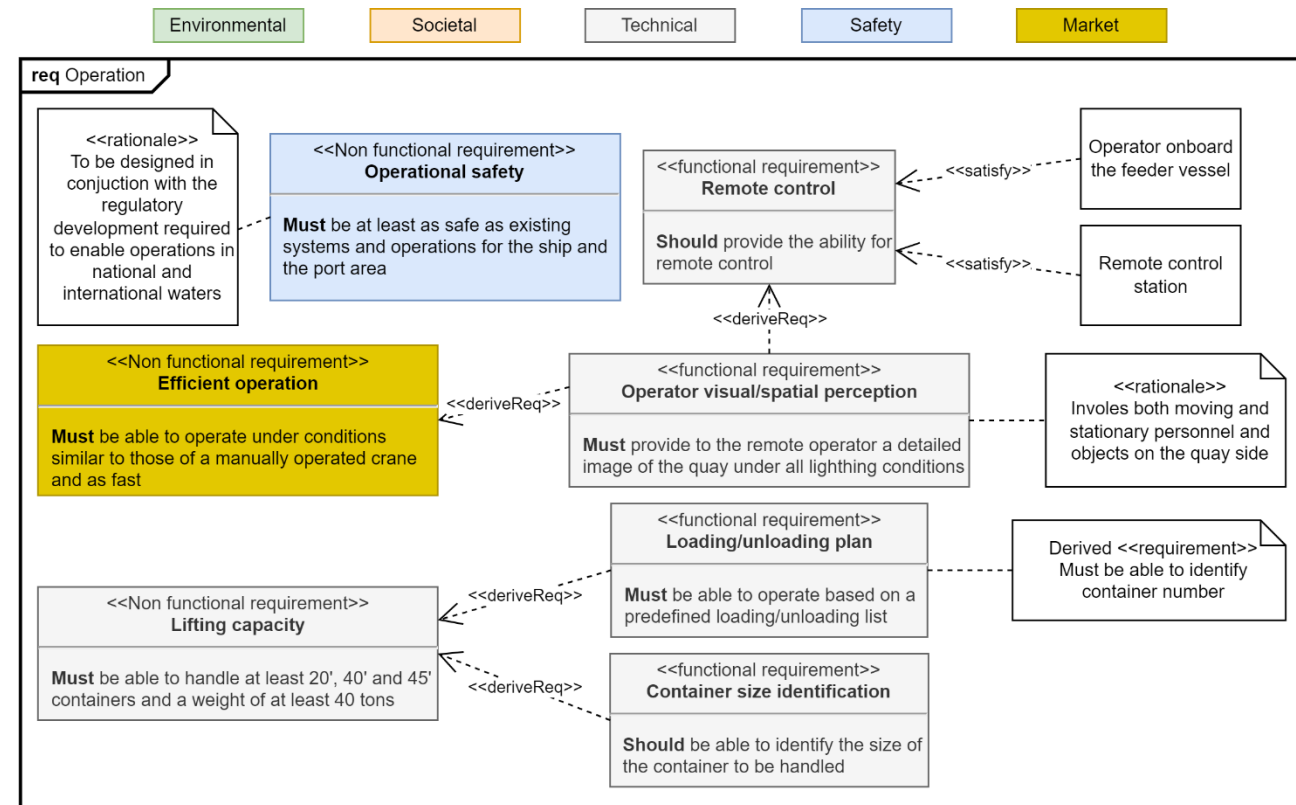
MOSES Innovation User Requirements

Autonomous Tugboats

10 functional, 2 non-functional

“Must” requirements

- operate as a swarm for handling vessels of various sizes
- at least at the same level as conventional tugboats in terms of safety, cost, and efficiency
- Fail-safe and resilient operation → the towing operation must continue even in case one of the tugboats in the swarm cannot continue its operation
- an operator in a remote control and monitoring station can override the autonomous operation



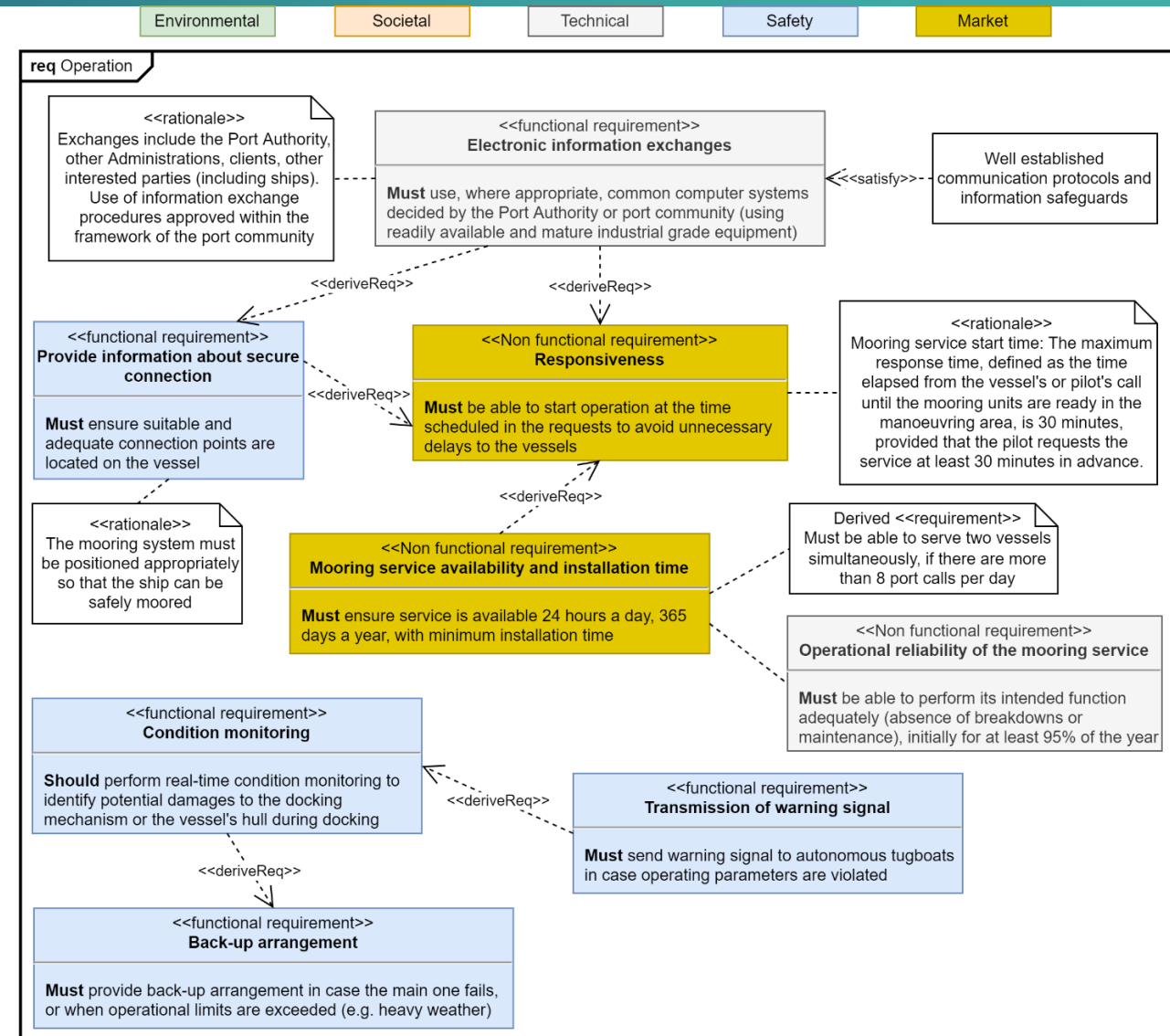
MOSES Innovation User Requirements

Automated mooring

8 functional

“Must” requirements

- integration into existing port operations and the cooperation with the Autonomous Tugboats for ensuring the vessel will be safely moored (e.g. send warning signals)
- start operation at the scheduled time to avoid delays
- operational reliability (i.e. absence of breakdowns or maintenance) at least 95% of the year



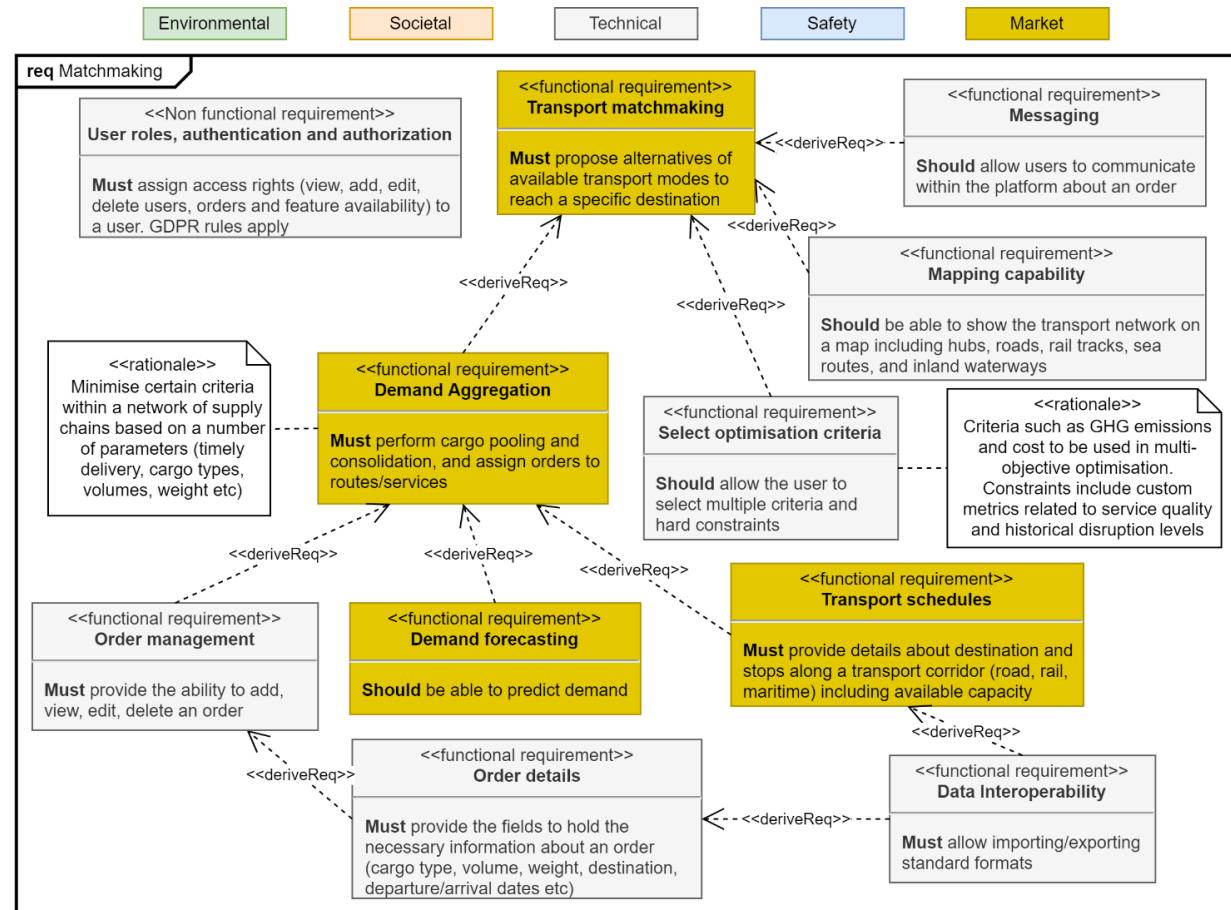
MOSES Innovation User Requirements

Matchmaking Platform

10 functional, 1 non-functional

“Must” requirements

- perform cargo pooling and consolidation
- Demand aggregation by providing details about destination and stops on a transport corridor and predicting demand
- Storing information (cargo type, volume, weight, destination etc.) and order management



Conclusions

- In total, **47** requirements have been documented

72% technical issues
19% market issues
8% environmental and
societal issues

77% functional, of which
60% “must-haves”
28% “should-haves”

- They have been used to determine the main functionalities of the MOSES innovations at early development
- Non-functional requirements will be used as a starting point for elaborating the qualities and performance characteristics of the MOSES innovations



Thank you very much for your attention!

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 [Maritime Risk Group \(MRG\)](#)