WP2. Preparing for Green Energy Transition in SMSPs Ecosystems

Deliverable 2.1. Green Energy State of the Art Record in SMSPs of SBA

Introduction

To assess and enhance the situation of Small and Medium-Sized Ports (SMSPs) in the South Baltic Region, a survey was conducted to gather insights from key stakeholders in maritime logistics, energy generation, and energy supply sectors. The objective was to identify technologies, challenges, opportunities, and potential areas for development that could improve operational efficiency and sustainability in the Green Energy Transition of SMSPs.

Methodology

The survey (interview) targeted organizations working in the Ports or related to ports' relevant industries, collecting both qualitative and quantitative data regarding their experiences, challenges, and perspectives. In addition to professional insights, respondents were asked to provide basic information such as their name and email address to enable further clarification or follow-up if necessary and invite them to the future DigiTechPort2030 events and trainings, and digital map as well.

Report on findings and analysis

The collected data was securely stored and processed exclusively for research purposes. The survey adhered to the European General Data Protection Regulation (GDPR), ensuring that participants' personal information remained protected. Respondents were also informed of their rights, including the ability to request access to or delete their data at any time.

We received 81 responses till now. The distribution of the responders among countries is shown on fig. 1. There are 28 from Lithuania, 29 from Poland, 11 from Sweden, 9 from Germany, one from Norway and one acting in Latvia, Poland and Croatia.

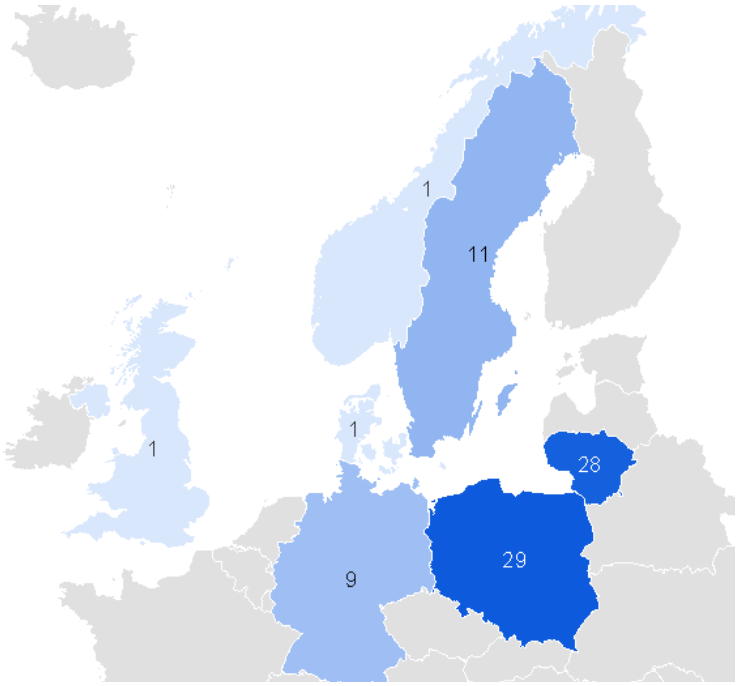

Figure 1 The distribution of responders.

We defined 5 sectors of operating which are related to maritime business within them responders indicated their own in following numbers:

Sector	Number
Associations	5
Chambers of commerce	1
Equipment and technology suppliers	5
ICT	1
Offshore oil and gas	2
Port authorities	9
Public authorities	3
Renewable Energy Supplier	3
Renewable Energy Technology Provider	3
Research park	2
Shipbuilding & Repair	9
Shipping companies	6
Stevedore company	9
Terminal operators	9
Other	23

Among "other" entities are also institutions or enterprises which act in more than one sector. Additionally, 4 more sectors were defined:

Sector	Number
Consulting and design	7
fishery	1
other port services	13
maritime education	1

The others port services include: heavy industry, tourism, forwarding, custom, port and ships agencies, logistics, medical research, pilotage and towage services and a free economic zone.

On the question of when your organization was founded, 42 of them answered that it was established in 21st century and 35 in the previous century, but the four oldest were founded before 1901 year (Fig. 2)

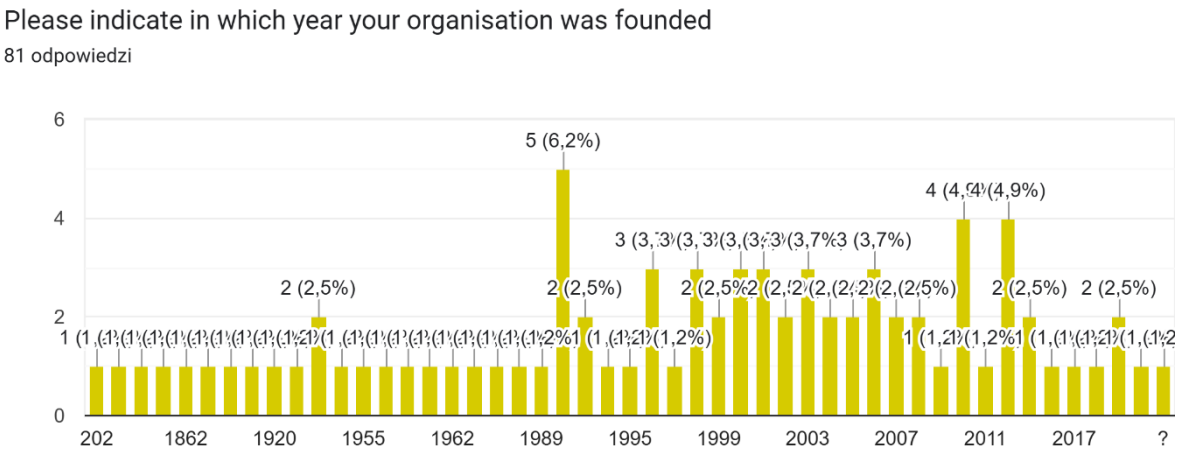

Figure 2 The year of founding the organizations.

The distribution of organizations age is shown on the below figure. Most (44) of the interviewed organizations are between 10 and 30 years old.

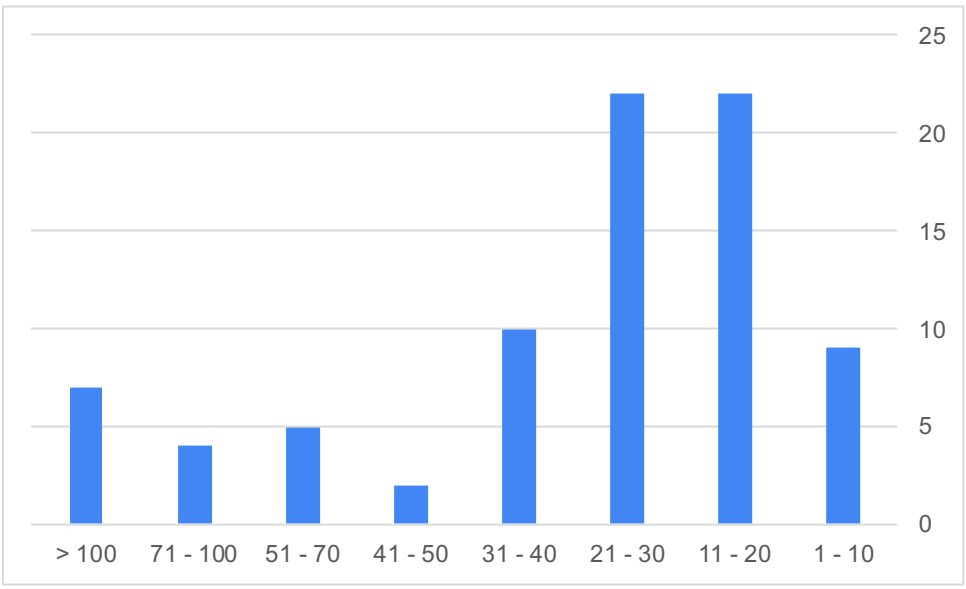

Figure 3 Distribution of the companies age.

The size of the organizations is defined by the number of employees. The next figure presents these numbers.

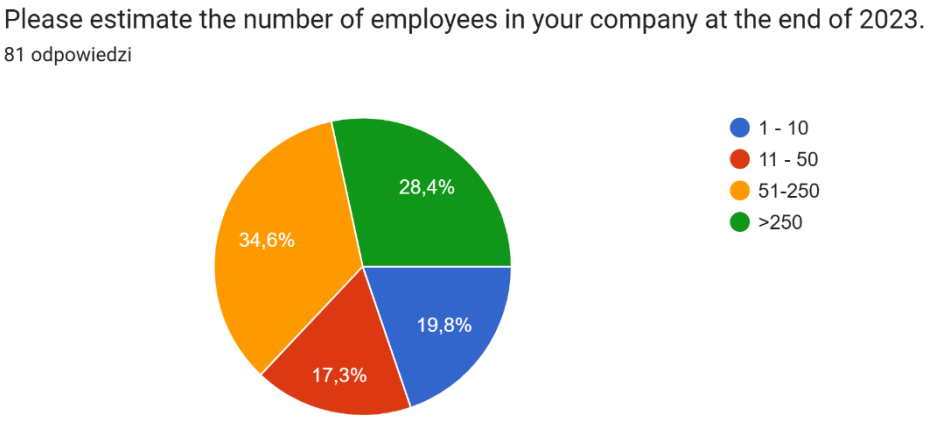

Figure 4 Numbers of employees.

Further parts of questionnaire were included questions divided into activities on strategic, management and operational levels.

The strategic level

Among the surveyed organizations almost 50% have a long-term strategy developed which complies with sustainable development goals, including the transition to Green Energy.

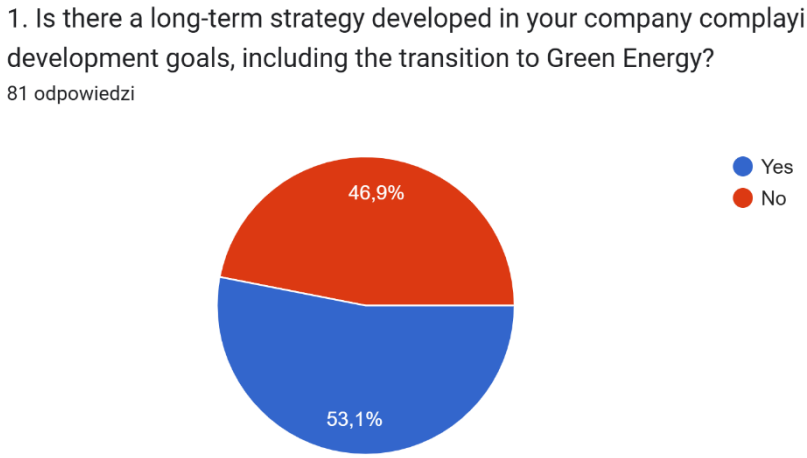

Figure 5 The number of institutions having a green long-term strategy

In 43 responders there is a long-term strategy which complains to sustainable development goals. Four of them have not introduced the long-term strategy yet, but those implemented ones, have begun after 2000.

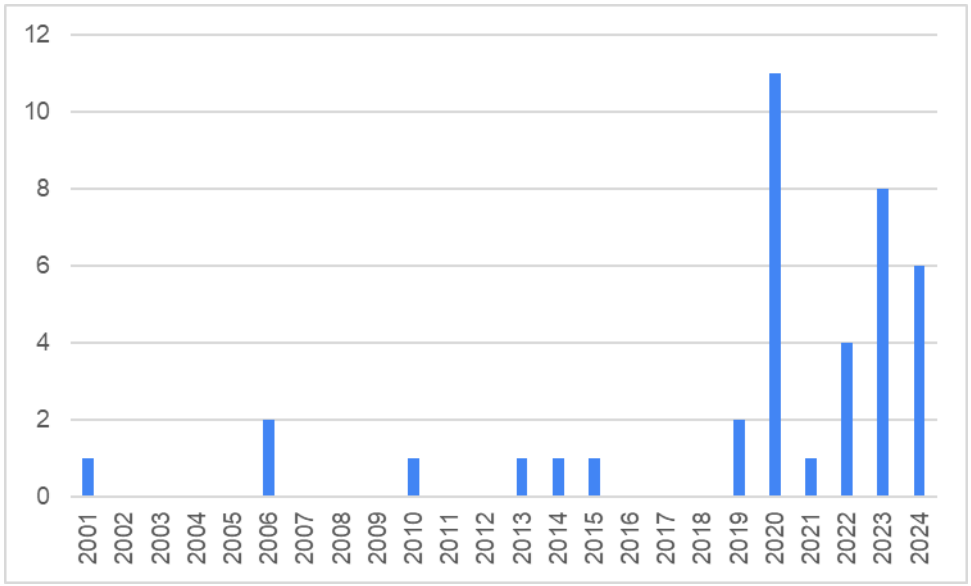

Figure 6 The year of implementation the long-term strategy

Four of them have not introduced the long-term strategy yet, but those implemented ones, have begun after 2000. Three organizations emphasized that it has green strategy from the very beginning of them

The following key reasons were for developing the strategy:

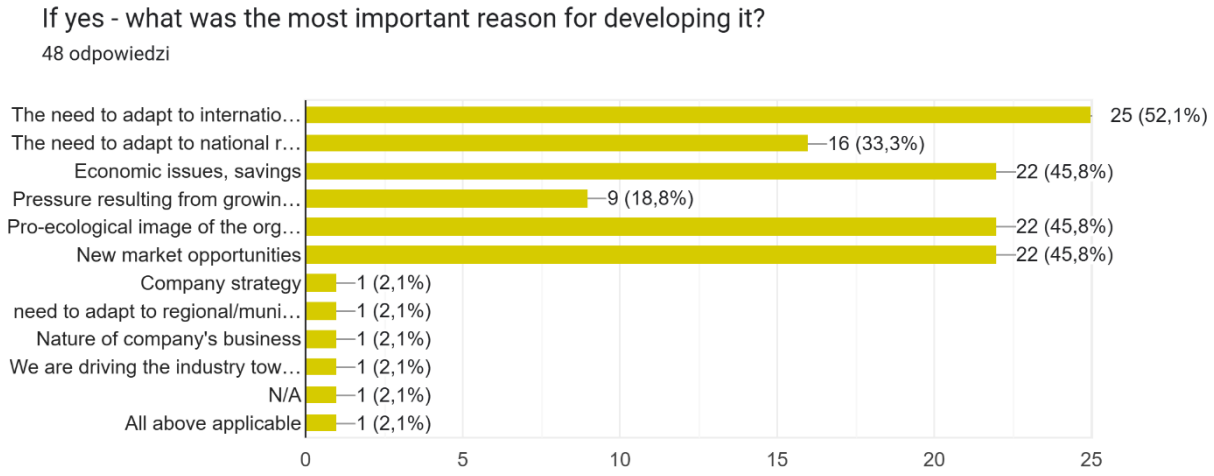

Figure 7 The most important reasons for developing the green long-term strategy

There were six pre-prepared answers:

- The need to adapt to international / EU regulations
- The need to adapt to national regulations
- Economic issues, savings
- Pressure resulting from growing public awareness
- Pro-ecological image of the organization
- New market opportunities

but responders indicate also the others:

- company strategy
- need to adapt to regional/municipal regulations
- Nature of company's business
- We are driving the industry towards our vision of net through our GHG rating and MEP

More than 50% of organizations confirmed a cooperation with authorities.

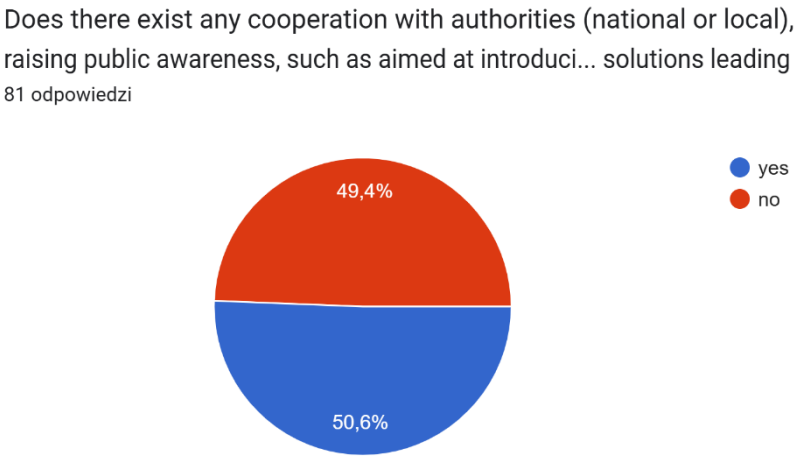

Figure 8 The cooperation with authorities

There are examples of cooperation indicated by organizations below:

	Achievements are publicized both in the media and among stakeholders. It also publicizes internationally
1	agreed pollution reduction requirements for shipping companies to raise public awareness
2	Consultation with port authorities
3	Cooperation projects, application development in different fields towards green transition
4	Cooperation to launch a photovoltaic installation
5	Cooperation with the port administration in the implementation of the green port concept
6	Customer education, participation in conferences
7	Energetic ministry, Environmental protection department
8	European network of maritime clusters, cluster collaboration platform, un global compact
9	Goverment sunsidies when implementing solar panels or electrc cars
10	Hafen Hamburg Marketing e.V, Eurogate, NOW GmbH, German Renewable Energy Federation (BEE) and Erneuerbare Energien Hamburg
11	HHLA as partly owned by Hamburg works with Hamburg marketing and strategic agencies
12	IAPA, ESPO and various national authorities around the world
13	Innovation Agency, Invest Lithuania, Klaipeda ID
14	Klimaallianz Schwerin
15	Lithuanian maritime cluster
16	LNG ships building
17	Logistikia, Participating in EU-project 'Sustainable Flow', local and regional municipalities
18	Mare Foundation – ecological bins for collecting garbage in port basins
19	Municipalities, Educational Institutions
20	Municiplepalacy
21	ports, sea terminals
22	Projects
23	Province gouverment. Marshall and president of Szczecin City
24	Race for the Baltic
25	Regional authorities cooperating with local ones and universities
26	Regular meetings with authorities and local communities
27	representatives from the company attended as a speakers at various conferences

28	There are ongoing discussions still as this transition requires huge investments and without EU or LT government support it will not happen very quickly
29	Various partnerships such as work with port of London and AD ports
30	various port authorities and customers with links to national agencies
31	Very close collaboration with Baltic Ports Organization
32	We as an organisation faciltiates triple-helix collaborations to support the green transition of the society as well as for single organisations.
33	We collaborate with national authorities and initiatives such as "state of green" which is aimed at raising private-public as well as cross country collaboration and dialogue
34	WFOŚiGW in Szczecin
35	Work with Port Authority in Gävle, Sweden and with Port Authority in Oslo, Norway
36	Yes, many maritime universities and institutes, including those like the Maritime Institute at Gdynia Maritime University, often cooperate with national and local authorities as well as various organizations to raise public awareness about green energy transitions. This include joint research projects, educational programs, and collaborations with governmental bodies or NGOs to promote sustainability and reduce the environmental impact of maritime activities.

25 organizations have financial or political support.

Management level

The role of management in strategic decision-making is important for a successful green energy transition. At the management level, leaders set the vision, allocate resources, and implement policies that drive sustainable change. The management's ability to integrate EU directives and goals with business strategies determines the effectiveness of transitioning to renewable energy sources. A well-structured strategic approach ensures that financial, technical, and regulatory challenges are addressed while maintaining operational efficiency. Strong leadership, informed decision-making, and cross-sector collaboration are essential for navigating this transition. Ultimately, management plays a pivotal role in integrating new technologies, fostering innovation, securing stakeholder commitment, and ensuring long-term resilience in the evolving green energy ecosystem.

In the survey they were asked about what management actions have been taken to reduce greenhouse gas emissions.

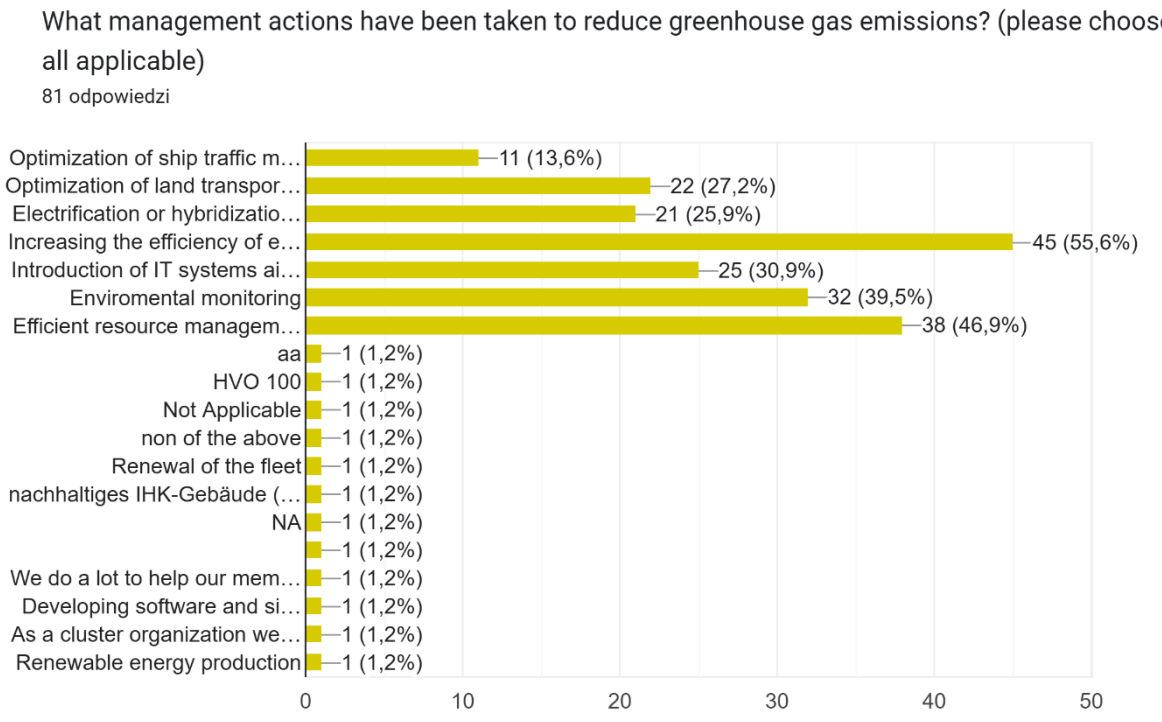

Figure 9 Managements actions to reduce emmissions

Management action	Number
Optimization of ship traffic management	11
Optimization of land transport (optimization of routes, schedules)	22

Electrification or hybridization of the equipment (cranes, overhead cranes, etc.)	21
Increasing the efficiency of energy management	45
Introduction of IT systems aimed at optimizing management	25
Enviromental monitoring	32
Efficient resource management	38
Other	7

What is the main reason for taking actions at the management level to reduce greenhouse gas emissions?

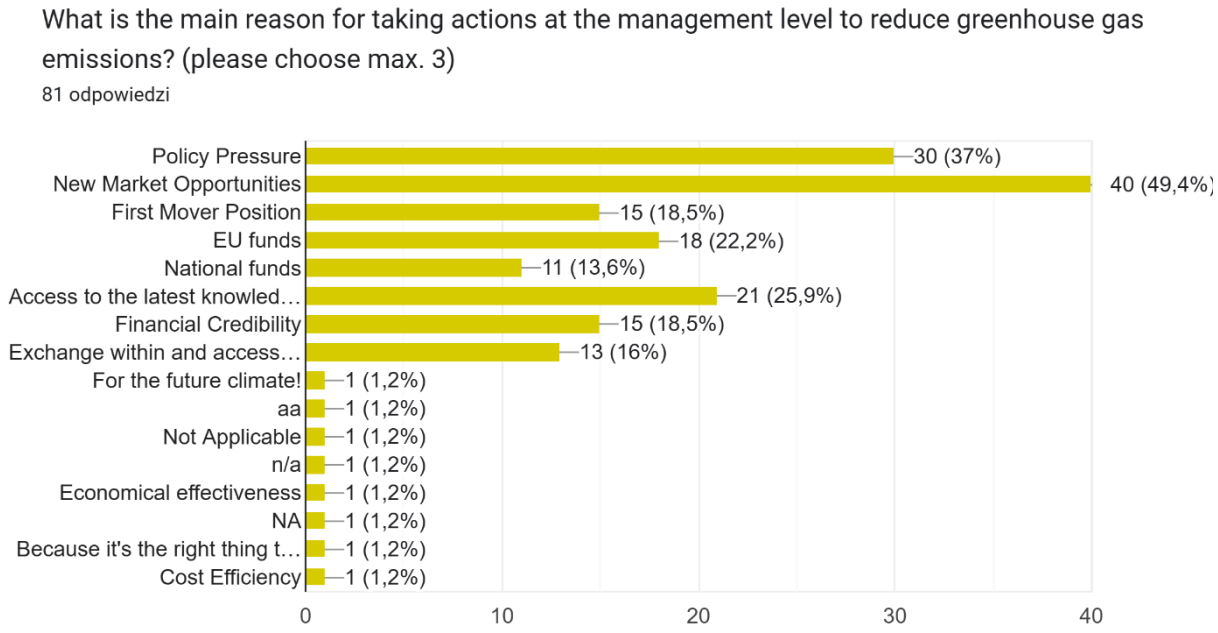

Figure 10 The main reason for taking actions to reduce greenhouse gas emissions

Reason for taking actions	**Number**
Policy Pressure	30
New Market Opportunities	40
First Mover Position	15
EU funds	18
National funds	11
Access to the latest knowledge	21
Financial Credibility	15
Exchange within and access to expert	13
Other	4

What is the main reason for not taking actions at the management level to reduce greenhouse gas emissions?

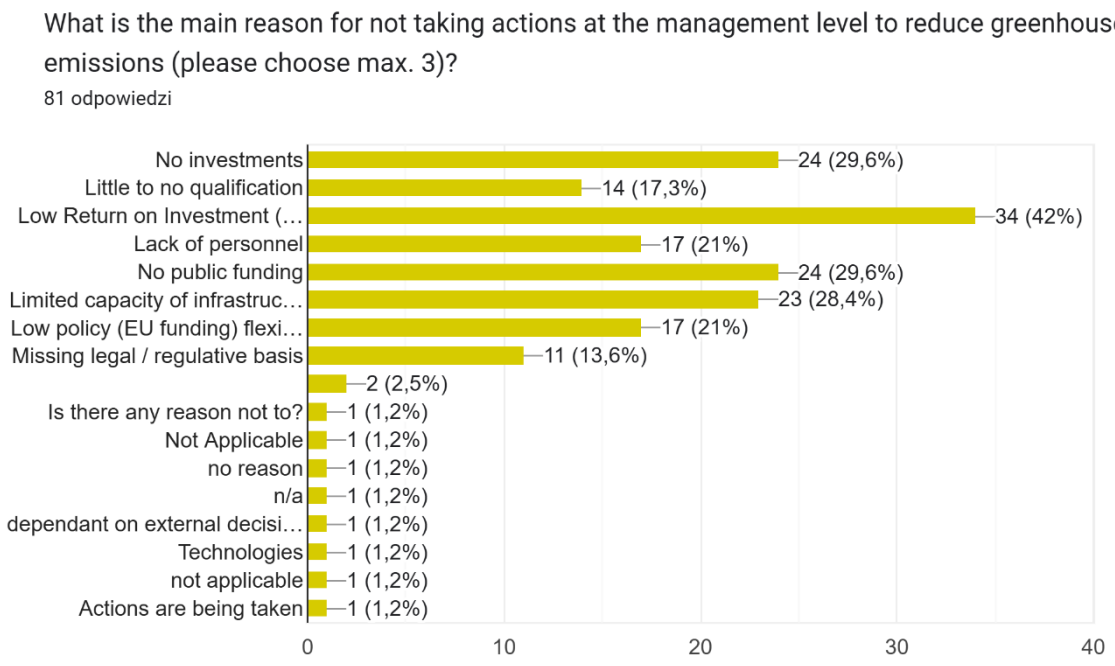

Figure 11 The main reason for not taking actions to reduce greenhouse gas emissions

Reason for not taking actions	**Number**
No investments	24
Little to no qualification	14
Low Return on Investment (ROI)	34
Lack of personnel	17
No public funding	24
Limited capacity of infrastructure	23
Low policy (EU funding) flexibility	17
Missing legal	11
Other	3

Operational level

At the operational level, effective monitoring, verification, and compliance methods are essential for ensuring a smooth and efficient transition to green energy in ports. Implementing robust methodologies allows port authorities to track technological performance, ensure regulatory compliance, and identify areas for improvement. Regular monitoring helps detect inefficiencies, while verification processes validate adherence to green energy transition goals and industry standards. Additionally, understanding the factors that limit operational activities - such as infrastructure constraints, financial limitations, or regulatory challenges - enables better decision-making and targeted interventions. A well-defined operational framework ensures that green energy transition strategies transform into actionable results, supporting ports in achieving long-term environmental and economic resilience.

We asked the companies for their actions that are implemented (or are planned in the near future), at the operational level, to reduce greenhouse gas emissions?

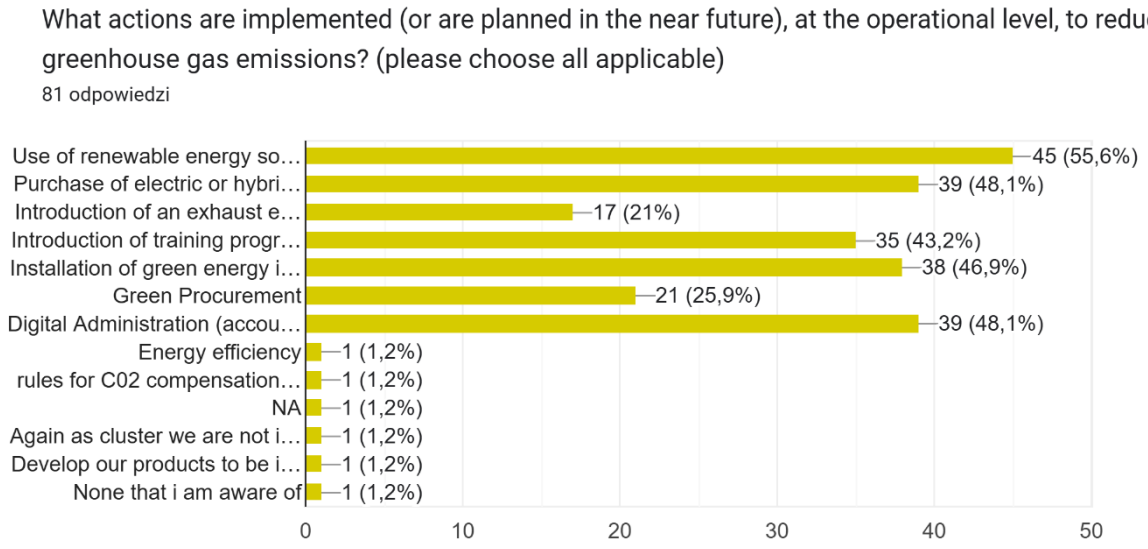

Figure 12 Actions implemented (or are planned in the near future), to reduce greenhouse gas emissions

Operational action	Number
Use of renewable energy sources (e.g. solar / wind power supply)	45
Purchase of electric or hybrid vehicles	39
Introduction of an exhaust emission control / monitoring system	17
Introduction of training programs aimed at increasing staff awareness and commitment	35

Installation of green energy infrastructure (e.g. OPS, wind / solar energy)	38
Green Procurement	21
Digital Administration (accounting / billing, customs)	39
Other	3

The following methods /methodology you are using for monitoring / verifying / compliance:

1 KPI's
2 statistical monitoring
3 Digital
4 Enterprise energy audit
5 Yes,monitoring. We have various SW solutions
6 Direct and electronic monitoring
7 Monitoring, measurement and setting goals
8 GHG inventory in accordance with GHG Protocol standards
9 Still in the future
10 measurement
11 Buying electricity from 100% renewable energy
12 CO2 monitoring system, Traffic monitoring, and planning
13 No major actions implemented yet for required monitoring.
14 We have a dedicated person for checking everything (environment/safety monitoring).
15 GHG emission monitoring, KPI
16 EU
17 A dedicated department within company monitors this subject
18 GHG emissions are monitored and submitted ot the Group. Hutchison Ports Group submits the results to SBTi for verification.
19 daily monitoring of CO2 emissions of ships
20 Environmental monitoring – in accordance with issued permits
21 vehicles monitoring
22 developed ICT tools for port and terminal operators to benchmark and simulate energy consumption in their operations
23 digital data is collected and displayed in dashboards
24 various IT systems and software for individual equipment and operations or processes
25 simulation
26 software systems (PLCs, IoT, etc.)
27 We do not take responsibility of monitoring the actions. This is left for each organisation that we collaborate with
28 Ghg rating and MEP
29 WE ARE CONSULTING WITH SPECIALIST
30 We are set it up in it system
In the case of green procurement or digital administration, we review procurement records and digital workflows periodically to ensure that suppliers meet green criteria, and that digital transformation efforts are contributing to operational efficiency and emissions reduction.
For training programs aimed at increasing staff awareness and commitment, we monitor engagement levels through surveys, feedback mechanisms, and follow-up assessments. This ensures that employees are applying the training in their day-to-day activities and contributing to emission reduction.
31 We also change our fleet to electric cars to decrease the local and regional footprint.

It is very important to identify the factors that are limiting the scope of activities undertaken at the operational level.

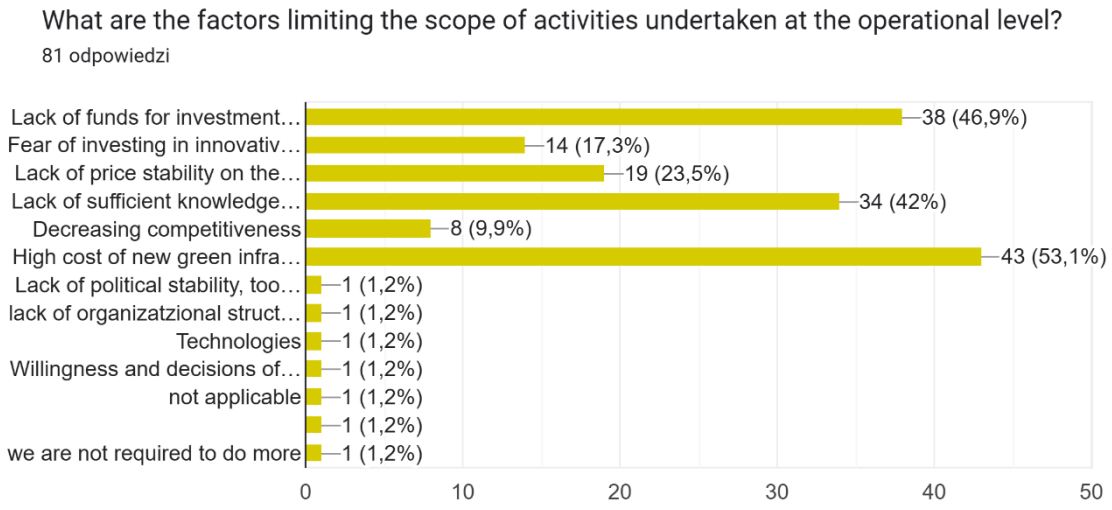

Figure 13 Factors limiting the scope of activities undertaken at the operational level

Factor	**Number**
Lack of funds for investments, lack of subsidies or preferential loans, or difficulties in obtaining a loan	38
Fear of investing in innovative technological solutions	14
Lack of price stability on the energy market (e.g. possible large increases in electricity costs)	19
Lack of sufficient knowledge or lack of possible solutions	34
Decreasing competitiveness	8
High cost of new green infrastructure and equipment	43
Other	5

In the final question, organisations were asked to identify themselves shortly and how they are going to proceed with the green energy transition

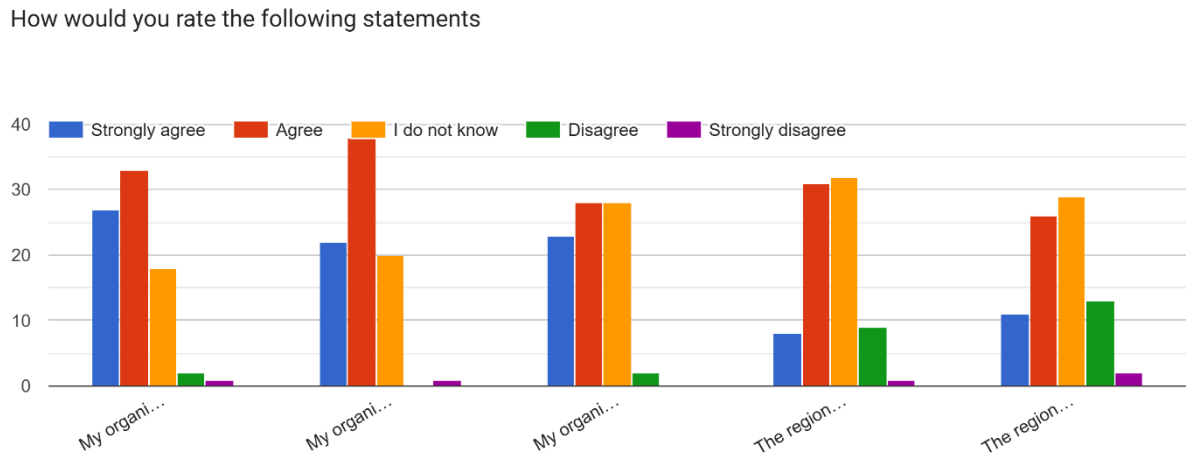

Figure 14 The opinions on ecological statements

	Strongly agree	Agree	I do not know	Disagree	Strongly disagree
My organisation will make substantial steps towards green transition (decarbonisation, electrification, sustainable business) in the next 5 years	27	33	18	2	1
My organisation will make green transition in 20-25 years	22	38	20	0	1
My organisation will make green transition for Fit for 55 (2050)	23	28	28	2	0
The region (SBA) will be Fit for 55 by 2030 (reduce emmissions to 55%)	8	31	32	9	1
The region (SBA) will be Fit for 55 by 2050 (zero emmissions)	11	26	29	13	2

Perspective

By seeing the respondents' answers and knowing the legal regulation directives, the project partners aim to collect as many practical examples as possible, which they could transfer to the ports of the Southern Baltic Sea region. Practical examples provide not only more knowledge, but also confidence in new technologies and their effectiveness.

Participation in SMW2024 provided the DigiTechPort2030 project group with a distinctive opportunity to gain insights into the latest trends and solutions propelling the decarbonisation and digitisation of port operations. The event facilitated connections with leading companies and organisations, highlighted by a significant visit to TCOMS, a research unit specialising in the impact of waves on technological solutions. The innovative approach witnessed in Singapore, which prioritises decarbonisation and emissions reduction from a business standpoint, stands as a beacon for global maritime sustainability endeavours, acknowledged by the DigiTechPort2030 project group.

Practical knowledge is collected by participating in conferences and study visits, during which identified the main themes addressed to green energy transition - decarbonisation and digitalisation.

Decarbonisation. Presentations and discussions explored various approaches, including:

- Alternative Fuels: Presentations showcased advancements in alternative fuels like liquefied natural gas (LNG), biofuels, and hydrogen fuel cells as potential replacements for traditional heavy fuel oil.
- Energy Efficiency Measures: Discussions revolved around optimizing vessel design, utilizing weather routing technologies, and employing innovative hull coatings to reduce fuel consumption.
- Clean Technologies: Technologies like shore power, waste heat recovery systems, and carbon capture and storage solutions were presented as strategies to minimize emissions at ports and during voyages.

The practical solutions presented during SMW2024 include:

- Air Lubrication Systems: These systems use compressed air bubbles to create a low-friction layer between the ship's hull and the water, reducing drag and fuel consumption.
- Solid Sail Technologies: Wind-powered propulsion systems utilizing rigid sails made from advanced materials are being explored as a supplementary power source for cargo ships.
- Hydrogen Fuel Cells: Companies showcased advancements in hydrogen fuel cell technology for powering smaller vessels, with the potential for larger applications in the future.

Digitalisation can also be considered from many different aspects, the most important of which are:

- Artificial Intelligence (AI): Presentations explored the use of AI for route optimization, predicting equipment failures through predictive maintenance, and automating routine tasks to improve operational efficiency.
- Big Data Analytics: Discussions highlighted the potential of big data analytics to glean valuable insights from vast amounts of maritime data, enabling better decision-making and risk management.
- Automation: Advancements in autonomous technologies like autonomous cargo ships and drone-based inspections were showcased, with a focus on their potential to enhance safety and crew efficiency.

Examples of the use of digitalisation to reduce greenhouse gas emissions include:

- Real-time Voyage Optimization Platforms: These AI-powered platforms analyse real-time weather data, ocean currents, and vessel performance to suggest the most fuel-efficient route for a voyage, significantly reducing emissions.
- Predictive Maintenance Solutions: Sensor-based systems coupled with machine learning algorithms can predict equipment failures before they occur, allowing for proactive maintenance and minimizing downtime.
- Digital Twin Technologies: Creating digital replicas of vessels and port operations allows for simulation and optimization of processes, leading to improved efficiency and safety.

Exploration of topics such as artificial intelligence (AI) underscored the significance of leveraging insights from events like SMW2024 to propel AI and decarbonisation initiatives within the region, benefiting industry partners and policymakers alike.

As the maritime industry evolves, the key insights from the survey and SMW2024 highlight the critical role of decarbonization and digitalization in shaping its future. These are not merely emerging trends but essential strategies for ensuring green energy technologies and competitiveness. The Port's success will depend on international collaboration, investment in innovation, and the seamless integration of digital and green technologies. Ports in the South Baltic region can exemplify how new technologies can drive economic growth while maintaining environmental responsibility. Also, the discussions at SMW 2024 provided a clear roadmap for the maritime sector, emphasizing that proactive adaptation and strategic innovation today will define the maritime ecosystem of tomorrow.