

CASE STUDY IDENTIFICATION SHEET

Practice 7: Continuous training and updates for pilots

This document has been developed by **Piri Reis University (PRU)** as part of the activities under Task 3.2 of the “GREENPORT Alliances” project, for which MAR.TE. S.c.ar.l. serves as the responsible entity. Task 3.2 focuses on identifying and analysing case studies that exemplify best practices for behavioural change among operators aimed at reducing the environmental impact of port operations.

The primary objective of this activity is to collect, document, and analyse concrete examples of technological, managerial, or behavioural innovation that have proven effective in contributing to the environmental, economic, and social sustainability of the port services sector. Through a structured selection and evaluation process, the document highlights the specific features of each case study and assesses their performance against key environmental and economic impact indicators.

The information gathered will be integrated into the overall framework of the GREENPORT Alliances project to promote the dissemination of sustainable solutions and the development of curricula for: a. higher education students (future personnel); b. current professionals (professional training); c. educators (train-the-trainer courses).

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1. GENERAL INFORMATION

A. **Case study title**

Enhancing Maritime Pilot Training at the Port of Quebec

B. **Green practice implemented**

Practice 7: Continuous training and updates for pilots

Establishment of a pilot-owned training facility equipped with state-of-the-art simulation technology.

C. **Specific goals**

To provide continuous, advanced training for maritime pilots, enhancing navigation safety and operational efficiency

D. **Direct impact of the practice**

Improved pilot proficiency, reduced navigation incidents, and enhanced port safety

E. **Place of implementation**

Port of Quebec, Canada

F. **Start and end date or duration of the pilot project**

Initiated in 2010; ongoing

2. CONTEXT AND DESCRIPTION

A. **Description of the practice**

In response to the increasing complexity of maritime navigation and the need for enhanced safety measures, the pilots at the Port of Quebec established their own training facility. This centre is equipped with advanced simulation technologies that replicate various navigational scenarios, allowing pilots to practice and refine their skills in a controlled environment.

Located in Quebec City, Canada, the **Maritime Simulation and Resource Centre (MSRC)** is a leader in training and development and holds unique expertise in navigational safety. It is open to all members of the maritime community, whether for training, professional development or the validation of economic development projects. It offers a stimulating work environment and an atmosphere conducive to learning and the exchange of knowledge.

MSRC is a division of the **Corporation of Lower St. Lawrence Pilots (CLSLP)**. The Centre's mission is to ensure training and development for pilots belonging to the CLSLP and to share its expertise in simulation with other pilots and professionals in the maritime domain.

Internationally Recognized Expertise

In operation since 2005, the Maritime Simulation and Resource Centre (MSRC) has been purposely built to function as a total turnkey port procedural development centre. It is one of

the few facilities in the world offering a full range of simulation options spanning from stand-alone desktop simulation to four fully interactive, manned tug and large vessel simulations.

B. Driving factor behind the adoption of the green practice

The primary motivation was to ensure that pilots could handle diverse and challenging navigation situations, thereby minimizing the risk of maritime incidents and promoting environmental protection

C. Stakeholders involved

Maritime pilots, Port of Quebec authorities, shipping companies, and local government agencies

3. IMPLEMENTATION

A. Description of the adopted practice

The training facility offers simulation-based programs that cover a wide range of scenarios, including adverse weather conditions, complex port manoeuvres, and emergency response situations

B. Technologies used (if applicable)

State-of-the-art navigation simulators capable of replicating real-world maritime environments

C. Competencies required

Expertise in maritime navigation, familiarity with simulation technology, and a commitment to continuous professional development

4. COLLECTED DATA

Before and after the implementation of enhanced maritime pilot training at the Port of Quebec, several types of data were collected to assess the impact on environmental goals:

Before Implementation:

Limited access to advanced training resources, reliance on on-the-job experience, and a higher incidence of navigation-related incidents .

1. **Fuel Consumption and Emissions Data:** Baseline data on fuel usage and greenhouse gas emissions from ships navigating the port.
2. **Incident Reports:** Records of navigational incidents, including near-misses and accidents, to understand the frequency and causes.
3. **Environmental Impact Assessments:** Studies on the impact of port activities on local ecosystems and biodiversity.
4. **Operational Efficiency Metrics:** Data on the time taken for docking and undocking procedures, as well as overall port throughput.

After Implementation:

Enhanced pilot competencies, a significant reduction in navigation incidents, and improved overall port safety

1. **Reduced Emissions Data:** Measurements showing changes in fuel consumption and emissions, indicating improvements in efficiency.
2. **Incident Reduction Statistics:** Updated records showing a decrease in navigational incidents and accidents.
3. **Environmental Monitoring Reports:** Ongoing assessments to track improvements in local ecosystem health and biodiversity.
4. **Operational Efficiency Improvements:** Data demonstrating faster and more efficient docking and undocking procedures, contributing to reduced fuel use and emissions.

These data points help in evaluating the effectiveness of the training programs and their contribution to the Port of Quebec's environmental goals

The key findings from the data collected before and after the implementation of enhanced maritime pilot training at the Port of Quebec highlight several significant improvements:

1. Emission Reductions:

- **Fuel Efficiency:** There was a notable decrease in fuel consumption due to more efficient navigation and docking procedures, leading to lower greenhouse gas emissions
- **GHG Reduction:** The port achieved a reduction in greenhouse gas emissions, contributing to its goal of cutting emissions by 40% by 2035

2. Operational Efficiency:

- **Faster Turnaround Times:** The time taken for docking and undocking procedures was reduced, improving overall port throughput and reducing idle times for ships
- **Incident Reduction:** There was a significant decrease in navigational incidents and accidents, enhancing safety and operational reliability

3. Environmental Impact:

- **Biodiversity Protection:** Improved navigation practices helped protect local marine ecosystems, contributing to the port's biodiversity goals
- **Environmental Management:** Enhanced training included best practices for environmental management, ensuring pilots were equipped to minimize the environmental impact of port activities

4. Stakeholder Engagement:

- **Community Involvement:** The port's efforts included active participation in community initiatives and consultations, fostering better relationships with local stakeholders

These findings demonstrate the positive impact of enhanced maritime pilot training on both operational efficiency and environmental sustainability at the Port of Quebec.

5. ECONOMIC AND ENVIRONMENTAL ANALYSIS (*IF THE INFORMATION IS ACCESSIBLE*)

A. Initial investment required

Funding for the construction of the training facility and procurement of advanced simulation equipment and technology

B. Key savings or economic impact

Reduction in costs associated with maritime incidents, such as vessel damage and environmental clean-up and decreased risk of environmental contamination due to improved navigation safety. Enhanced maritime pilot training at the Port of Quebec has led to significant savings and positive economic impacts. Here are some key points:

1. Cost Savings:

- **Fuel Efficiency:** Improved navigation techniques have resulted in reduced fuel consumption, leading to substantial cost savings for shipping companies
- **Reduced Downtime:** More efficient docking and undocking procedures have minimized delays, reducing operational costs associated with idle time

2. Economic Impact:

- **Increased Throughput:** Enhanced training has improved the overall efficiency of port operations, allowing for a higher volume of ships to be handled, which boosts port revenues
- **Accident Reduction:** Fewer navigational incidents and accidents have decreased costs related to repairs, insurance, and environmental clean up
- **Job Creation:** The need for ongoing training and the implementation of new technologies have created jobs in the maritime and training sectors

3. Environmental and Social Benefits:

- **Sustainability Goals:** By reducing emissions and protecting local ecosystems, the port has enhanced its reputation as a sustainable and environmentally responsible entity, which can attract more business
- **Community Engagement:** Improved environmental practices have fostered better relationships with local communities, potentially leading to increased support and collaboration

These savings and economic impacts demonstrate the value of investing in enhanced maritime pilot training, not only for operational efficiency but also for broader economic and environmental benefits.

C. Contribution to environmental goals

Enhancing maritime pilot training at the Port of Quebec has significantly contributed to the port's environmental goals. The training improvements are part of a broader strategy to integrate environmental, social, and governance (ESG) considerations into the port's operations. Here are some key contributions:

1. **Reduction in Emissions:** Enhanced training has led to more efficient navigation and docking procedures, reducing fuel consumption and greenhouse gas emissions from ships
2. **Improved Environmental Management:** The training includes best practices for environmental management, ensuring that pilots are well-versed in minimizing the environmental impact of port activities
3. **Support for Decarbonization:** By promoting the use of cleaner technologies and more efficient practices, the training supports the port's goal of reducing its greenhouse gas emissions by 40% compared to 2022 levels by 2035
4. **Biodiversity Protection:** Pilots are trained to navigate in ways that protect local marine ecosystems, contributing to the port's efforts to preserve and enhance biodiversity

These efforts are part of the Port of Quebec's comprehensive sustainable development action plan, which aligns with the United Nations' Sustainable Development Goals and aims to make the port a leader in environmental stewardship

6. CONCLUSIONS

The establishment of the pilot-owned training facility has proven successful in enhancing the skills of maritime pilots, leading to safer and more efficient port operations. There is potential to expand the facility's programs to include training for other port personnel and to collaborate with other ports for shared learning opportunities. Investing in continuous training infrastructure is crucial for ports aiming to enhance safety and operational efficiency.

The **Enhancing Maritime Pilot Training at the Port of Quebec** initiative, primarily conducted through the Maritime Simulation and Resource Centre (MSRC), has provided several valuable lessons:

1. **Simulation-Based Training:**
 - **Lesson:** High-fidelity simulators are crucial for realistic and effective training.
 - **Impact:** Pilots can practice complex manoeuvres and emergency responses in a controlled environment, leading to improved skills and confidence
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2. **Customized Training Programs:**
 - **Lesson:** Tailoring training programs to specific port conditions and pilot needs enhances relevance and effectiveness.
 - **Impact:** Customized scenarios help pilots better understand local navigational challenges and improve their decision-making abilities
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3. **Continuous Professional Development:**
 - **Lesson:** Ongoing training and skill improvement are essential for maintaining high standards of pilotage.

- **Impact:** Regular updates and refresher courses ensure pilots stay current with the latest technologies and regulations
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- 4. **Collaboration and Knowledge Sharing:**
 - **Lesson:** Collaboration among pilots, trainers, and industry experts fosters knowledge sharing and innovation.
 - **Impact:** Sharing experiences and best practices leads to continuous improvement and a stronger pilot community
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- 5. **Use of Advanced Technologies:**
 - **Lesson:** Integrating advanced technologies like AI, AR, and VR enhances training effectiveness.
 - **Impact:** These technologies provide immersive and interactive learning experiences, improving retention and application of skills
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- 6. **Evaluation and Feedback:**
 - **Lesson:** Regular evaluation and feedback are critical for assessing training effectiveness and making improvements.
 - **Impact:** Collecting feedback from trainees and stakeholders helps refine training programs and address any gaps

These lessons highlight the importance of realistic simulation, customized training, continuous development, collaboration, advanced technologies, and regular evaluation in enhancing maritime **pilot training**.

The Enhancing Maritime Pilot Training at the Port of Quebec initiative utilized several advanced technologies to improve training effectiveness:

1. **High-Fidelity Simulators:**
 - Description: These simulators replicate real-world maritime scenarios, allowing pilots to practice complex manoeuvres and emergency responses in a controlled environment.
 - Example: The Maritime Simulation and Resource Centre (MSRC) uses Full Mission Bridge Simulators and Full Mission Tug Bridge Simulators
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2. **Portable Pilot Units (PPUs):**
 - Description: PPU's provide real-time navigational data, including electronic charts, tidal information, and vessel positioning.
 - Example: Pilots use PPU's to enhance situational awareness and improve safety during manoeuvres
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3. **Augmented Reality (AR) and Virtual Reality (VR):**
 - Description: AR and VR tools offer immersive training experiences, allowing pilots to visualize navigational data overlaid on the real world or practice in virtual environments.
 - Example: AR glasses and VR headsets are used to simulate port environments and complex navigational scenarios
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4. **Artificial Intelligence (AI):**
 - Description: AI systems analyse vast amounts of data to provide decision support, route optimization, and predictive maintenance.

- Example: AI-powered tools help pilots make informed decisions quickly and efficiently

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5. Cybersecurity Tools:

- Description: Systems and protocols to protect maritime operations from cyber threats.
- Example: Cybersecurity measures ensure the security of navigational and operational data

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6. Energy Efficiency Technologies:

- Description: Technologies focused on reducing energy consumption and emissions.
- Example: Green technologies and practices are integrated into training to promote sustainability

These technologies collectively enhance the training experience, ensuring that pilots are well-prepared to handle modern maritime challenges.

7. ANNEXES

Include relevant supporting materials

This case study is based on the establishment of a pilot-owned training facility in Quebec City, as highlighted by Captain Mike Watson, President of the International Maritime Pilots' Association (IMPA) and the American Pilots' Association (APA).



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