Lessons Learned and Implementation Strategy for the Pilot Project 2

Pilot 2 – Digital Twin with AI for Energy Management

Implementation

The pilot focused on the development of a Digital Twin platform integrating real-time operational data, AI-driven forecasting algorithms and secure communication infrastructure. The solution was designed to monitor energy generation, storage and consumption while supporting predictive control of energy flows.

Key achievements included:

- Development of a functional Digital Twin prototype.
- Integration of real-time sensor and IoT data.
- Application of AI algorithms for energy forecasting and optimization.
- Implementation of secure VPN-based data communication.
- Introduction of AI-supported anomaly detection for enhanced reliability and cybersecurity.
- Creation of a scalable architecture suitable for ports, shipyards and industrial facilities.

The pilot demonstrated how Digital Twin technologies can support industrial decarbonization objectives while improving operational efficiency and energy resilience.

Collaboration Experience

The pilot brought together industrial, academic and governmental stakeholders. Collaboration was organized through regular coordination meetings, technical working sessions and shared digital platforms for communication and document exchange.

Particularly successful aspects included:

- Joint collection and validation of operational data.
- Collaborative process mapping and system modelling.
- Strong cooperation between technical experts and implementation partners.
- Shared understanding of energy sources, loads and operational constraints.

- Open exchange of knowledge and practical problem-solving approaches.

The project benefited from the active contribution of Iskra, the University of Ljubljana, the University of Antwerp and the Slovenian Environment Agency (ARSO), ensuring a combination of industrial expertise, scientific rigor and regulatory alignment.

Knowledge Exchange and Innovation

Knowledge exchange was a central component of the pilot. Partners collaborated closely on understanding industrial energy processes, modelling complex energy systems and applying advanced AI methods.

Key areas of knowledge transfer included:

- Digital Twin methodologies and system modelling.
- Neural networks and machine learning applications.
- Energy forecasting and optimization techniques.
- Cybersecurity practices and secure data management.
- Validation of industrial energy data and operational workflows.

The consortium organized workshops, review sessions and co-creation activities where partners jointly evaluated results, shared experiences and refined modelling assumptions. The final Digital Twin solution was made accessible to project partners as a common platform for testing, analysis and future development.

Lessons Learned

Several important lessons emerged during the implementation of Pilot 2.

Structured Communication is Essential

Differences in organisational timelines, approval processes and resource availability occasionally slowed decision-making. The experience demonstrated the importance of frequent communication, clear action tracking and transparent decision-making processes.

Co-Creation Accelerates Innovation

Workshops and collaborative review sessions proved highly valuable for aligning expectations, refining technical solutions and identifying potential risks early in the process.

Academic and Industrial Expertise are Complementary

The combination of industrial know-how, academic expertise and governmental support ensured that solutions were both scientifically robust and practically relevant. Cross-sector collaboration significantly improved the quality of outcomes.

Clear Responsibilities Improve Project Efficiency

The pilot highlighted the need for clearly defined ownership of tasks, response-time expectations and structured meeting routines to maintain momentum and avoid delays in multi-partner projects.

Impact

Pilot 2 demonstrated the potential of Digital Twin technologies to support energy efficiency, emissions reduction and operational optimization.

The pilot delivered:

- Improved understanding of industrial energy flows.
- Enhanced capabilities in AI-based forecasting and optimization.
- Increased awareness of Digital Twin technologies among stakeholders.
- Stronger collaboration between academia, industry and public authorities.
- A scalable framework that can be adapted to different industrial and maritime environments.

The pilot also contributed to capacity building by exposing partners to advanced modelling, cybersecurity practices and digital innovation methodologies.

Future Collaboration and Sustainability

The partners identified significant opportunities for further collaboration beyond the project. The Digital Twin architecture was intentionally designed as a scalable and adaptable framework that can be transferred to additional industrial facilities, ports, logistics centres and energy-intensive operations.

Future activities may include:

- Expansion of Digital Twin applications to new sectors.
- Integration of additional renewable energy sources.
- Deployment in maritime infrastructure and port operations.
- Further research on AI-based predictive energy management.

- Development of new collaborative R&I initiatives building on the pilot results.

The methodologies, tools and collaboration practices developed during Pilot 2 provide a strong foundation for future innovation projects supporting Europe's digital and green transition.