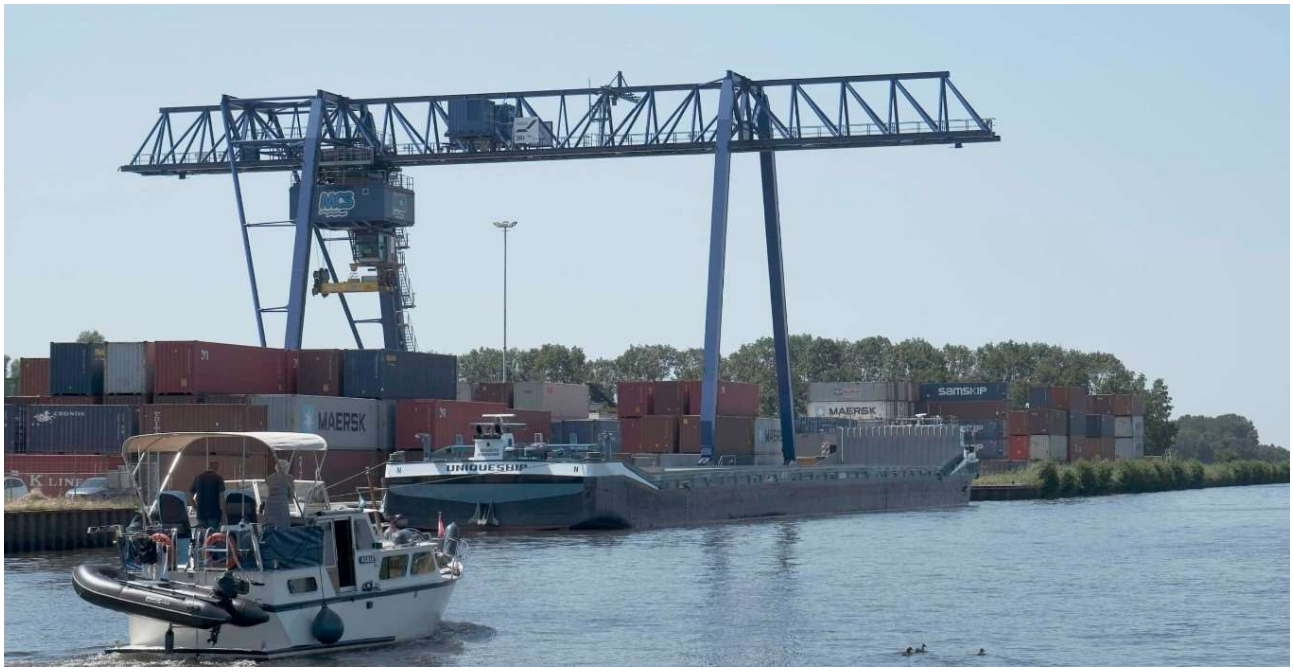
Insights, strategies, and recommendations for ports on the path to efficiency, sustainability, and digital transformation



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1 Executive Summary

The rapid advancement of digitalization has prompted Small and Medium-sized Ports (SMPs) in the North Sea Region to navigate a complex and evolving landscape. To address multifaceted challenges and stride towards a future that is both technologically advanced and environmentally sustainable, these ports have embarked on a journey of smart modernization and eco-innovation.

This report delves into the results of the NON-Stop project's pilots, providing insights, lessons learned, and recommendations for other ports seeking sustainable digitalization and efficiency.

Sustainable digitalization is not only a strategic imperative for individual ports but also a collective effort to users in a more eco-conscious and digitally advanced future for the entire sector. The lessons and experiences shared through the NON-Stop project serve as a valuable guide for SMPs navigating this transformative landscape.

Insights and Recommendations:
NON-STOP provides valuable insights and practical recommendations for SMPs:

- **Collaboration and Knowledge Sharing:** Collaborative partnerships among SMPs, technology providers, and diverse ports foster innovation and collective problem-solving.
- **Customization of Digital Solutions**: Tailoring digital solutions to unique port needs ensures relevance and optimal effectiveness.
- **Environmental and Economic Benefits:** Embracing eco-friendly solutions contributes to substantial reductions in emissions while promoting financial gains.
- **Data-driven Decision-making and Digital Leadership:** Leveraging real-time data informs decisions, and considering digital leadership roles enhances strategy.
- **Scalable Digital Roadmaps and Robust Infrastructure:** Scalable roadmaps and solid digital infrastructure provide a reliable foundation for digitalization.
- **Regulatory Compliance and Sustainability:** Aligning digitalization with evolving eco and digital policies safeguards operations and industry positioning.

Strategy for Implementation:
Implementing eco-innovation and digitalization in SMPs requires a structured approach:

- **Define a Clear Vision and Goals:** Craft a clear vision and establish SMART goals to guide your digitalization journey.
- **Leadership and Governance:** Appoint dedicated digital leaders and establish governance frameworks for effective decision-making.
- **Customized Roadmap Development**: Create dynamic roadmaps tailored to your port's unique circumstances, prioritizing projects based on impact and feasibility.
- **Collaboration and Continuous Improvement:** Forge partnerships and foster a culture of continuous improvement to stay aligned with objectives.

2 Introduction

In an era marked by advancement of digitalization, Small and Medium-sized Ports (SMPs) within the North Sea Region have been navigating a complex and rapidly evolving landscape. This transformation has caused port authorities to embark towards smart modernization and eco-innovation in their management practices. The imperative is clear: embrace digitalization to not only address multifaceted challenges but also stride towards a future that is not only more advanced but also environmentally sustainable.

The NON-Stop project stands as a testament to this commitment. With a partnership of ports and technological expertise, including:

- Port of Zwolle Coöperatie (Ports of Zwolle, Meppel, Kampen, Netherlands)
- Municipality of Zwolle (Netherlands)
- Municipality of Meppel (Netherlands)
- Municipality of Kampen (Netherlands)
- Port of Oostende (Belgium)
- Citymesh (with supporting partner Port of Antwerp-Bruges, Belgium)
- Niedersachsen Ports GmbH & Co. Kg (Germany)
- Port of Korsør (Denmark)
- Port of Helsingør (Denmark)
- Bluebridge (Belgium)
- Berg-Packhäuser & Kollegen / BPK (Germany)

The core strategy revolves around the introduction, testing, and continuous monitoring intelligent technologies and processes. These innovations span the data management related to marine conditions to optimizing sea and landside operations and rationalizing energy production, consumption, and distribution within the ports.

At its heart, NON-Stop will achieve two goals: A 10% reduction in the time required for pre-defined logistical and maintenance port operations and a corresponding decrease in port-related energy consumption and pollution.

The effect of this project should lead to more efficient, agile, and transparent data management port ecosystem. This will not only serve the needs of North Sea Region SMPs but will also enhance the ability of ports to cater effectively to their clients. Furthermore, it positions these ports to meet the benchmarks set by the evolving EU and national eco and digital policies while fostering an environment beneficial to continued innovation and growth.

This report will dig into the results of the pilots in NON-STOP, and will provide insights, lessons learned, and recommendations for other ports looking to embrace sustainable digitalization and efficiency.

3 Results of the Pilots

The NON-STOP project has yielded significant results in enhancing the digitalization and sustainability of small and medium-sized ports (SMPs) within the North Sea Region. Several ports across different countries collaborated to explore and implement digital solutions, contributing to the project's overarching goals.

3.1 Port of Zwolle, the Netherlands

The Port of Zwolle, within a dynamic environment, successfully embraced digitalization through the implementation of a cutting-edge harbor management system. This innovation streamlined operations and led to tangible reductions in CO2 emissions. Onshore power supply (OPS) infrastructure was introduced, allowing vessels to dock and operate without emitting CO2 or generating noise pollution. The OPS installation in Meppel, Zwolle, and Kampen has led to a considerable reduction in CO2 emissions. Furthermore, the adoption of ShipLogic software resulted in energy savings and significant time reductions in registration processes, benefitting both port authorities and visiting vessels.

3.2 Port of Oostende, Belgium

The Port of Oostende focused on the development of a digital twin component, incorporating sensor-equipped cameras into the harbor. While precise CO2 emissions reductions were challenging to quantify, this transition improved energy efficiency and facilitated real-time data analysis. The innovative approach also inspired similar initiatives in other ports, contributing to the broader adoption of digital solutions.

3.3 Citymesh and the Port of Antwerp Bruges, Belgium

Citymesh, in collaboration with the Port of Antwerp Bruges (PoAB), deployed an innovative Private 5G network equipped with air quality sensors. This network facilitated real-time environmental monitoring and data-driven optimization of operational efficiency. The introduction of 5G technology led to significant time savings, faster decision-making, and enhanced collaboration among stakeholders.

3.4 Niedersachsen Ports GmbH & Co. Kg, Germany

Niedersachsen Ports took a pioneering role in developing a smart sediment and water management system at the port of Emden. The project aimed at reducing materials' influx from the river Ems into the port, improving drainage in the hinterland, and supporting maintenance dredging. As a result of these efforts, significant reductions in CO2 emissions, energy usage, and time required for various port-related processes were achieved, demonstrating the potential of digitalization in addressing multiple challenges simultaneously.

3.5 Port of Korsør, Denmark

The Port of Korsør invested in an onshore power supply (OPS) system to reduce carbon emissions during ship operations. Estimates suggest substantial CO2 emissions reductions, significant energy savings, and the potential for time savings through streamlined vessel operations. This investment positioned the port as an environmentally conscious and responsible facility.

3.6 Port of Helsingør, Denmark

The Port of Helsingør is exploring ways to enhance its environment, reduce CO2 emissions, noise, and pollutants by considering an OPS. Situated in the historic town center near the UNESCO-protected Kronborg Castle, preserving scenic views and maintaining port operations are essential. Initial steps, such as the business case and feasibility study, have been completed, with a final investment decision expected in 2023.

3.7 Bluebridge, Belgium

Bluebridge facilitat*ed* insightful webinars that enriched discussions on various project activities and pilot achievements. These webinars covered an array of relevant themes, including change management, intelligent digital quality monitoring in ports, autonomous maritime transport, updates on port developments, advanced technologies for port inspections, and the digital representation of port operations. Bluebridge's contribution ensured the dissemination and constructive dialogue surrounding critical topics *and* served as a platform for sharing knowledge and fostering collaboration within *and outside* the NON-STOP community.

3.8 Berg-Packhäuser & Kollegen (BPK), Germany

Berg-Packhäuser & Kollegen developed the Antara platform, enhancing the efficiency, transparency, and sustainability of port area management. The platform simplified decision-making for port authorities, streamlined administrative tasks, and promoted efficient collaboration among port stakeholders. This digital tool not only improved internal efficiency but also reinforced the port's commitment to sustainability.

4 Insights and recommendations

The NON-STOP project offers invaluable insights and practical recommendations for small and medium-sized ports (SMPs) venturing into sustainable digitalization and heightened operational efficiency. These insights span various dimensions of the digital transformation journey within SMPs, encompassing both technical aspects and organizational strategies.

4.1 Collaboration and knowledge sharing

Collaboration and knowledge sharing emerged as foundational pillars in the NON-STOP project. The power of collaboration among SMPs, driven by partnerships with diverse ports and technology providers, stood out as a transformative force. This synergy facilitated innovation and accelerated the digitalization process, enabling ports to draw from each other's experiences. The network cultivated through collaboration proved central in overcoming challenges collectively and ensuring the successful implementation of digital solutions.

4.2 Customization of digital solutions

SMPs operate within distinct operational contexts, each with unique requirements and constraints. NON-STOP highlighted the significance of tailoring digital solutions to align precisely with the specific needs of each port. This tailoring approach involves an assessment of existing infrastructure, operational intricacies, and strategic goals. Customization ensures that technological investments are not only relevant but also optimally effective, directly addressing the port's strategic objectives while preserving its operational integrity.

4.3 Environmental and economic benefits

A central theme within the NON-STOP project was the realization of significant environmental and economic advantages resulting from digitalization efforts. The adoption of eco-friendly solutions, exemplified by the implementation of onshore power supply (OPS), emerged as a beacon of sustainability. Beyond the substantial reduction in CO2 emissions, these measures enhanced the port's reputation as a steward of the environment. Importantly, they also demonstrated the long-term economic structure of sustainable practices, creating a win-win scenario where environmental responsibility contributes to financial gains.

4.4 Data-driven decision-making and digital leadership

Digitalization's most potent asset is the wealth of data it generates. NON-STOP showcased the transformative potential of leveraging real-time data for informed decision-making. Notably, the Port of Zwolle's introduction of real-time quay availability information significantly reduced vessel idling time, improving operational efficiency. The project highlights the strategic importance of considering the appointment of a Chief Digital Officer (CDO) or an equivalent digital leadership role to effectively steer the port's digital strategies. Such leadership ensures alignment with organizational goals, fosters a culture of innovation and experimentation, and provides the expertise required to navigate the digital landscape successfully.

4.5 Scalable digital roadmaps and robust infrastructure

Scalable digital roadmaps emerged as a lesson from the NON-STOP project. The approach favored incremental digitalization efforts over hastily embarking on complex projects. These roadmaps, characterized by adaptability to evolving technologies and operational needs, provide a structured path to manage digitalization effectively. Concurrently, the report emphasizes the importance of investing in robust digital infrastructure. This encompasses upgrading communication networks, sensor deployment, and optimizing data storage capabilities. A solid digital infrastructure acts as the foundational basis upon which innovative digital solutions can be built, ensuring their reliability and performance.

4.6 Regulatory compliance and sustainability

The regulatory landscape and sustainability considerations remain ever-evolving. Ports must remain aware and adaptive in navigating this terrain. The NON-STOP project emphasizes the importance of aligning digitalization efforts with the dynamic eco and digital policies of both the European Union (EU) and individual national authorities. This alignment not only safeguards the port's ongoing operations but also positions it favorably within the maritime industry. It is a testament to the project's commitment to ensuring that digitalization is not just a technological endeavor but also an instrument for advancing sustainable and eco-conscious practices within the sector.

4.7 Robust infrastructure: preparing for climate change

Port infrastructure should be designed and upgraded with climate change resilience in mind. This includes measures such as elevated infrastructure and flood barriers to protect against rising sea levels and extreme weather events. Collaboration with experts and adherence to sustainability standards are crucial in this regard. Additionally, a well-defined climate resilience plan should be established and regularly evaluated to ensure its effectiveness.

4.8 Safety and security of data collection and handling

Ensuring the safety and security of data collection and handling is paramount. This involves implementing robust data security policies that encompass encryption, access controls, and frequent security audits. Employee training on cybersecurity best practices is essential to mitigate data breaches. Moreover, investments in data encryption technologies and regular software updates are vital to safeguard sensitive information.

4.9 Digitalization of ports and new industries (offshore renewables, deep sea mining, automation of shipping)

Ports should actively explore digitalization opportunities in emerging industries such as offshore renewables, deep-sea mining, and automation of shipping. Strategic roadmaps should be developed in collaboration with industry experts, and ports should stay informed about evolving regulations and trends in these sectors. Partnerships with technology providers and research institutions can help drive innovation. Emphasis should be placed on data-driven decision-making and real-time data collection to enhance operational efficiency in these evolving industries.

5 Strategy for implementation

Implementing eco-innovation and digitalization in SMPs is a multifaceted effort that demands planning and execution. This strategy provides a roadmap for SMPs seeking to enhance their efficiency, eco-innovation, and digital capabilities:

5.1 Define a clear vision and goals:

At the heart of successful digitalization lies a well-defined vision. Begin by crafting a vision that encapsulates your port's aspirations for the future. Consider how digitalization can contribute to sustainability, operational efficiency, and competitiveness. This vision should serve as a guide, inspiring the facets of your digital journey.

Alongside your vision, establish specific, measurable, achievable, relevant, and time-bound (SMART) goals. These goals will act as the compass, providing a clear sense of direction. Whether it's reducing emissions, enhancing operational efficiency, or optimizing data management, well-defined objectives will shape your strategy.

5.2 Leadership and governance and stakeholder management:

Effective leadership is paramount to the success of your digitalization efforts. Appoint dedicated leaders who champion the cause of digital transformation. Consider creating a Chief Digital Officer (CDO) role or empowering an existing team member with a digital leadership mandate. This leader should possess a deep understanding of digital technologies and their applications within the port industry.

Simultaneously, establish a robust governance framework. Clearly define roles and responsibilities, ensuring that accountability and compliance are core tenets of your strategy. Governance structures will help streamline decision-making, ensuring that digital initiatives align with your overall objectives.

To ensure the success of your digitalization efforts, it's crucial to focus on stakeholder management. Identify who within your organization can have access to specific data and establish clear protocols for data handling. Engage all stakeholders in the port community by creating channels for collaboration and feedback. Consider establishing a data governance committee that includes representatives from different stakeholder groups, fostering inclusivity in decision-making. This approach will help build trust, enhance data security, and ensure that digital initiatives align with the diverse needs and objectives of all stakeholders.

5.3 Customized roadmap development:

Building a customized roadmap tailored to your port's unique circumstances is pivotal. Your roadmap should be a dynamic document that outlines the steps needed to achieve your digital goals. Prioritize projects based on their potential impact and feasibility.

In crafting your roadmap, blend short-term wins with long-term sustainability objectives. These milestones will help maintain momentum while laying the foundation for enduring digitalization. Assemble a cross-functional team to oversee the execution of this roadmap, ensuring that every project aligns with your overarching vision.

5.4 Collaboration and continuous improvement:

Collaboration is the cornerstone of digitalization success. Forge partnerships with other SMPs, technology providers, and industry organizations. Leverage collective expertise and resources through knowledge sharing and collaborative projects. Seek alliances that can accelerate your digital initiatives.

Embrace a culture of continuous improvement. Regularly assess the progress of your digitalization initiatives against predefined goals and key performance indicators (KPIs). Be prepared to adapt and refine your strategy as needed to stay on course. Rigorous evaluation and learning from both successes and setbacks are instrumental in refining your approach.

By embracing this strategy, SMPs can embark on a structured and sustainable digitalization journey. This approach empowers ports to harness the myriad benefits of digitalization while mitigating risks and ensuring alignment with their overarching goals. Through visionary leadership, strategic governance, customized roadmaps, and collaborative innovation, SMPs can unlock the full potential of sustainable digitalization.

6 Conclusion

In an era defined by the relentless march of digitalization, Small and Medium-sized Ports (SMPs) within the North Sea Region have found themselves at a critical crossroads. This transformation has compelled port authorities to embark on a journey towards intelligent modernization and eco-innovation in their operational practices. The imperative is clear: embrace digitalization to not only confront multifaceted challenges but also steer towards a future that is not only technologically advanced but also environmentally sustainable.

The NON-Stop project stands as a testament to the unwavering commitment of these ports. With a partnership consisting of ports and technological experts the core strategy revolves around introducing, testing, and continually monitoring intelligent technologies management and processes. These innovations span from data management related to marine conditions to optimizing sea and landside operations and rationalizing energy production, consumption, and distribution within the ports.

The culmination of this project is expected to result in a more efficient, agile, and transparent data management in port ecosystems. This will cater to the needs of North Sea Region SMPs and enhance the ports' ability to effectively serve their clients. Furthermore, it positions these ports to meet the benchmarks set by evolving EU and national eco and digital policies while fostering an environment conducive to continued innovation and growth.