

Towards green shipping: A decision-support method for (plastic) waste minimisation

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Introduction

Every year, in the European Union, 7% to 34% of ship-related waste (i.e. 60-300 tonnes), is not delivered at ports (European Commission, 2018), and by extension is likely lost or disposed of at sea. The most common type of waste from the shipping industry is plastic (Moheea et al., 2012). Marine litter, and especially plastic marine litter, poses a serious threat to marine ecosystems and to human health, and serious economic damages to tourism, fishing, and shipping (Boucher & Bilard, 2020). Plastic consumption and plastic waste minimization efforts should therefore be at the forefront of the shipping industry's waste management efforts.

The management of ship waste has consistently been among the top ten environmental priorities of European ports (European Sea Ports Organization [ESPO], 2022). However, shipping is a global industry, making waste management optimisation particularly challenging, as the legislative framework and implemented practices vary significantly between home ports and ports of call. The International Maritime Organization's Marine Pollution Convention (MARPOL) is the main international policy instrument concerning ship waste management at sea. MARPOL mandates minimum waste segregation and management requirements and prohibits the disposal of plastic waste at sea. Nonetheless, proper waste segregation onboard is often inadvertently disincentivized by the improper waste segregation at port reception facilities (European Commission, 2018).

As the maritime industry navigates towards greater sustainability, addressing waste management practices becomes paramount. Sustainability and reporting against the shipping industry's performance is necessary to create value and growth opportunities for the industry (Di Vaio et al., 2020). Amidst this landscape, the Cypriot shipping industry emerges as a potential catalyst for driving environmental stewardship and fostering the transition towards a green and circular economy since Cyprus is a pivotal flag state which plays a significant role in global maritime operations. The nation boasts a robust merchant fleet, totalling approximately 24 million gross tonnage, making it the third-largest registry within the European Union and the eleventh-largest globally (Shipping Deputy Ministry [SDM], 2020).

While considerable attention has been devoted to decarbonization initiatives within the Cypriot shipping industry (e.g. Nisiforou et al., 2022), research focusing on waste minimization and optimization of waste

management practices remains relatively sparse. In light of the growing emphasis on sustainability and regulatory compliance within the shipping industry, there exists an imperative to bridge this knowledge gap and explore avenues for enhancing waste management practices.

Method

ISOTECH Environmental Research and Consultancy developed and owns the the DeCyDe-4 method and tools used to engage stakeholders in informed decision-making processes. The method is adaptable, site- and case-specific decision-support method that leads to informed, science-based, and justifiable decisions on issues relating to sustainability and resilience (Loizidou et al., 2024). DeCyDe-4-Shipping was designed specifically for the development of solution-oriented action plans for solid waste management in the shipping industry. The method was implemented in Cyprus over two consecutive years.

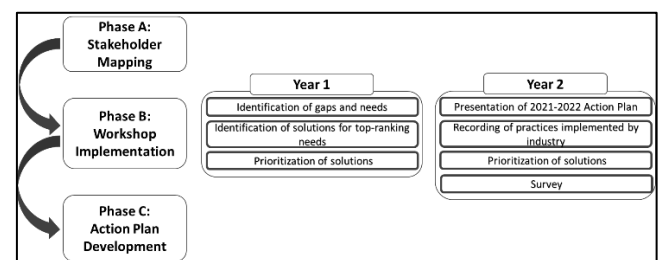


Figure 1. Schematic of the DeCyDe-4-Shipping method

DeCyDe-4-Shipping is structured in three phases (Figure 1): Phase A Stakeholder Mapping, Phase B Participatory Decision Support Workshop Implementation, and Phase C Action Plan Development. The first year of implementation (2021) served as the baseline study, a first scan for the identification of the problems of the industry related to waste minimization and waste management optimization and resulted in the development of the first Cypriot Action Plan for Waste Minimization and Waste Management Optimization in Shipping. In the second year of implementation (2022), progress was monitored, and a revised, more focused Action Plan was developed.

Results and Discussion

The Year 1 workshop was implemented in Limassol, Cyprus in October 2021, whereas the Year 2 workshop took place in Nicosia, Cyprus in October 2022, as a side event to the 9th Environment for Europe Ministerial Conference. Thirty-nine stakeholders representing the Shipping Deputy Ministry of Cyprus (SDM), the Cyprus Port Authority (CPA), the Cyprus Shipping Chamber, representatives of ship owners, operators and shipping industry suppliers, NGOs working on environmental issues that concern the shipping industry, and privately managed port terminals participated at the workshops.

The first year of implementation of the DeCyDe-4-Shipping method resulted in the identification of the industry's main gaps and needs regarding waste management, and the identification of solutions to address the main needs. This led to the development of the first-ever waste minimization and waste management optimization action plan for the Cypriot shipping industry. The second year of the DeCyDe-4-Shipping method

implementation engaged stakeholders in the reporting of the practices that they implement within their organizations to advance the Action Plan, and in the prioritization of the solutions for improving waste management in shipping.

Thirty-five practices implemented by the Cypriot shipping industry to minimise waste production and optimise waste management were recorded. Some of these practices are implemented in Cyprus whereas others, reported mainly by shipping management companies and logistics/supply provisions companies, concern practices that are implemented on-board or at ports of call, and are thus more international.

The recording of implemented practices provided the background against which the shipping industry set its revised, more focused Action Plan. The developed Action Plan includes 12 actions split across four Pillars:

- Pillar A: Creating fit-for-purpose port reception facilities. The identified actions concern the better definition of waste categories to align with MARPOL and practices on board, the development of the necessary infrastructure to promote waste valorisation, the revision of fees to incentive waste minimisation, and progressive actions for transforming Cypriot ports into pioneering Circular Ports.
- Pillar B: Policy implementation and enforcement. Three actions are included in the Action Plan, and they concern improved monitoring of the amount of waste produced per category or waste, the imposition of fines to polluters through more effective controls, and the formalization of synergies between stakeholders for better policy implementation.
- Pillar C: Research and Innovation. The three actions included in the Action Plan concern the identification of the main technological research and development needs through discussions with stakeholders across the supply chain, the incentivization of the application of innovative technologies on board and at port reception facilities that can contribute to waste minimization, and the financing of solution-oriented R&D through a dedicated call for proposals.
- Pillar D: Environmental behaviour and awareness raising. This pillar includes actions that should be considered horizontal activities, implemented alongside all other actions in the Action Plan. These include awareness raising campaigns for the public, education for crew and decision makers, and the establishment of a business reward/award scheme specifically for waste minimization and circularity.

Conclusions

Shipping is of vital importance to the economy of Cyprus, not only because of its contribution to the island nation's gross domestic product, but also because Cyprus depends almost exclusively on the shipping industry for trade. While decarbonization is rightfully a priority for the shipping industry, waste management should not be neglected as it is intrinsically linked with the good environmental status of the marine environment, resource efficiency, circularity and thus climate change. The industry must thus be incentivized to concurrently work on minimizing resource consumption and optimizing waste

management, adjusting and adapting its supply and value chain so that it becomes more circular.

Here we present the DeCyDe-4-Shipping method for engaging the Cypriot shipping industry in the identification of waste minimisation practices and overall waste management optimisation. The work resulted in the recording of practices that are already implemented by the Cypriot shipping industry and in the development of an Action Plan containing actions that are relevant, effective, implementable, and stem from stakeholder consensus and industry commitment.

The wide geographic coverage of the waste management minimization and optimization already implemented by the Cypriot shipping industry demonstrates the positive impact that the industry can have globally, whereas the defined Action Plan demonstrates that the industry recognises the need to further work towards minimising its contribution to marine litter pollution. Through the participatory and consensus-based approach of the DeCyDe-4-Shipping method, which brings together all the key stakeholders including policymakers, the industry holds ownership of the Action Plan. This in turn maximises the possibility that the identified actions will be taken forward.

The implemented work represents a significant step towards fostering industry-wide commitment to waste management optimization. By empowering stakeholders and fostering collaboration, this approach has the potential to drive meaningful change and pave the way for a more sustainable future in the shipping industry.

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