

SmartShip's Innovative Approach

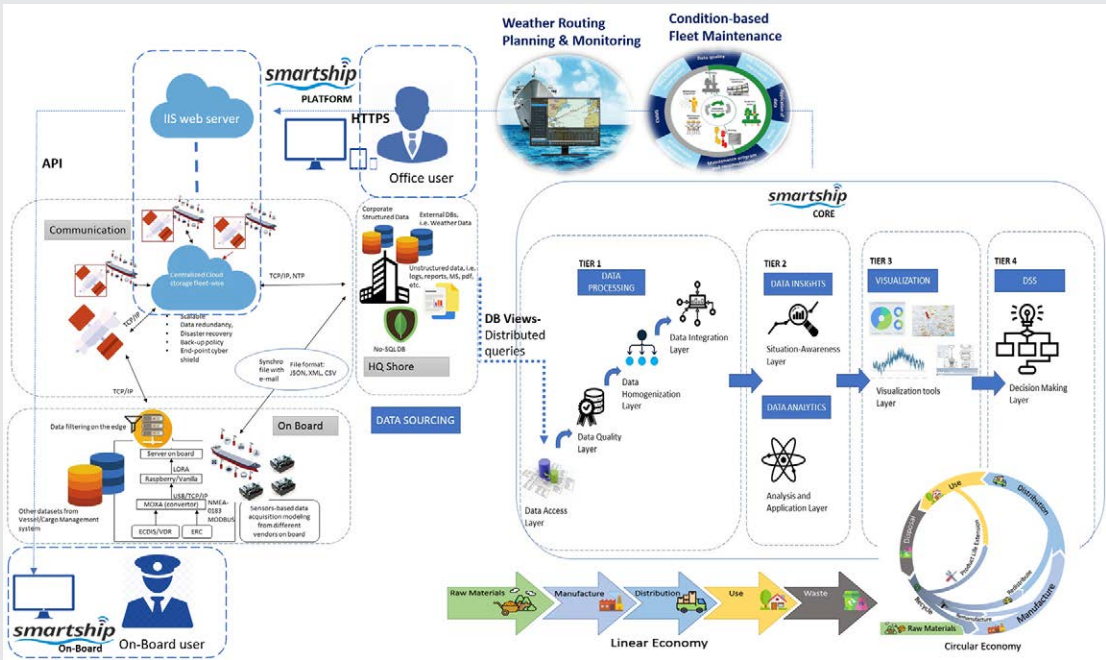


Figure 1: The SmartShip system is a data analytics, decision support, and circular economy-based multi-layer optimization platform.

Why SmartShip?

The maritime industry faces a critical challenge in reducing greenhouse gas emissions, with the International Maritime Organization targeting a 50% reduction in international shipping emissions by 2050 compared to 2008. Achieving this goal necessitates transition to more sustainable policies. Incorporating energy-saving devices and adopting necessary investment strategies are vital for enhancing existing operations and complying with the new regulatory environmental schema. While expensive retrofit solutions hold promise, they also pose challenges and uncertainties regarding their technical effectiveness and return on investment. This is the reason that you should first look at the way you are doing things, how you operate your vessels today, and try to achieve cost-effective improvements before

you move to heavy investments. To do so, it is crucial to examine policies and decisions through a digital transition and a data-driven approach, which is precisely what the SmartShip system offers.

The SmartShip project stands as an example of innovation, seeking to redefine the maritime sector's approach to sustainability. The main objective of SmartShip is to facilitate a profound transformation, aligning the industry with international emissions targets and embracing circular economy principles.

What is SmartShip Project?

At its core, SmartShip is a data-driven holistic framework, designed to optimize energy efficiency, reduce emissions, and enhance fuel consumption in maritime operations (Figure 1). The SmartShip system offers a data analytics,

decision support, and circular economy-based multi-layer optimization platform. It introduces a new way of approaching ship design, operation, and maintenance, aligning with the global trend for greener and more sustainable fleet management.

What is the SmartShip System?

SmartShip takes advantage of cutting-edge tools and frameworks to build and develop the project's holistic system by researching the following fields:

- Energy efficiency management and monitoring
- Emissions control in the maritime sector
- Cloud-based and Internet of Things (IoT) systems usage in the maritime industry
- Sensor technologies for maritime applications
- Algorithms and optimization techniques, including Life Cycle Assessment
- Advanced data analytics and decision support systems

The SmartShip system is characterized by three foundational components, each playing a pivotal role in its success:

1. **Data sourcing (IoT):** At the base of the SmartShip architecture, this component considers tools, communication protocols, and network topology for data retrieving, pre-processing at the edge, and finally, transferring information to the SmartShip core for further processing and analysis.
2. **SmartShip core system:** The heart of the ecosystem, the SmartShip Core, is where data is processed, analyzed, and visualized to support decision-making for critical maritime operational procedures defined in the project's use cases:
 - a) **Weather routing optimization:** This use case provides optimized routing advice to onboard masters, considering various factors, including weather conditions and individual vessel characteristics, to reduce fuel consumption and enhance efficiency.
 - b) **Route monitoring:** Complementing

the first, this use case continuously monitors vessel progress along their planned routes, ensuring they stay on course and documenting any deviations.

- c) **Condition-based maintenance:** Leveraging technology-driven fleet performance monitoring, this use case optimizes maintenance practices through historical data analysis, predictive analytics, and strategies to ensure peak performance.

3. **User applications:** The top layer facilitates practical utilization of insights derived from data analysis. It allows onshore and onboard users to use data insights for informed decisions, fostering interaction between shore and vessels, enhancing sustainability.

A Circular by Design System and its Benefits

About 47% of maritime businesses use IoT and advanced data analytics techniques to measure and forecast fuel consumption. Increased IoT uptake will improve the monitoring of ship components and improve longevity and performance, while real-time monitoring will enhance the scheduling of maintenance when necessary.

Embedding circular economy principles in the different components of the SmartShip system is the novel proposition of the project, which brings benefit to the existing data driven approaches in the industry. Circularity characteristics to consider in the development of the platform are:

- **Circular attributes:** Location, Condition, and Availability
- **Circular design:** Modularity, Scalability, Functionality
- **Data collectors' requirements:** End-to-end security/privacy, Dependability, Operability
- **Trust:** Trustworthiness, Confidentiality, Security

The circular design concept of the SmartShip system comes with many notable benefits including:

- Digital transformation of vessels:
Maximize sustainable vessel utilization and ensure long-lasting durability of the assets.
- Value driven: Extract value from the large amount of data generated by digital transformation of vessels, ensuring an effective flow of information for natural capital rebuilding.
- Eliminate waste: Achieve waste reduction through data reusability and lean management in decision-making for fleet operation and maintenance.
- Green thinking and sustainability:
Minimize energy consumption per unit by effectively combining technologies.
- Integrated framework: Extends across the entire fleet and vessel's lifetime, pairing value drivers for efficiency through comparative analysis.

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A specialist in project management and business development, Fotis Oikonomou has gained experience in leading and managing projects in a diverse range of industries including logistics, port, shipping, and technology. He joined DANAOS as a senior consultant and research officer facilitating the planning and execution of research projects. He is participating in a number of EU research projects focused on applying innovative solutions in the maritime industry.