Schedule

Slot	Presentation title	Speaker
08:30 – 08:45	Improved waterborne logistics with small uncrewed feeder vessels	Odd Erik Mørkrid (SINTEF)
08:45 – 09:00	Leveraging autonomy to create cost effective and sustainable businesses for intra-European transport	Kristoffer Kloch (DFDS)
09:00 – 09:15	Automated cargo handling to reduce transhipment costs	Janne Suominen (MacGregor)
09:15 – 09:30	The necessity of digital as well as physical automation for sustainable modal shifts	Konstantinos Louzis (NTUA)
09:30 – 10:00	**PANEL DISCUSSION** Challenges related to effectively exploiting automation in the supply chain and the way forward towards more sustainable cargo transport	

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TRANSPORT RESEARCH ARENA
LISBON 2022

MOSES

The necessity of digital as well as physical automation for sustainable modal shifts

Konstantinos Louzis, NTUA

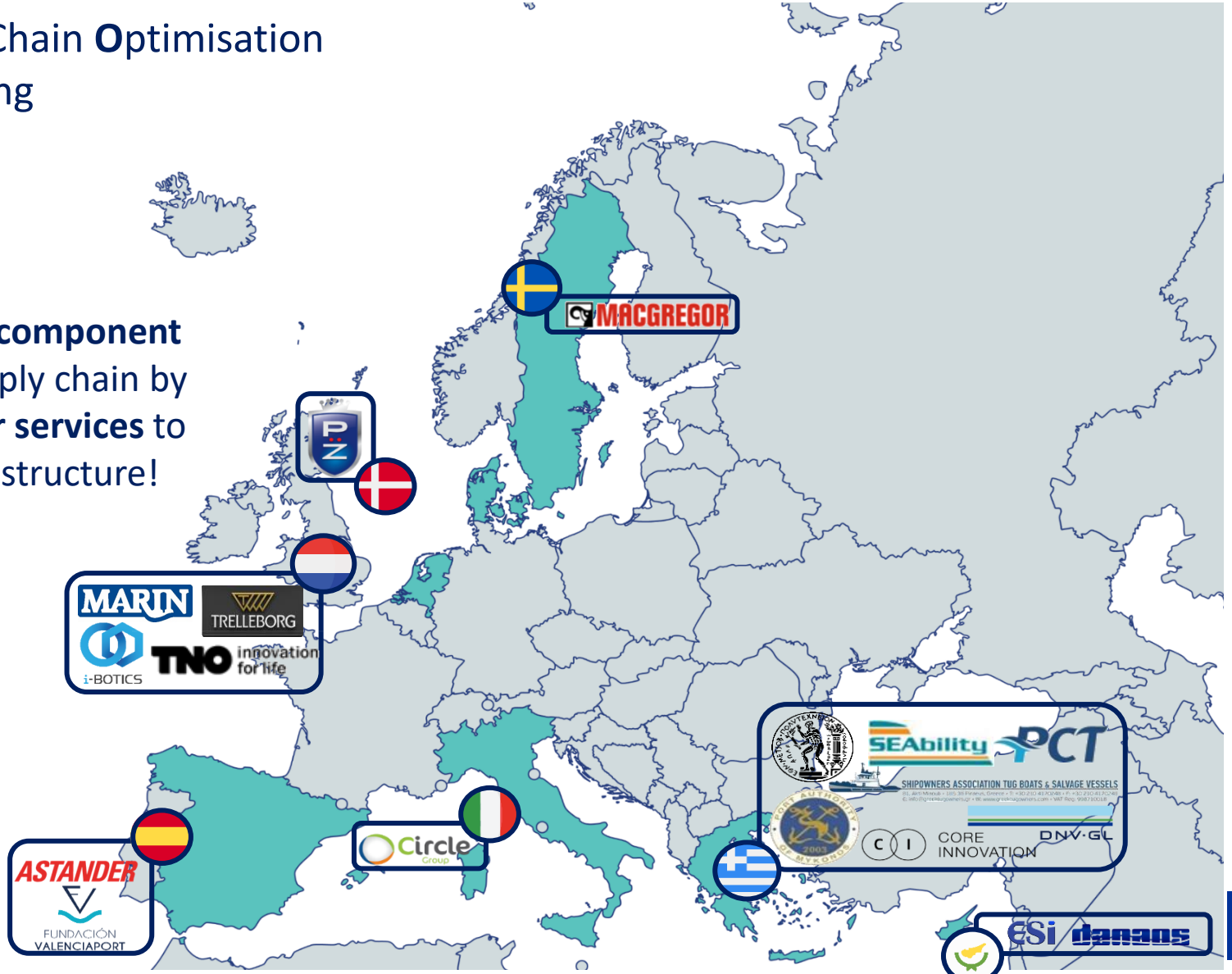
Invited session 51:
Safe and efficient modal shift from roads to waterways: Automated technologies and processes, human-autonomy interactions

16/11/2022, Lisbon

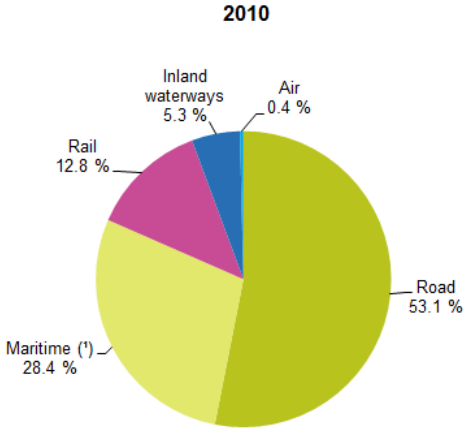
Facts about the MOSES project

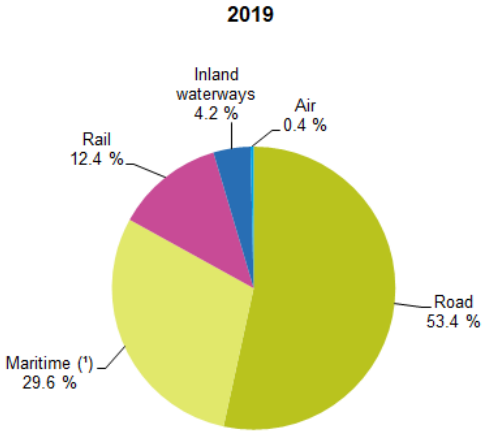
AutoMated Vessels and Supply Chain Optimisation for Sustainable Short SEa Shipping

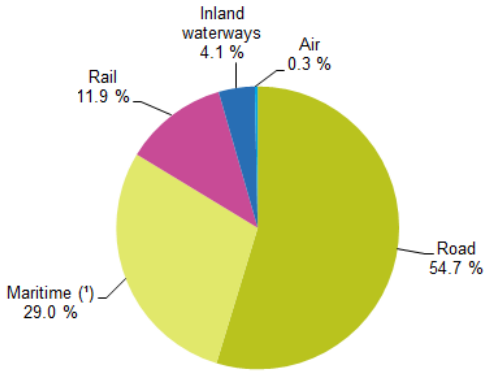
Significantly **enhance the SSS component** of the European container supply chain by **stimulating sustainable feeder services** to ports with limited or no infrastructure!

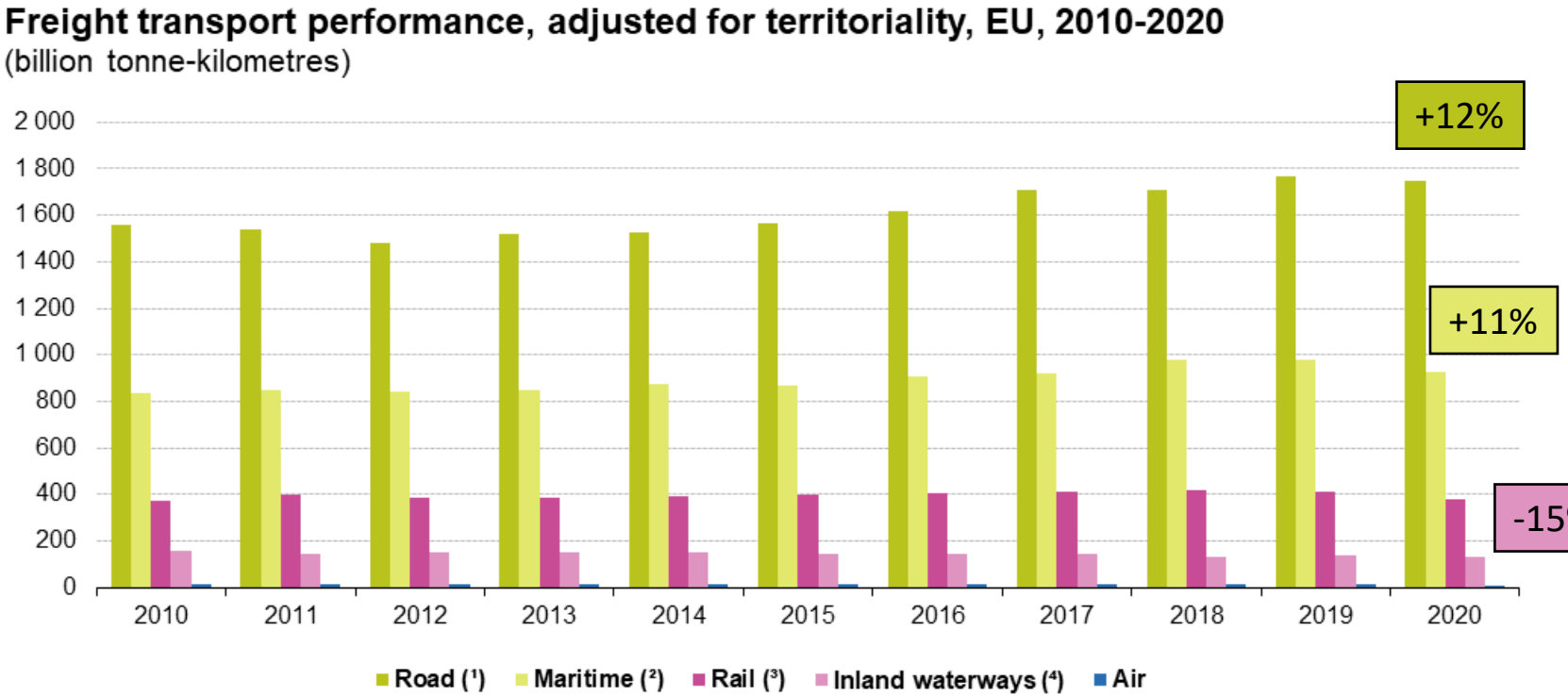


Modal shift status in the EU









Modal split percentages have remained relatively constant since 2010

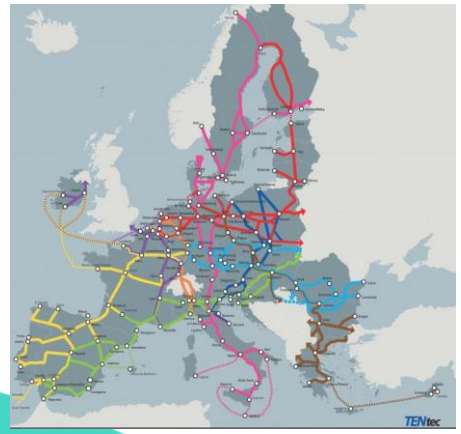
Between 2010 and 2020:

- Road and maritime transport have marginally increased
- Inland waterway transport share has slightly decreased

Modal shift status in the EU

	Target from road to other transport modes [billion tkm]	Achieved [billion tkm]
I (2003 – 2006)	48	21.9 overall (**46%**)
II (2007 – 2013)	143.5	41.9 overall, **35.3% (maritime)**

(Takman and Gonzalez, 2021)



2019 Revision of the TEN-T policy set new targets

Traffic on high-speed rail will double **by 2030**. **By 2050** rail freight traffic will double.

Transport by inland waterways and short sea shipping will increase by 25% **by 2030**.

(EU Mobility Strategy)

Is modal shift relevant?

Trucks are on their way towards zero-emissions!

With the global push for decarbonization, land-based transport modes are also becoming more energy efficient and green!

But there will still be problems, such as congestion…

Is modal shift relevant?

Illustration of ASKO's zero emission shuttle
Source: ASKO Maritime

MV Yara Birkeland
Source: Yara International

Modal shift to maritime transport will be meaningful if we start to **think different**…

For example, towards smaller vessels that will provide a reliable, economically viable, and just-in-time service…

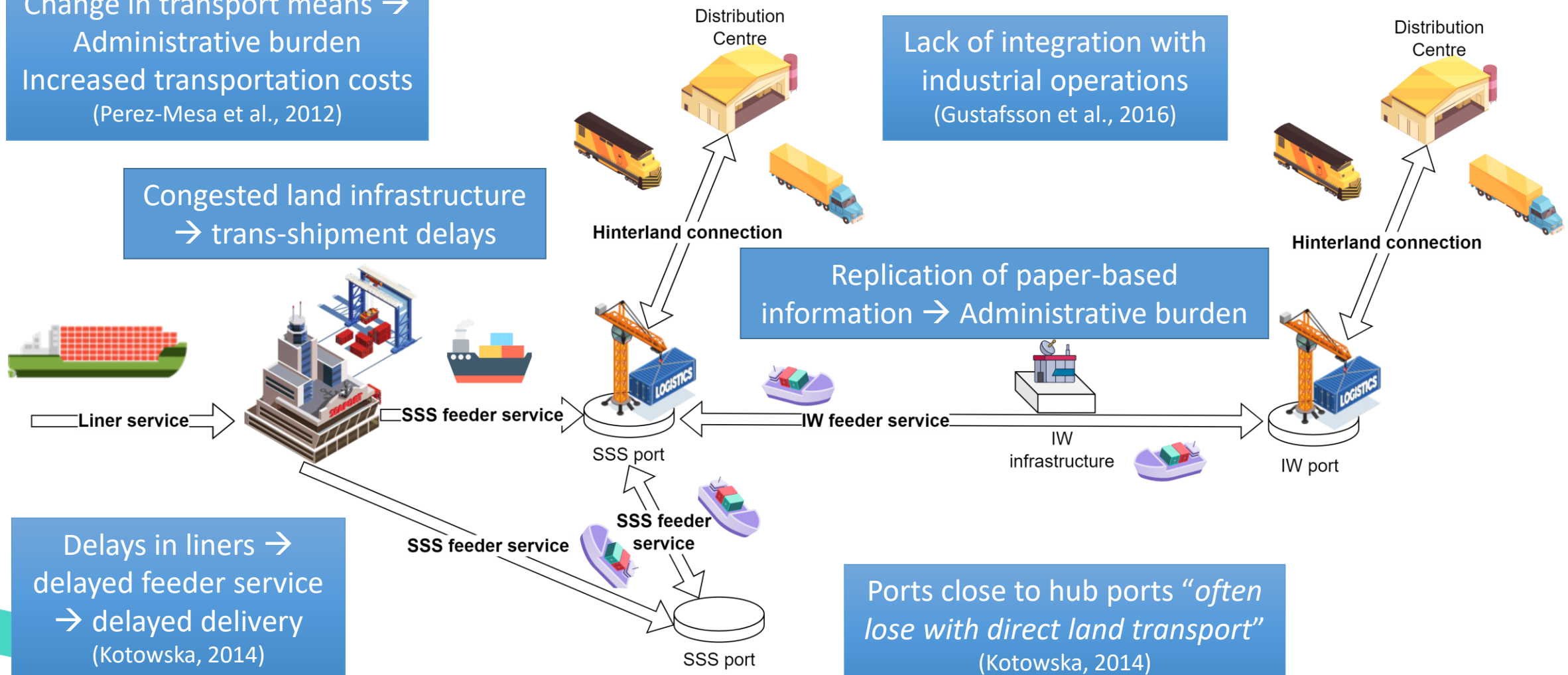
Modal shift and the supply chain

Change in transport means → Administrative burden
Increased transportation costs
(Perez-Mesa et al., 2012)

Lack of integration with industrial operations
(Gustafsson et al., 2016)

Congested land infrastructure → trans-shipment delays

Replication of paper-based information → Administrative burden



Delays in liners → delayed feeder service → delayed delivery
(Kotowska, 2014)

Ports close to hub ports "*often lose with direct land transport*"
(Kotowska, 2014)

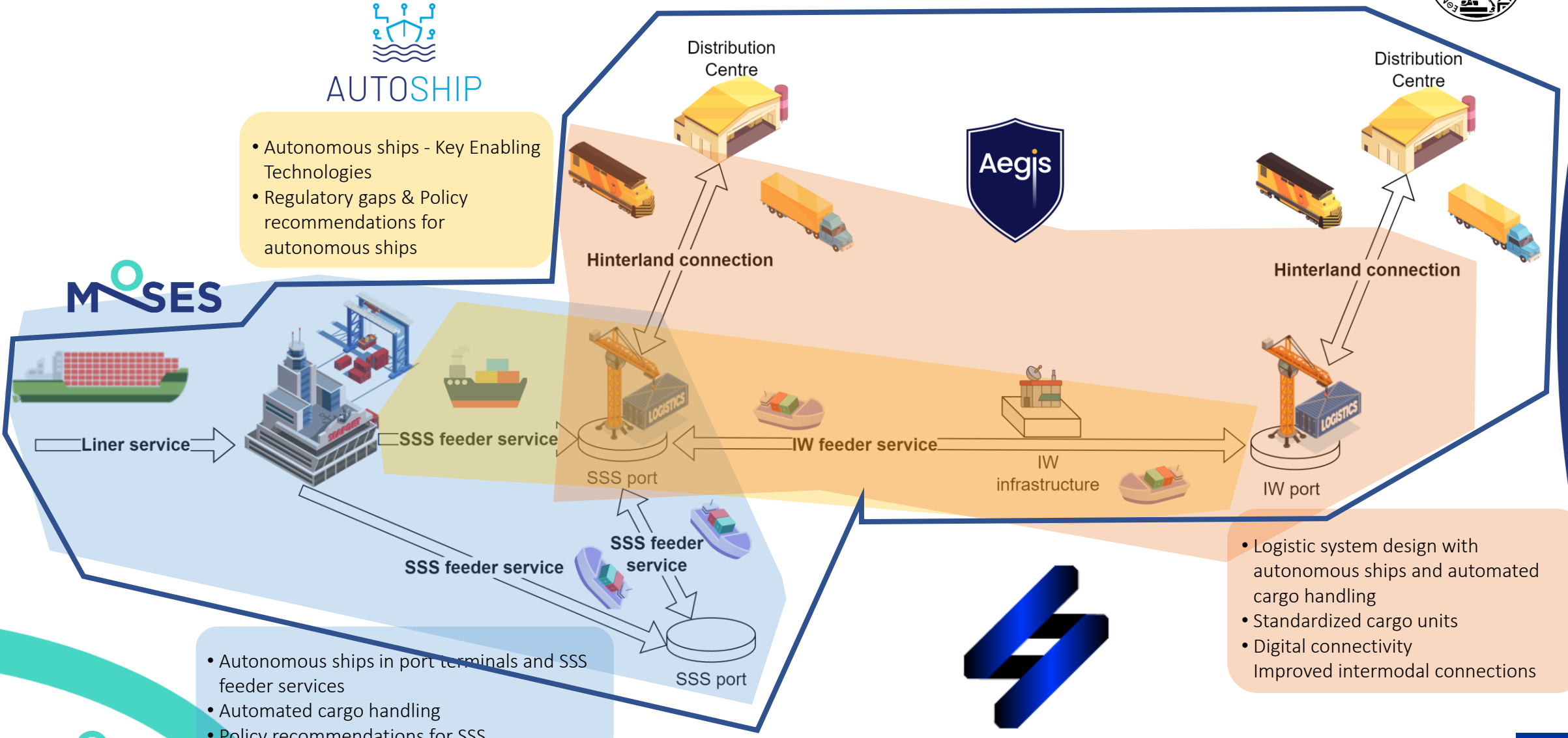
Is digital and physical automation necessary for a sustainable modal shift to maritime transport?

* Sustainable modal shift to maritime transport means stakeholders steadily prefer this mode to other alternatives

Research towards sustainable modal shift

AUTOSHIP

- Autonomous ships - Key Enabling Technologies
- Regulatory gaps & Policy recommendations for autonomous ships

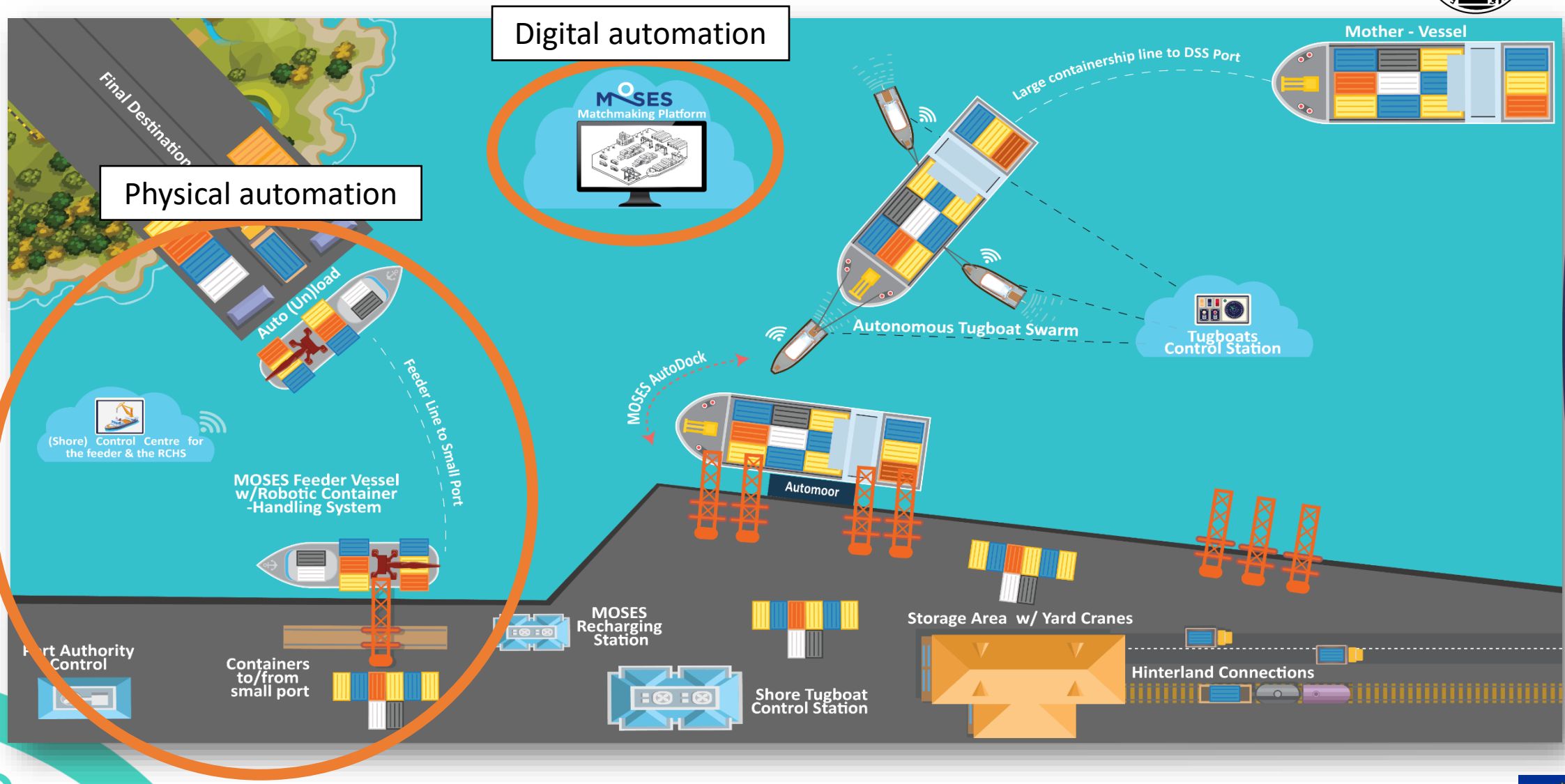


- Autonomous ships in port terminals and SSS feeder services
- Automated cargo handling
- Policy recommendations for SSS

- Logistic system design with autonomous ships and automated cargo handling
- Standardized cargo units
- Digital connectivity
Improved intermodal connections

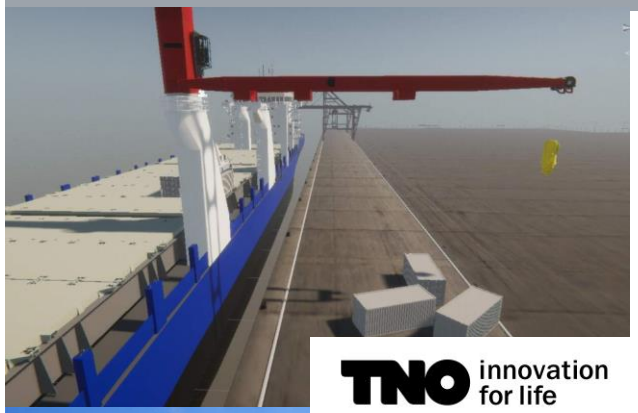
SEAMLESS

The contribution of MOSES to modal shift



The contribution of MOSES to modal shift

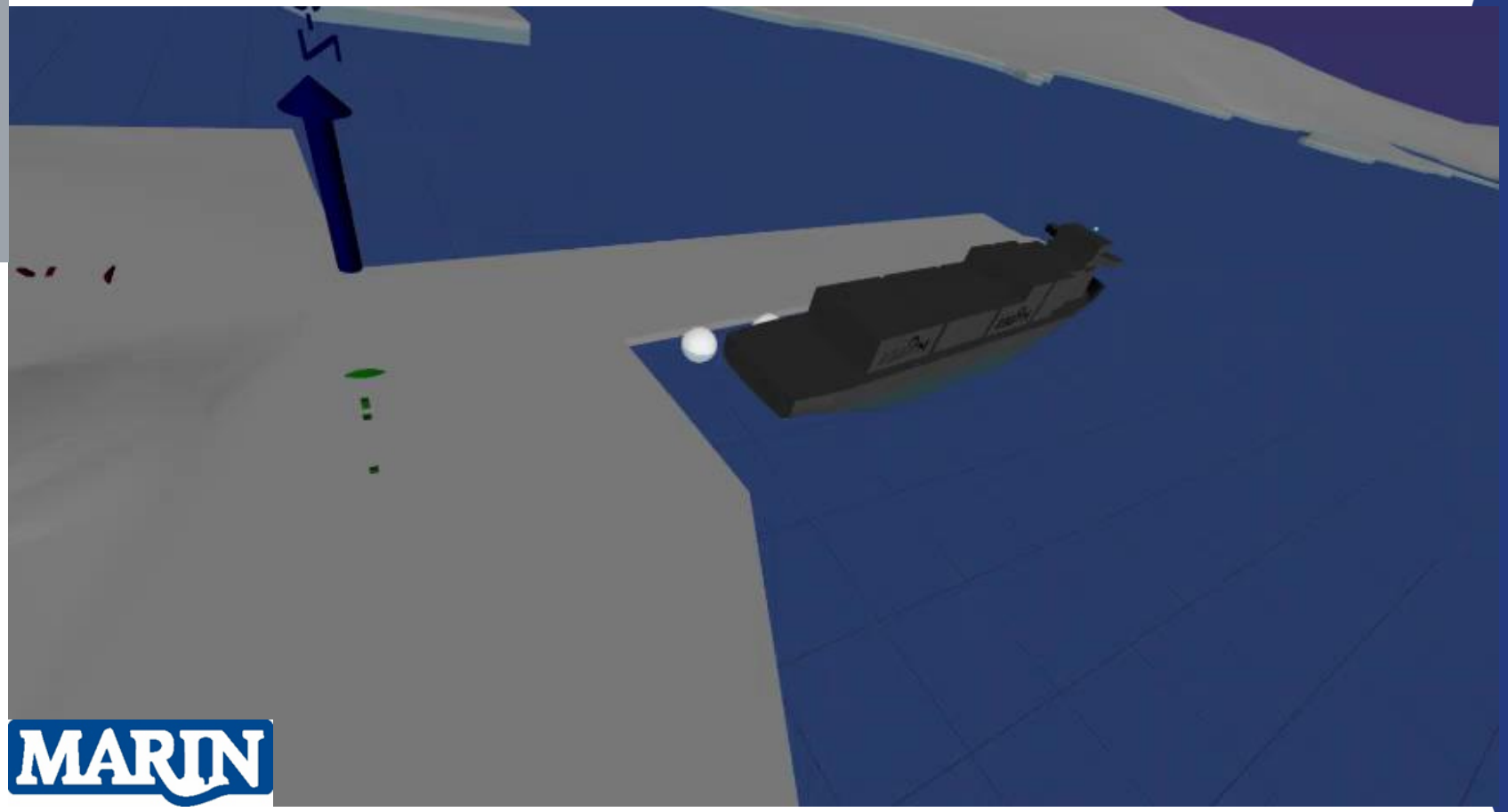
Autonomous feeder and automated cargo handling



TNO innovation for life

MACGREGOR

MARIN



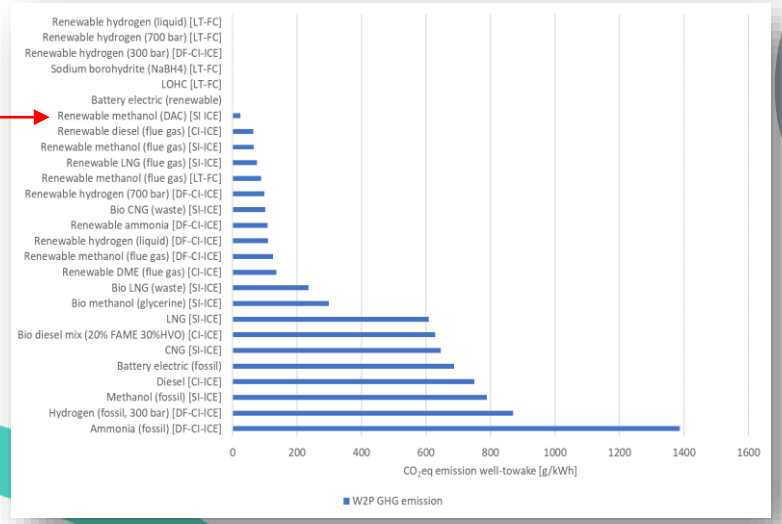
MARIN

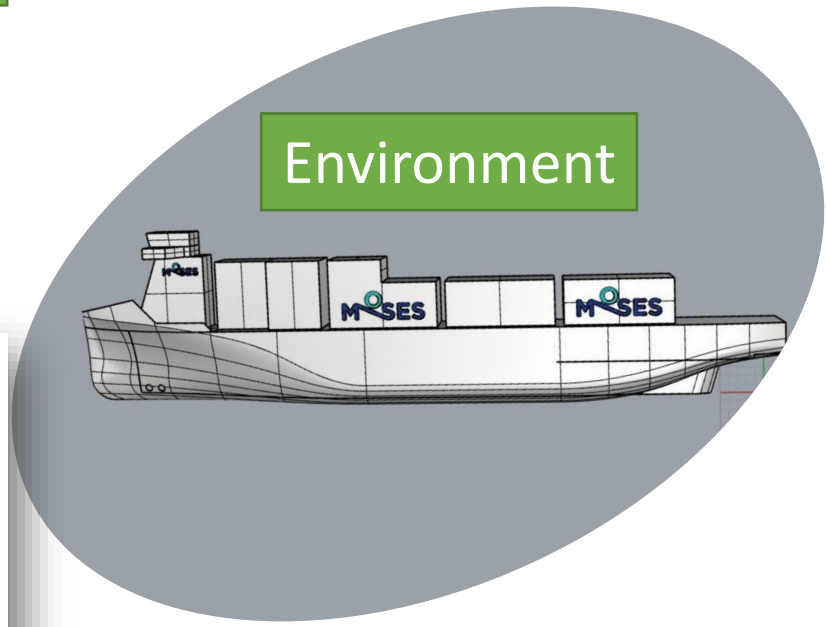
Autonomous feeder and automated cargo handling

Emissions compared to alternative land-based transportation modes

40%

- (near) zero emissions operation - hybrid with methanol ICE and batteries
- 10% lower OPEX compared to green alternatives
- onboard battery systems and shore power connections while berthed at port





Replacement of Ro-Ro traffic used to transport containers on trailer trucks

>15%

Initial estimation: Feeder will be competitive if > 40% of existing Ro-Ro traffic is captured

Autonomous feeder and automated cargo handling

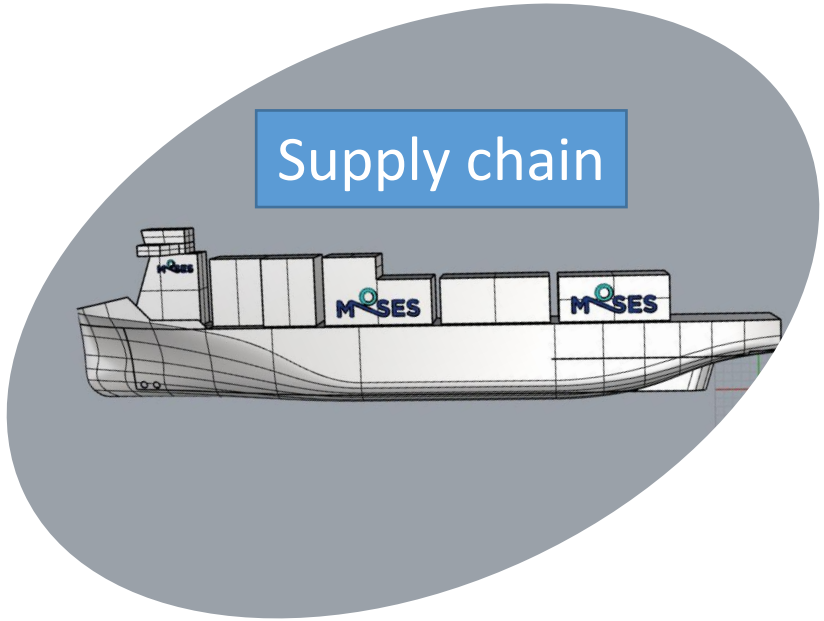
Dependence from port infrastructure ↓ **100%**

- Independent from **port cargo handling** (Onboard crane)
- Partly independent from **port mooring services** → (un)loading operations without using mooring lines (DP with azimuth thrusters)

EU ports able to host container feeder vessels ↑ **10%**

Initial estimates from the business cases:

- 14 ports near EU core ports
- 6 small ports in the Aegean archipelago



End-to-end costs for container transport for captive and DSS feeder traffic ↓ **5%**

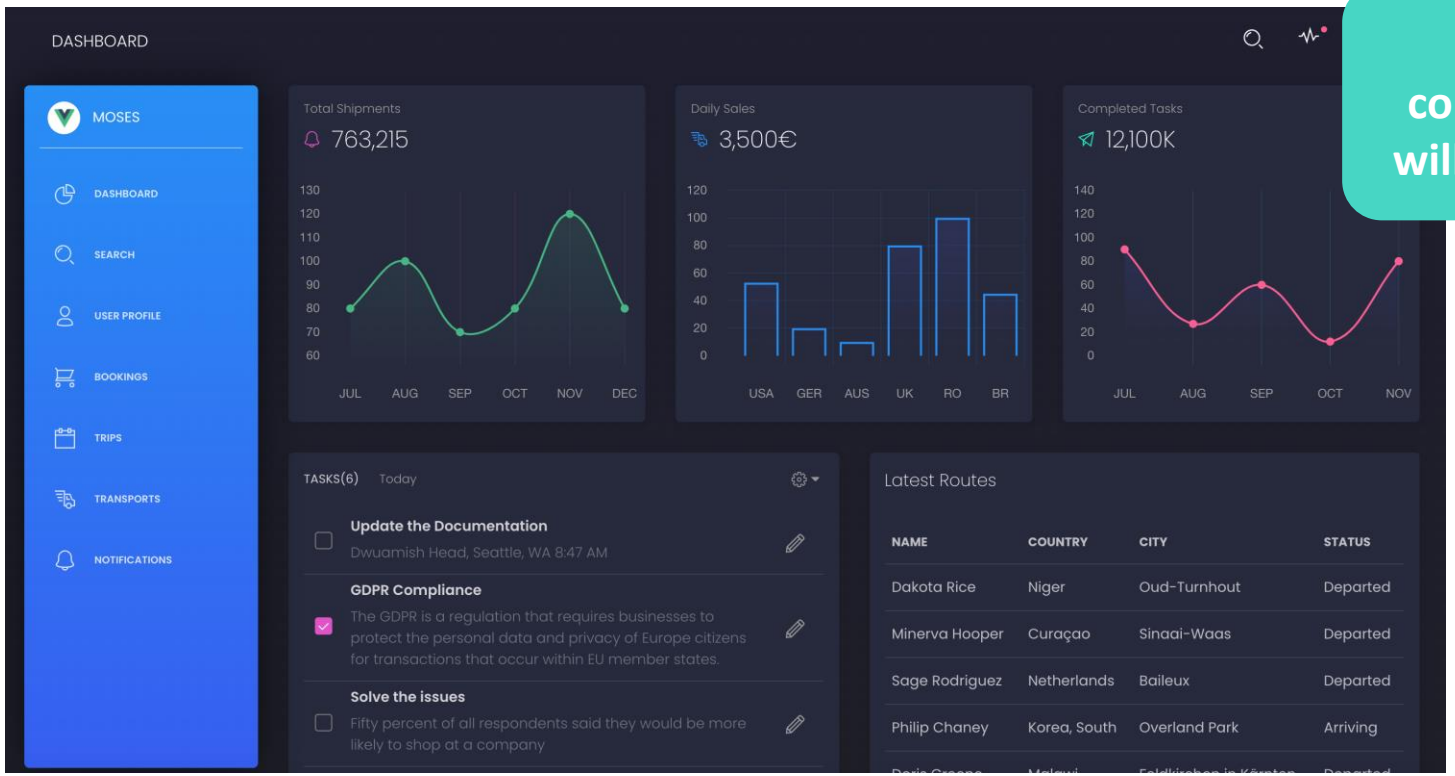
Greek case (80% demand)

- -3.5% cost / cargo unit,
- 13%-14% higher end-to-end costs due to the higher price of energy carrier (methanol)

Spanish case (3 truck haulages / day to hinterland)

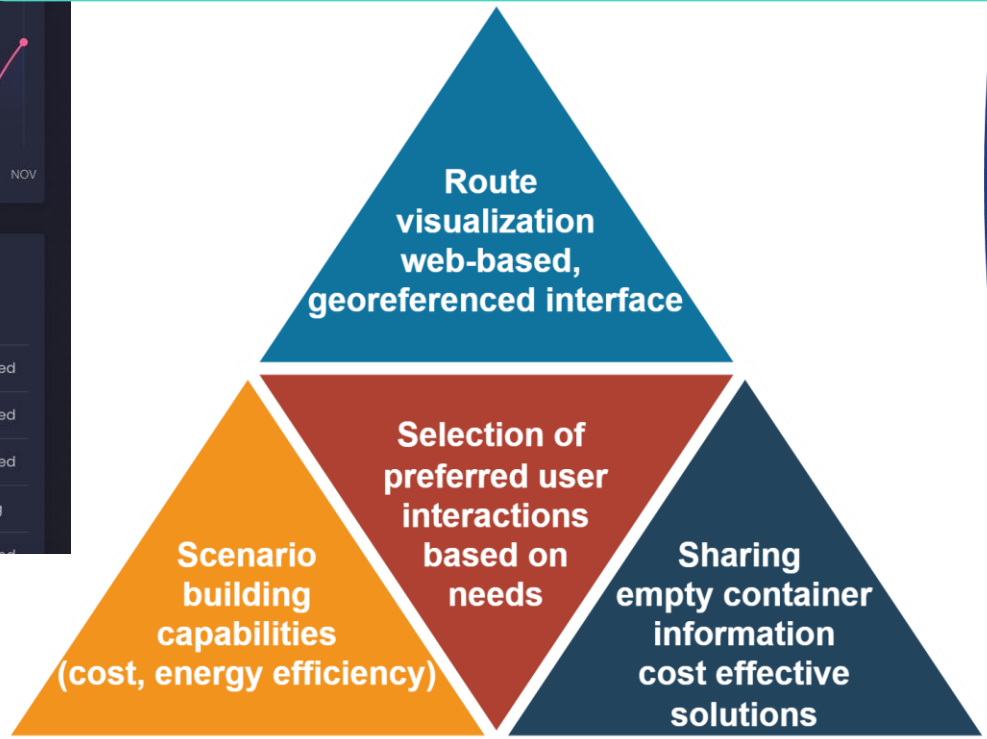
- Valencia to Sagunto: -3.7% / cargo unit
- Valencia to Gandia: - 10.6% / cargo unit
- -10.8% costs - no need for port tugboats

Matchmaking platform



AI-based optimization of distribution routes and improvement of empty container management

The platform will implement horizontal collaboration among logistics stakeholders and will match demand and supply of cargo volumes



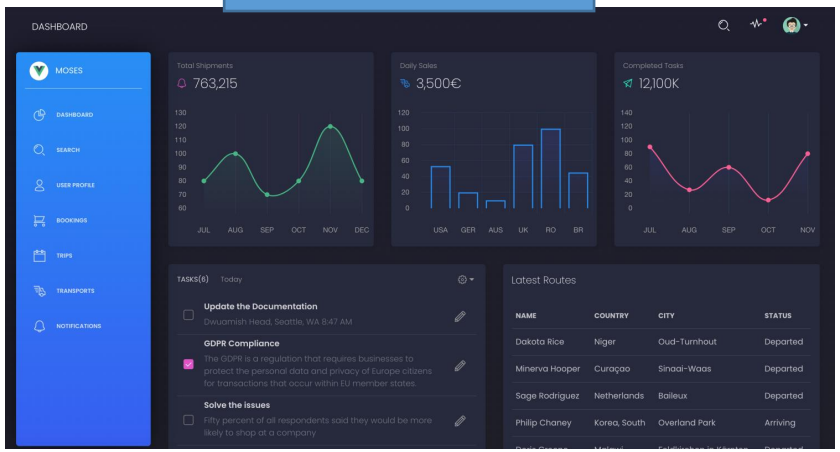
Matchmaking platform

Improve modal-split in favour of SSS

>10%

- Identification of SSS alternatives
- Historical data → in 18% of road transport cases there is an alternative route with SSS

Supply chain



Road traffic around hub ports from container-hauling trucks

Groupage and shared container loads → reduction of traffic for:

- the execution of the freight transport orders
- the commuting for executing administrative tasks that involve the exchange of paper documents

Logistics costs for (im-) exporters of container cargo destined to small ports

Horizontal collaboration among shippers and freight forwarders to

- identify groupage opportunities, shared container loads
- match opposite routes to minimise empty container runs

Logistics stakeholders in the platform at the project end

>10

The National Logistics Council of Greece has shown interest in the platform and the benefits for its members

Digital and physical automation is expected to contribute to modal shift to maritime transport

Is automation all that is needed?

Additional challenges related to automation

Technology readiness

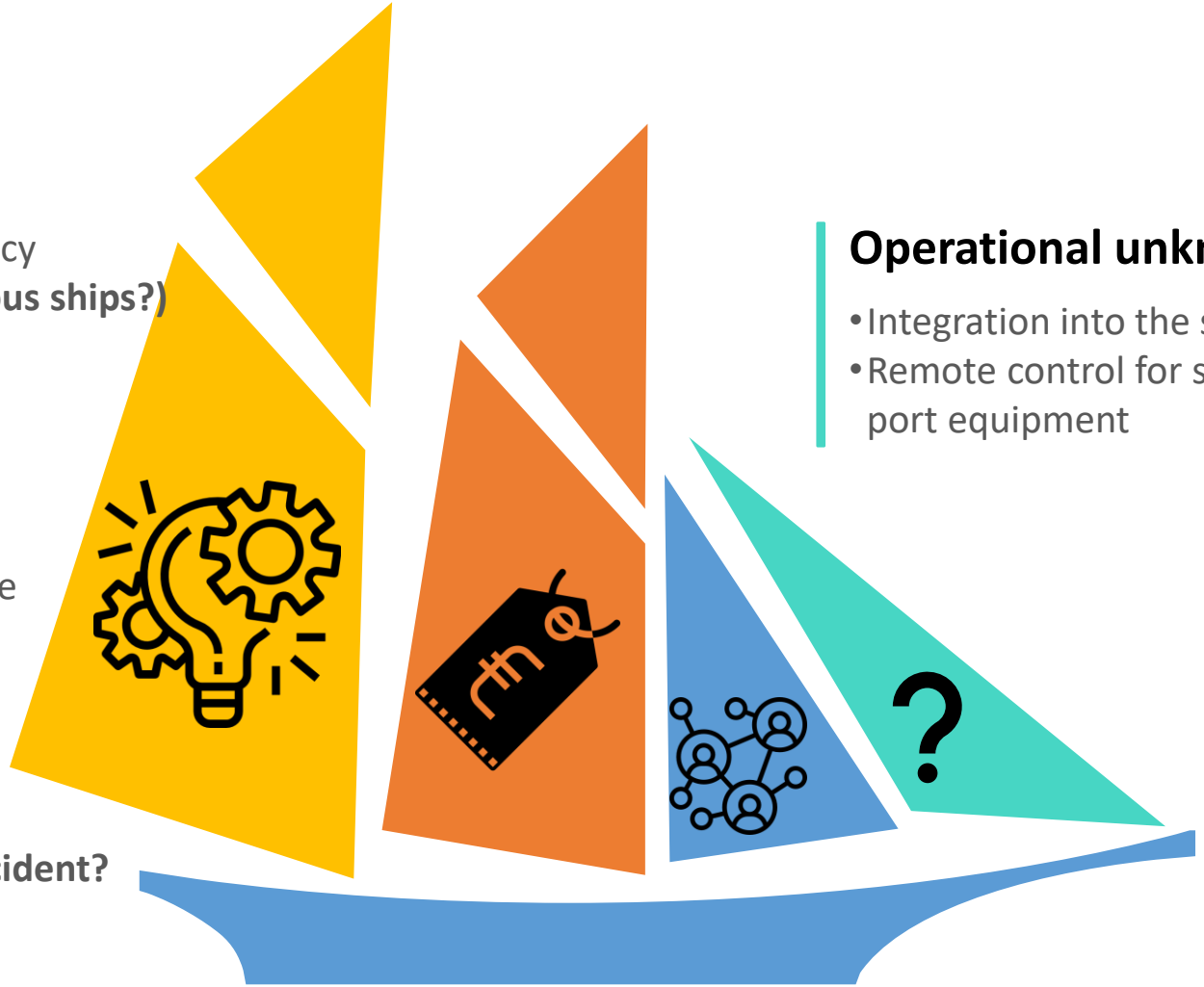
- Complexity (failures, maintenance)
- **Is full autonomy the way to go?**
- Interaction of automated systems with legacy infrastructure (e.g. **port calls for autonomous ships?**)

Economics

- Redesign of logistics chains
- Development of new business models for dependable, synchromodal, and just-in-time services
- **Additional costs related to automation?**

Stakeholder readiness

- **Who is to blame in case of an accident?**
- Regulatory complexity
- General public acceptance
- Willingness to invest



Operational unknowns

- Integration into the supply chain
- Remote control for ship, port, and port equipment

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MOSES Project

Thank you for your attention!

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