



Circular-Economy in the Smartship project

Paris, 19.09.2022

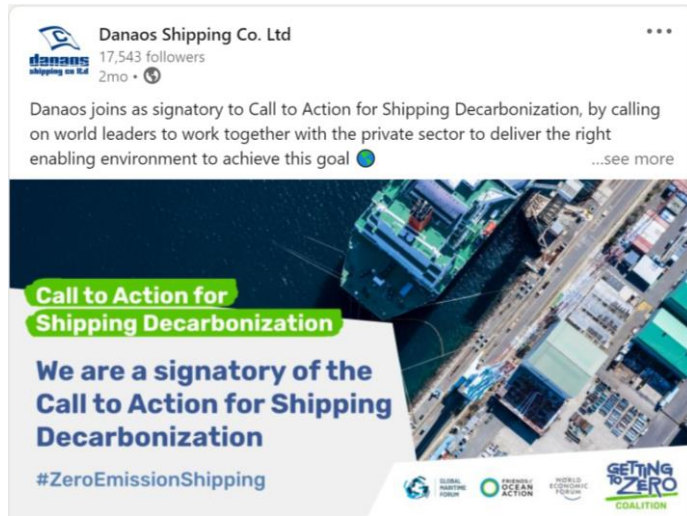
Beneficiary: Consortium

Presenter: Vlatka Katusic - CERC



The SmartShip project has received funding from the European Union's Horizon 2020 research and Innovation programme under the Marie Skłodowska-Curie grant agreement No 823916

Increased need for sustainability in the maritime industry



Novo Nordisk to suppliers: Switch to green transport or lose us as a customer

Major pharmaceutical company Novo Nordisk now tells its 60,000 suppliers that they must both produce and transport their products 100 percent sustainably from 2030. Otherwise they will lose Novo Nordisk as customer.



Lars Fruergaard Jørgensen, CEO, Novo Nordisk. | Photo: Novo Nordisk / PR



Further reading

Renowned analyst sees two players ready for growth despite declining bunker market

Hapag-Lloyd and Port

- ▶ With an ever-mounting climate challenge and with the whole world as one global integrated market, being in control of energy consumption and CO2 emissions is a crucial area for future-proofing operations
- ▶ Need to reduce direct and indirect emissions from the shipping sector
- ▶ Need for sustainable ship recycling and for ensuring the re-introduction of materials into the cycle to be used to manufacture new products
- ▶ Need to propel vessels differently

ENVIRONMENT DECEMBER 5, 2018 / 8:44 AM / UPDATED 2 YEARS AGO

World's largest container shipper Maersk aims to be CO2 neutral by 2050

By Stine Jacobsen

2 MIN READ

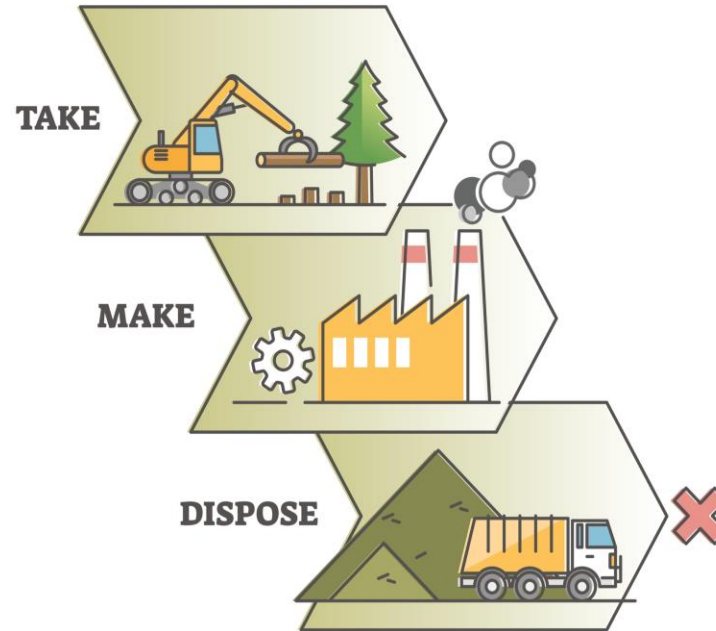


COPENHAGEN (Reuters) - Maersk, the world's biggest container shipper, aims to be carbon neutral by 2050, in a challenge to the rest of the world's fossil fuel-dependent fleet.

From linear to circular: the maritime industry

- ▶ Linear economic model:
 - ▶ raw materials are produced to be used and to become waste
- ▶ Circular economic model:
 - ▶ production and consumption involves sharing, leasing, reusing, repairing, refurbishing and recycling existing materials and products as long as possible

LINEAR ECONOMY



CIRCULAR ECONOMY



SmartShip: objectives

- ▶ Energy efficiency and fuel consumption management
- ▶ Environmental compliance with maritime sector regulations in terms of emissions' control
- ▶ Exploitation of technologies used for (i) and (ii), considering applications of circular economy (CE) principles in the maritime sector

Circular Economy principles

Keep products and materials in use, maintaining its value and resources value for as long as possible.



Regenerate natural systems by minimizing generation of waste and resource intensity of manufacturing (minimise negative externalities) and fostering system effectiveness.



Design out of waste and pollution to return value of products materials and resources into the product cycle at the end of their use.

Digitalization enabling the circular economy

- ▶ Increased connectivity
- ▶ Gathering, sharing and analysis of data
- ▶ Maximizing its value to produce better products and services
- ▶ Using of data and digitally enabled solutions to change people's and businesses' mindset processes, products and services



SmartShip: ICT & IoT



DATA ANALYTICS



IOT



**DECISION SUPPORT
SYSTEMS**



**VISUALIZATION
TOOLS**



**OPTIMIZATION
ALGORITHMS**

IoT exploitation



- About 47% of maritime businesses use IoT to measure fuel consumption (electronic reporting), and is expected to increase 100% by 2023



- Increased IoT uptake could improve the monitoring of ship components and improve longevity and performance (MarketLine, 2018).
- Real-time monitoring could also improve the scheduling of maintenance when necessary (MarketLine, 2018)

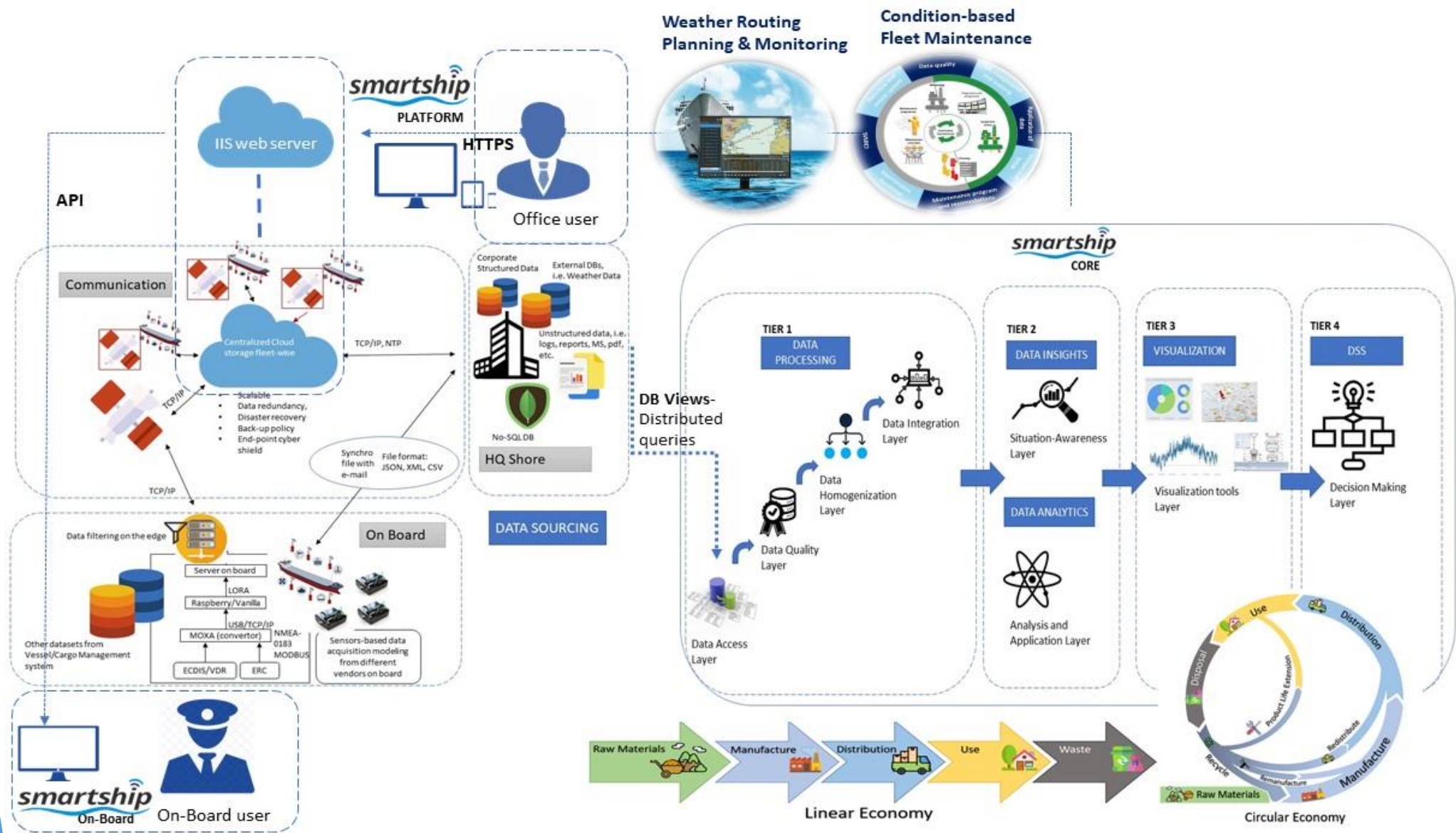


- 5G could potentially optimize the routing undertaken by maritime vessels, resulting in less distance travelled and lowered emissions
- One example of IoT integration is in the Port of Rotterdam which uses IoT sensors (e.g., environmental data) to reduce berthing times by one hour (saving of around 80 K€) (CFTC, 2019)



- IoT enabled augmented reality glasses are increasingly being used by ship crew to communicate with support departments remotely.
- Advantages may include faster resolution of technical faults, and reduced reliance on having a technician travel to the site (reduced emissions or pollutants). Also, may be applied for medical emergencies to prove safety (One Net, 2019a)

Integrated Architecture design



Circular Economy Platform Requirements

Circular Attributes

- **L**ocation
- **C**ondition
- **A**vailability

- Allow the monitoring of devices and recommended maintenance actions
- Competitive advantage to improve new products applying circular by design concepts

Circular Design

- **M**odularity
- **S**calability
- **F**unctionality

- Based on open standards
- Provides Interoperability with existing IoT environments
- Support the evolution of the platform for relevant changes in the future

Requirement's data collectors

- **E**nd-to-end security / privacy
- **D**ependability
- **O**perability

- Anonymization, encryption and authenticity
- Ensure sensitive information

Trust

- **T**rustworthiness
- **C**onfidentiality
- **S**ecurity

- Enable secure trustworthy information exchange by design

Opportunities for the circular economy in SmartShip: use cases

- ▶ The shipping sector has a large potential for pairing circular economy and Smart ICT
- ▶ Opportunities identified in SmartShip use cases:
 - ▶ **Use case #1 & #2: Weather routing optimization and monitoring**
 - ▶ optimized vessel routing
 - ▶ Fuel and energy consumption can fluctuate greatly, even between comparable trips, improved monitoring of fuel consumption
 - ▶ **Use case #3: Condition-based (predictive) maintenance (CBM)**
 - ▶ predictive maintenance
 - ▶ facilitate remote support (resolve technical failures, assist medical emergencies)



Initial definition of Circular Economy KPIs Use case #1 and #2

Topic	KPI	Applied Use Case	Measurement Validation
Enhance environmental performance in Shipping operation	Assessment of Results in Voyage performance in terms of fuel consumption and emission control compliance due to SmartShip routing advice	#1,#2	At least 5% enhancement in environmental performance due to SmartShip routing scenarios against existing algorithmic-based routing advices
Value added proposition to existing tools	Improvements in Performance % of existing weather routing optimization tool	#1,#2	At least 5% improvement in accuracy of routing advice and voyage performance evaluation due to SmartShip build-in functionalities
Through Circular Economy principles enhance the uptake of new fuel technologies.	Performance of a feasibility study.	#1, #2	Identification of at least two new fuel technologies from the ones currently used in the sector.
Through Circular Economy monitoring or energy-efficient operations performance	Monitoring Energy efficient operations performance	#2	Identify at least a 10% improvement on the Fuel Operational Consumption (FOC) model
Enhance the uptake of Circular Economy in the maritime sector	Performance of a Gap analysis	#1,#2,#3	The identification at least two improvements from the current business models used.
Knowledge transferability between academic and non-academic experts	Whitepapers & publications in professional journals	ALL	At least 2 technical papers or 4 papers in international conferences or journals introducing achievements and new approaches as applied in SmartShip use cases

Initial definition of Circular Economy KPIs Use case #3 and #4

Topic	KPI	Applied Use Case	Measurement Validation
Value added proposition to existing tools	Improvement in results of existing vessel performance monitoring tool	#3	At least 5% enhancement in anomaly detection and failure prediction of vessel machinery components due to SmartShip build-in functionalities
Circular Economy Concept	Introduction of Circular Economy criteria in maritime operation	#3	At least 5% improvement in Engine fatigue treatment and performance monitoring to prolong asset lifetime and retain value.
Circular economy	Reuse and remanufacturing strategies and operations	#3	Development of at least 1 reuse and remanufacturing Database of materials for engine components
Circular Economy	Collaboration to foster an extended lifetime of products	#3	At least 1 contact with stakeholders on the product life supply chain
Value added proposition to existing tools	Improvement in user friendliness and experience	#4	User acceptance validation test by DANAOS staff
Enhance the uptake of Circular Economy in the maritime sector	Performance of a Gap analysis	#1,#2,#3	The identification at least two improvements from the current business models used.
Knowledge transferability between academic and non-academic experts	Whitepapers & publications in professional journals	ALL	At least 2 technical papers or 4 papers in international conferences or journals introducing achievements and new approaches as applied in SmartShip use cases

Thanks for your attention



Questions