Policy Agenda for Eco-Efficient Maritime Industry in the Baltic Sea region

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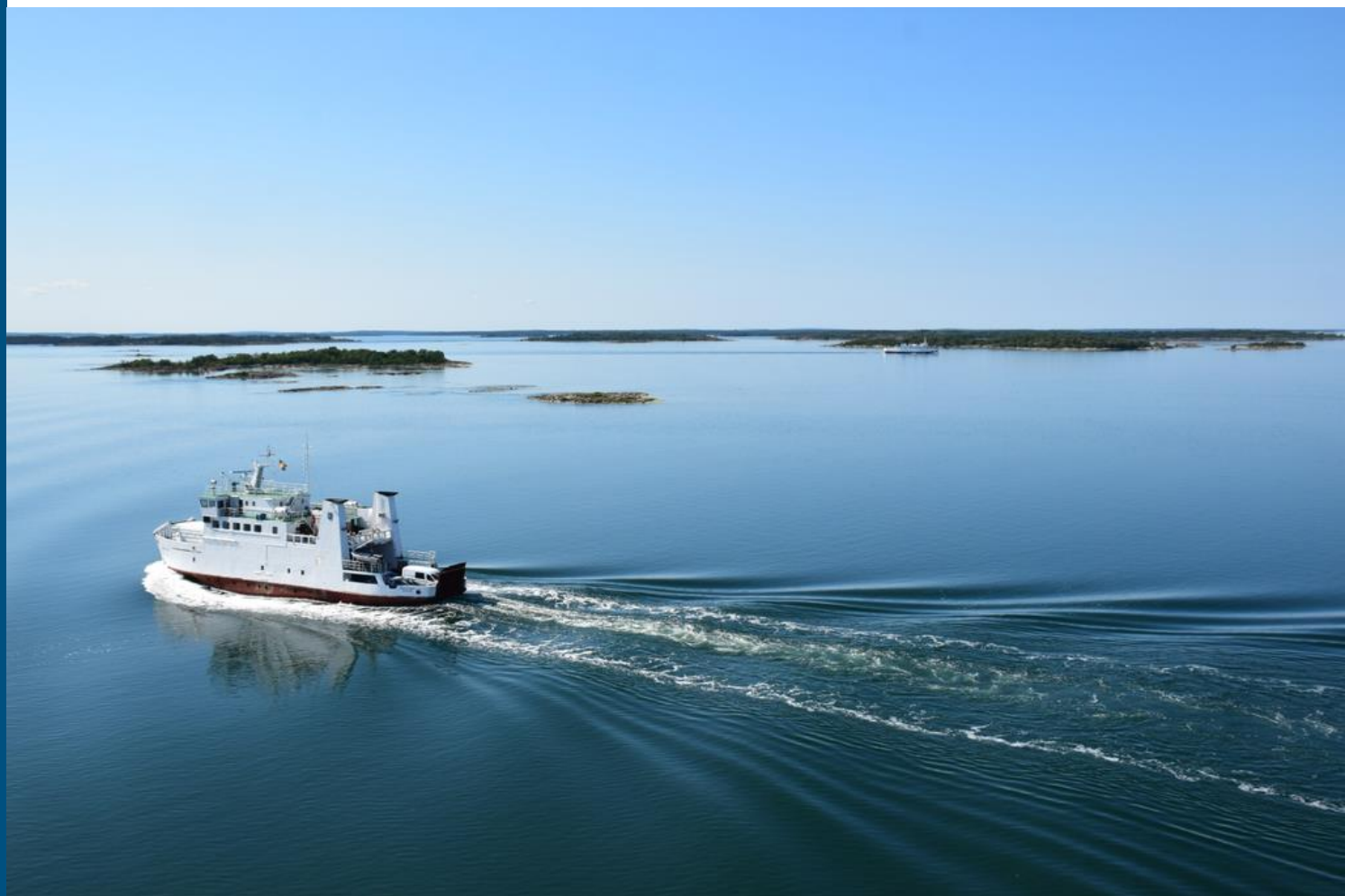


ECOPRODIGI – Bringing Eco-efficiency and Digitalisation to the Maritime Industry

The aim of the ECOPRODIGI project is to increase eco-efficiency in the maritime sector of the Baltic Sea region by creating and piloting digital solutions in close cooperation with industry end-users and research organisations. Ultimately, ECOPRODIGI supports the Baltic Sea region in becoming a front-runner in maritime industry digitalisation and clean shipping.

In the ECOPRODIGI project three technology cases were studied:

- **Digital performance monitoring of vessels**
- **Cargo stowage optimisation**
- **Shipyard process optimisation**

Digital performance monitoring of vessels enables a visible increase in eco-efficiency in shipping

Enhancing eco-efficiency in shipping is commonly connected to building new, more economic and more eco-friendly ships. However, this takes time and money and thus is out of reach in many subsectors of shipping. Through monitoring digital performance, it is possible to make both new and existing older vessels eco-efficient saving both the environment and money. With relatively simple and inexpensive digital solutions, shipowners can achieve significant results quickly, even in cases where there is no need to replace or economic possibility of replacing old vessels with new ones. Fuel consumption and emissions can potentially be reduced by up to 20%, according to data and analysis from distinct ship segments, routes and their baseline situations.

Many tactics and practises in vessel operation related to route choice, manoeuvring, machinery workload and other aspects can be done differently depending, for example, on weather conditions, water depth and timetable. Great potential exists for reducing fuel consumption and emissions, preventing engine breakdowns and reducing maintenance and repair costs.

These effects can be obtained by using digital technologies and models created for improving and predicting the operations of ships and their various components. The usable digital technologies and models include, for example, data capture from engine and bridge systems via sensors and flowmeters, high frequency data logging via low-cost IOT devices, use of AIS (Automatic Identification System) and weather (hindcast) data, connectivity via 4G or satellite, cloud storage and AI models enabling real-time monitoring and decision support and optimizing trim and intake of ballast water.

Recommendations and instruments for implementation

- **More emphasis should be placed on transforming existing vessels to be more eco-efficient.**
- **Different digital performance monitoring solutions that can be installed also on existing fleet are needed.**
  - Research and development of technology and software needs financing on both national and EU levels.
  - Technology development funds and programmes are suitable tools.
- **Shipowners should be encouraged to retrofit their existing vessels with new or better digital devices and software for monitoring vessel performance.**
  - Fuel costs savings are the best incentive, but investment aids could also be used in cases where reduction in emissions is specially desired (such as environmentally sensitive areas).
  - Vessels equipped with and using digital vessel performance devices could be allowed a reduction in dues and taxes such as fairway dues.
- **Promoting the use and development of international standards for data exchange and performance monitoring is crucial.**
  - The EU and the International Maritime Organization (IMO) need to work together with the International Organization for Standardization (ISO) in this topic.
  - Expert groups consisting of data professionals, shipping company representatives and officials on different levels are needed to carry the work on.
- **Training users both onshore and onboard in the discipline of digital vessel performance monitoring is crucial to utilise all its potential.**
  - Maritime academies and schools should include this theme in their basic education programmes and provide courses as part of their further education programmes. It is very important to do this in cooperation with both the shipping companies and the system developers.
  - Different types of national and international funding programmes are recommended for supporting this as training improves competitiveness of companies, skills of students and employees and interaction between companies and schools.

Optimising cargo stowage processes increases effective use of ships

The primary role of ships is to efficiently transport cargo and, in some cases, passengers. Cargo loading and discharging times should be as short as possible and all waiting in anchor and in ports should be avoided. This would benefit both the shipowners and the environment. Existing vessels can be operated more efficiently, and fewer ships may transport the same amount of cargo. The speed of ships can be optimised, most often reduced, minimising emissions and purposeless waiting. Clients will also benefit as their waiting times shorten and service improves.

Current inefficiencies in cargo handling and stowage processes can be diminished using digital technologies. It is important to look at the whole logistics chain from producer to end user, not only the maritime part of it. There are many sub-processes from booking cargo units through all steps in the port and ship operations until the cargo leaves the port of destination to be transported to the receiver.

The main emphasis of the ECOPRODIGI project is focused on port operations and the loading and discharging operations of ships, especially Ro-Ro vessels. However, the needs to develop the other parts of the logistics chain was also recognised. The optimised system needs, for example, a reliable connection to ships sailing on oceans to receive data from them.

Simultaneous loading and unloading of a Ro-Ro vessel (dual cycling) speed up the cargo handling operations and reduce the time spent in port. This can be enabled by developing end-to-end cargo stowage ‘digital twin’ simulation models using 3D scanning. These simulation models can also be used in developing more optimal and eco-efficient plans for port operations. Optimal stowage based on digital data reduces the need to balance stability and trim with ballast water. According to estimations, fuel consumption and emissions can potentially be decreased by at least 2–10% per route and ship in the medium term, depending on the baseline situation.

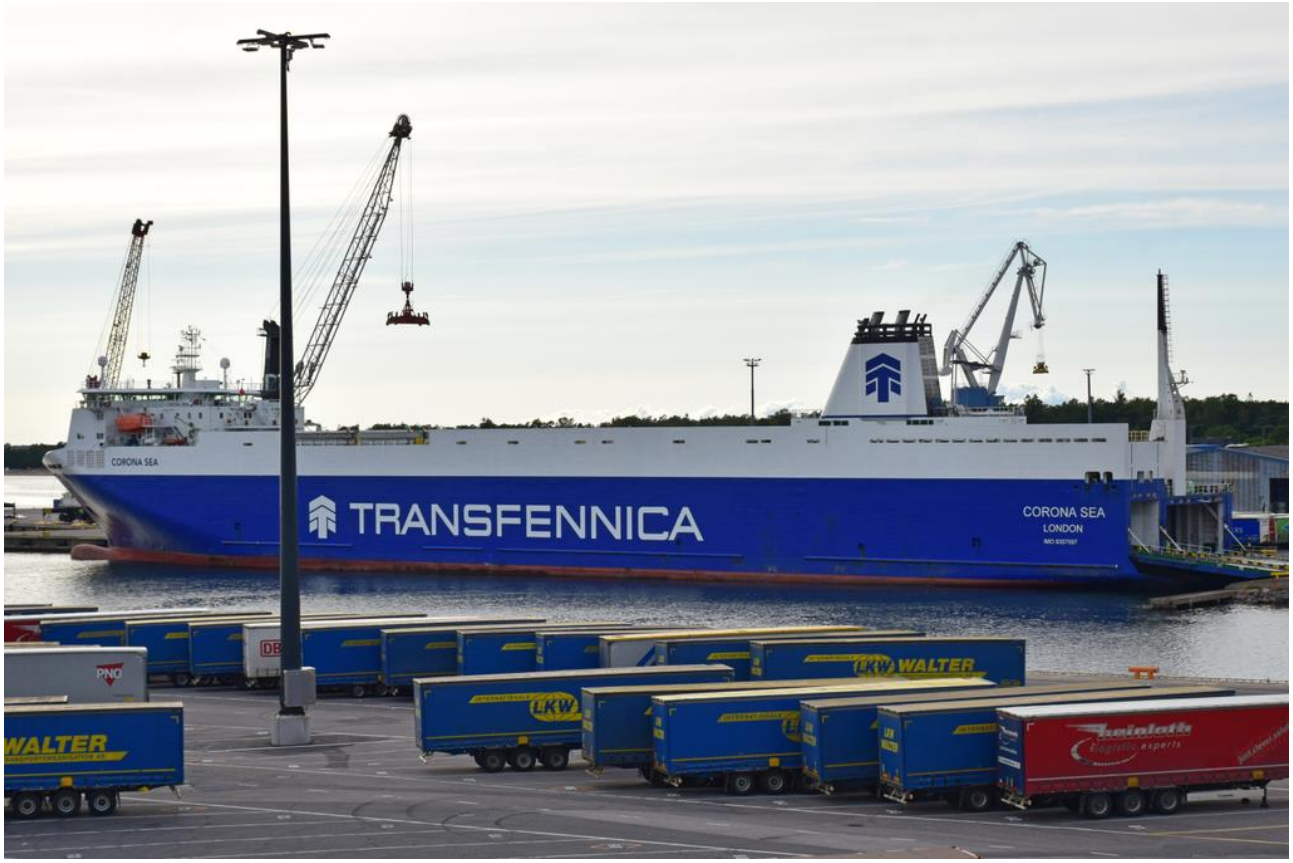
Even though the project focused on Ro-Ro ships, many of the results are valid for other ship types as well. Voyages with full cargo loads and those avoiding ballast are always preferable from both the shipowner and the environmental point of view. The same applies for the goal of minimising the time spent in ports. With more and accurate online data, a vessel’s speed can be optimised to minimise fuel consumption and emissions.

Recommendations and instruments for implementation

- **Digital technology has to be developed to be more sophisticated, reliable, cost-efficient and user-friendly.**
  - Investments in research and innovations in solutions and automation should be promoted on both EU and national levels.
- **Data capture, storage and performance monitoring need more standardisation.**
  - Standards for sharing cargo unit and vessel positions and conditions across the logistics chain and for maritime cyber security are essential.
  - International vessel voyage codes for Ro-Ro vessels would also be useful.
  - The same procedures recommended in the case of digital performance monitoring of vessels are valid also in this case.
- **Data must be shared across the end-to-end cargo stowage process.**
  - Better cargo unit tracking and connectivity are needed.
  - IT systems and applications need development and user training.
- **Satellite connections for transmitting data from ships must be improved to be constantly reliable.**
  - This requires international cooperation and funding as the construction and maintenance of comprehensive satellite systems are costly and cannot be covered solely by users.
  - Policymakers are in key roles in enabling this kind of international cooperation which benefits all users regardless of nationalities or international borders.
- **Policymakers should actively promote the creation of an IMO-based regulatory framework covering Ro-Ro cargo units.**
  - The real weight and dimensions of each cargo unit is important data to be available before the loading plan is made.
- **Installation of automated mooring systems in ports is a good step towards more efficient port operations.**
  - Automated systems make the mooring procedure faster.
  - Safety of work on quays will be better.
- **The use of cold ironing (shore-to-ship power) in ports is highly recommended and deserves promoting and funding by national and EU authorities.**
  - Emissions from ships in port decrease remarkably, which has positive effects on the population's health in port cities.
  - EU-funded programmes are very suitable instruments in promoting systems like cold ironing and automated mooring. It is important to provide co-funding for these kinds of rather small, but in large scale remarkable solutions.

Recommendations and instruments for implementation

- **Training of crews, both onboard and in port terminals, and of clients is a top priority.**
  - Vessels and ports are different, so the digital solutions must be customised.
  - Simulation-based training and skill building are recommended and they need financing at least from the national allocations but EU co-funding would be appreciated as well.
- **As Ro-Ro shipping is particularly important in the Baltic Sea, EU programmes like Interreg Baltic Sea Region or Central Baltic provide useful instruments for co-financing in many of the above-recommended subjects. In addition to these, there is a constant need for flexible financing instruments customised specially for the maritime sector.**



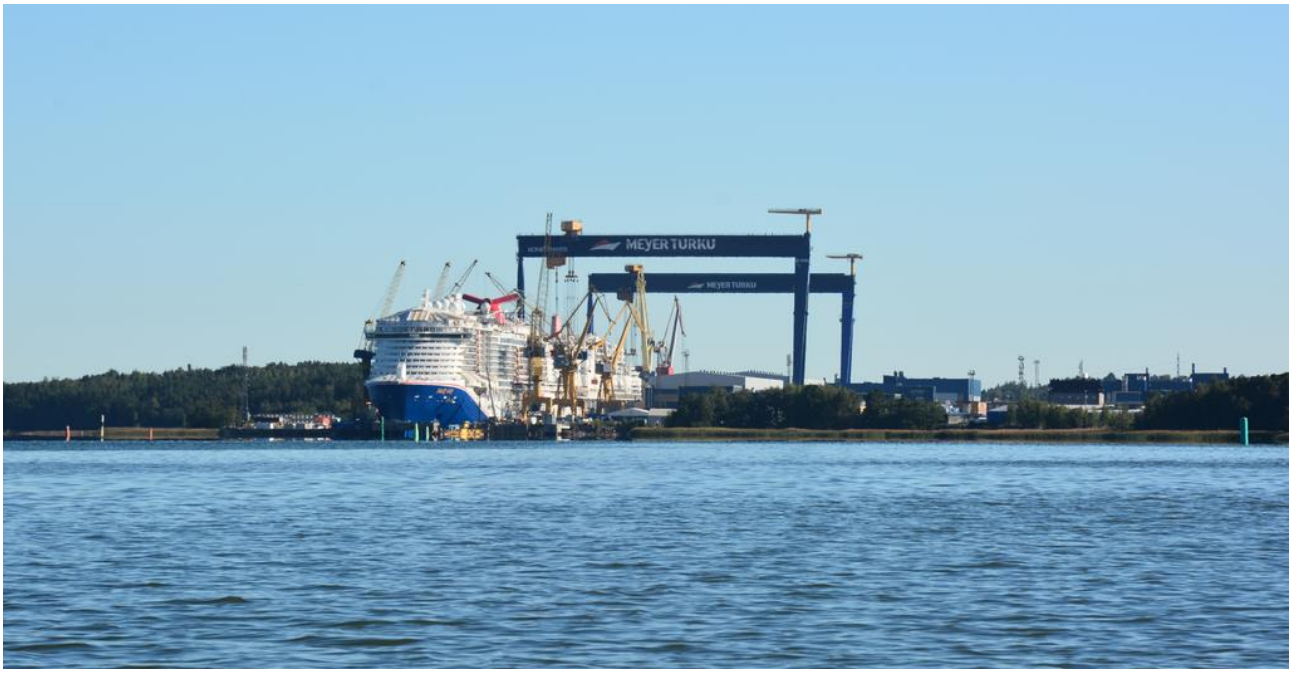
Optimisation of shipyard processes boosts productivity and eco-efficiency

Eco-efficiency in shipping is often focused on ship operations, but it is important to widen the perspective to cover shipbuilding and ship repair. Reducing waste material and improving recycling have direct positive effects on eco-efficiency. Increased productivity and efficiency of production processes have positive impacts as well, as there will be fewer useless transfers of items, fewer damages and less need for adjusting or fixing work phases.

There are many phases in the shipbuilding process where productivity and (eco-)efficiency can be improved. Optimised and digitalised operations and processes; restructuring of work; and capitalisation of new technologies like augmented reality and virtual reality applications, 3D and digital twins and other digital solutions can be used to reach this goal.

A shipbuilding process involves a lot of sub-contractors and other companies operating in the network of a shipyard. Thus, it is important to focus on process and supply-chain management to make the whole process more effective. Information-sharing and transparency across and between these companies is crucial and needs improvement.

The adaption of new digital solutions also has positive effects on the environment as material use can be reduced and less waste produced. It is possible to save man-hours as well because 3D scanning and measuring enable better process planning and proactive actions. The benefits of digital solutions also apply to ship repair.

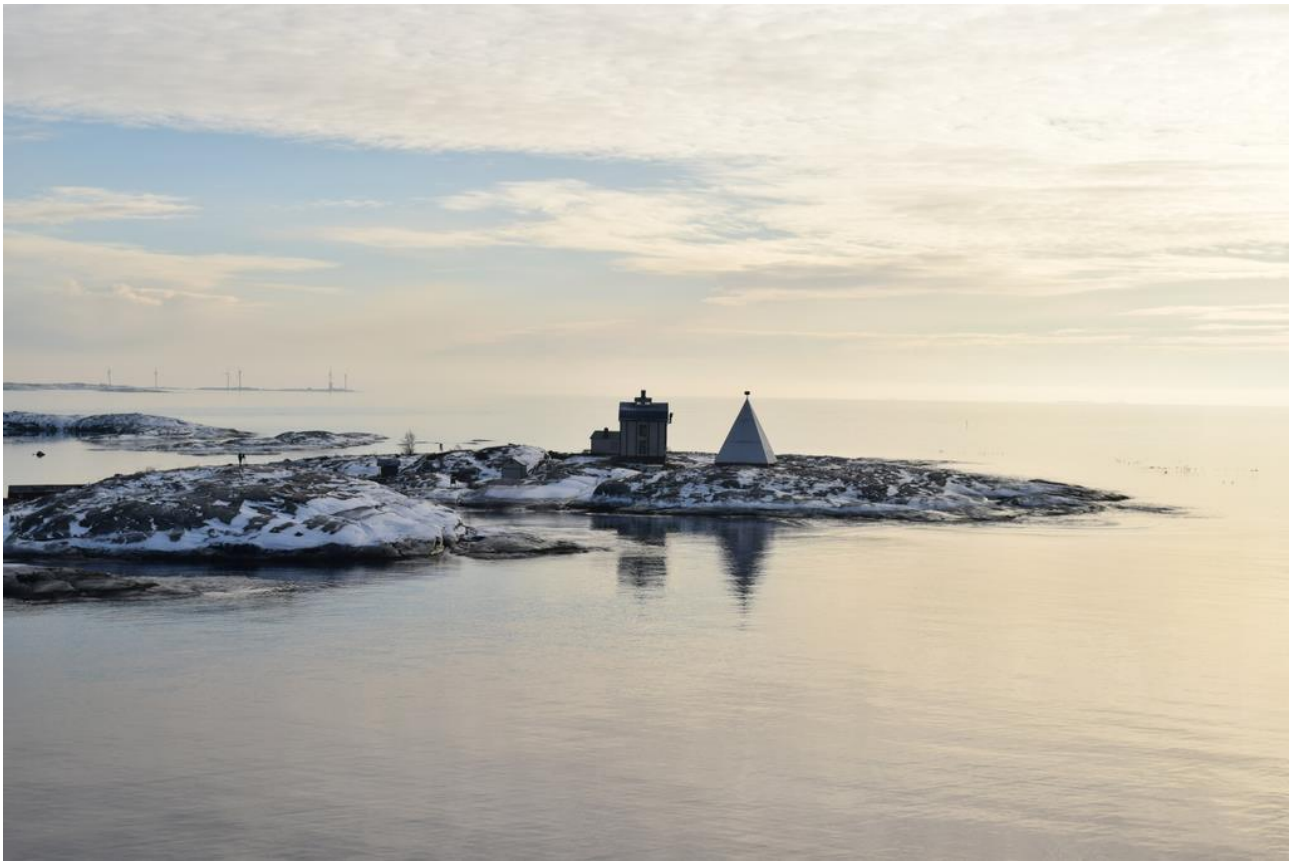


Recommendations and instruments for implementation

- **Digital solutions have many benefits in shipyard processes.**
  - They can be used in basic work like in monitoring welding quality in real time or in using welding robots.
  - There is much potential in real-time planning and problem reporting, improving task training and handover, and controlling and managing warehouse inventory.
  - With 3D printing, it will be possible to manufacture spare and missing parts.
  - Both developing and implementation of the solutions will benefit from policies enhancing both digitalisation in general and maritime processes in specific.
- **New operating methods and policies have to be applied across the supply chain to get all advantages of them.**
  - All subcontractors will need to follow the same instructions which is a challenge to the management of the supply chain and network.
  - More information exchange and visibility are needed across the supply chain.
  - External experts and advisors have a role in implementing these methods and policies.
- **Special emphasis must be placed on enhancing the digital capabilities and knowledge of small and medium-sized companies.**
  - Financing via EU and national programmes is recommended.
  - This benefits many other sectors as well.
- **Knowledge-sharing within organisations needs to be improved.**
  - Knowledge management is one key issue in the transition to a digitalised working environment.
  - Personnel must be convinced to realise the benefits knowledge-sharing provides.
  - Cooperation between companies and education providers has a crucial role in the process. This cooperation will get stronger by support from policy level decisions.
- **Technological capabilities for processing large amounts of data to share and view data online need investments.**
  - Funding for research, development and innovation (RDI) work on sophisticated software is essential.
  - Inputs on both EU and national levels in technology RDI-programmes are needed.
  - New financing instruments which are more flexible and suited to both large and small enterprises are required.

Recommendations and instruments for implementation

- **Education rises to a top priority in promoting the digitalisation of shipyard processes.**
  - Employees must have skills and readiness to use the new digital technology.
  - Further education via courses and other methods locally and in institutes is highly recommended.
  - The crucial role of education needs to be noticed on both EU and national levels, and more focus must be put on ensuring proper resources for the educational programmes.



Conclusion

Some basic elements are common to all three technology cases studied in the ECOPRODIGI project. They have to receive special emphasis at national and international levels if the possibilities the digital solutions provide are to be fully realised. Usability of these solutions and applications is, in many cases, not restricted to the maritime sector; they can be applied in many other sectors as well.

The represented views and findings are based on research conducted in the project and on observations of mutual dialogue between the academics, industry end-users and policymakers in many events and other interaction during the project. They share the common view, that promoting the topics mentioned in this policy agenda are essential in making the construction and operation of ships more eco-efficient and sustainable.

A good foundation for making the maritime industry more efficient and sustainable through digitalisation already exists. However, **there is significant potential for further development of technology, solutions and applications**. We have only taken the first steps on the road of digitalisation. Therefore, research, development and innovation work in this subject area must get enough funding at EU and national levels. Investments in RDI activities will be recouped by higher productivity, safer working environments and less fuel consumption, emissions and waste, which makes them well worth promoting.

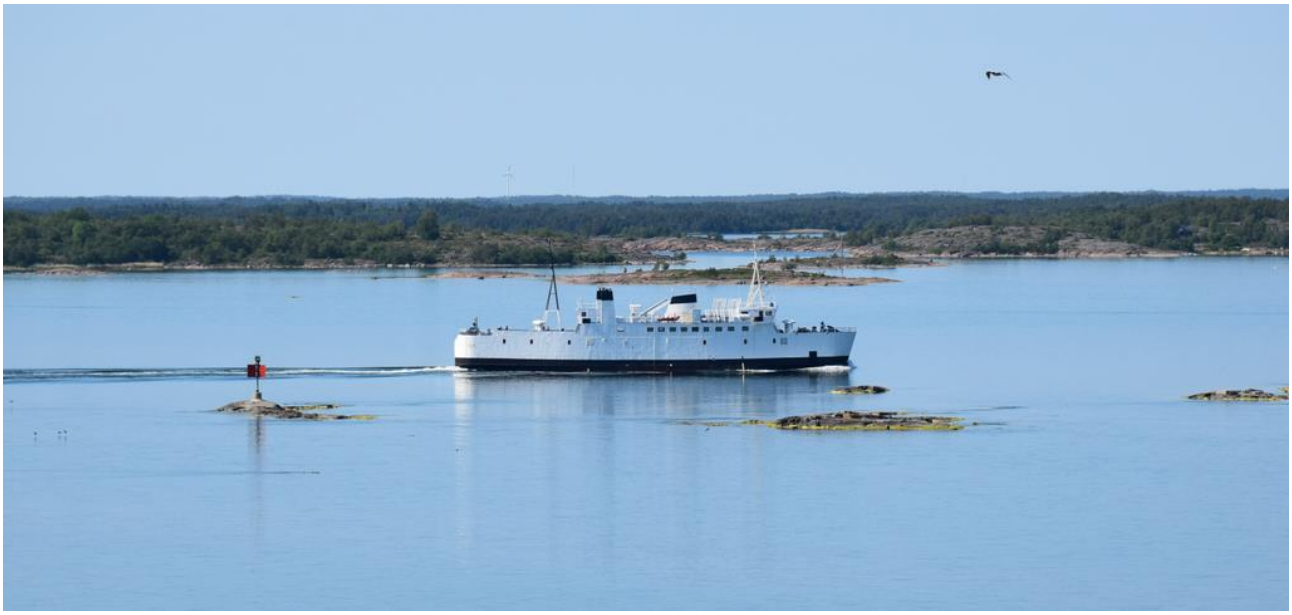
Standardisation of several maritime-related things and procedures would promote the utilisation of digital solutions. Reliable, secure and fast transfer of information is crucial in the digitalised operational environment. The IMO plays a crucial role in the standardisation of maritime matters and the ISO is responsible for standardisation in general, but the EU can also promote standardisation by giving instructions, for example directives, which each member state follows.

The benefits of standardisation are not limited to digitalisation; they are also obvious in safety and security matters, and in environmental issues. One good example is cold ironing, the provision of onshore electricity to power ships while at berth. The needed technology has been available for a long time, but a lack of standardisation limited its implementation. At last, in 2019, an international standard was achieved, which will greatly enhance the use of cold ironing. This shows that promoting the standardisation efforts is crucial in ensuring that new and more eco-efficient technologies can be adopted quicker.

New digital technology, solutions and standards are essential, but **training and education are key factors in getting personnel to adopt new digital solutions**. This applies to all cases presented in this policy agenda and should be noted at all possible levels (local, national and international) and in all possible institutions, from educational institutions to political decision-making. Technology without personnel who are willing and able to use it is worthless. Education is a top priority, and lifelong learning is an essential part of every employee's working life.

Conclusion

During the last ten years many significant environmental regulations negotiated and decided on different policy levels have come into force. Important examples of them are limits on sulphur oxides (SOx) emissions from ships, Energy Efficiency Design Index (EEDI) and the Ballast Water Management (BWM) Convention. Currently the main focus is on reducing greenhouse gas (GHG) emissions from ships. According to the IMO initial GHG strategy, the total annual GHG emissions from international shipping should be reduced by at least 50% by 2050 compared to 2008.



The topics researched in the ECOPRODIGI project support the GHG strategy in many ways. Solutions developed in the project help the maritime industry to achieve the goals. The project has shown the importance of cooperation between academics, industry and policymakers when developing and promoting new technology and solutions – in this particular case in maritime industry, but the same applies to other sectors as well. An active goal-oriented dialogue between the technology developers, industry end-users and policymakers is crucial. Goals have to be ambitious enough, but reasonable enough to achieve them with the technology and solutions the developers are able to produce and that the end-users are able to obtain and use as well.

The dialogue can take place in established organisations and working groups. In addition to this, projects like ECOPRODIGI are very good generators of dialogue as they gather developers, industry end-users and policymakers together around a burning issue.

Further reading:

Publications and other ECOPRODIGI outputs are available on the website of the project:
https://ecoprodigi.eu/publications

The project:

ECOPRODIGI is funded by the Interreg Baltic Sea Region Programme
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