

1. GENERAL INFORMATION

A. Case study title

Best practice - Port of Constanta (Romania)

Note: This case study is a combined research project performed in two steps: first, field research on the site of one logistic company and Constanta Port Administration, collecting actual and factual data, and second, extensive desk research for additional data collection, verification and analysis to complete and conclude the study.

B. Green practice implemented

Practice 09: Supply chain optimization

C. Specific goals

The case study analyses the optimization of a logistic company activities through the adoption of new digitalization tools. It highlights the fact that achieving a high level of effectiveness and efficiency, as well as environmental protection, requires optimized resource utilization and improved coordination among logistics chain actors.

Additionally, the study examines the initiatives of the Port of Constanța Administration to implement digitalization measures aimed at enhancing the coordination of port actors' activities, including pilotage and towing services, to increase operational efficiency and reduce environmental impact.

D. Direct impact of the practice

- Reducing waiting times for ships or goods
- Preventing congestion and operational overloads
- Emissions reduction
- Reduction of operational costs
- Alignment with green port practices and policies for reducing the port's carbon footprint

E. Place of implementation

Port of Constanta (Romania)

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

The digitization and optimization activities of the logistics company analysed in the case study have been implemented. They are currently in the validation phase, during which benefits are being assessed, and solutions for improved utilization are being explored. The Administration of the Port of Constanța, in collaboration with a specialized company, has defined the requirements for the implementation of the Port Community System. In the upcoming period, a tender will be organized to award the development and implementation of this system.

2. CONTEXT AND DESCRIPTION

A. Description of the practice

Increasing the level of digitalization and integrating highly automated equipment into logistics chain activities within the port platform are effective solutions that enhance resource efficiency and reduce the impact on climate change. This best practice is encouraged by authorities through the creation of funding lines for such projects, as well as by the Port Administration's efforts to harmonize activities through the implementation of a Port Community System.

Best practice involves identifying specialized software applications to optimize terminal activities as well as the associated data flows.

B. Driving factor behind the adoption of the green practice

Port of Constanța has implemented several green initiatives aimed at enhancing environmental sustainability and reducing its carbon footprint:

- The establishment of a funding line within the Ministry of Transport's programs, including European funds, to support port companies in implementing measures to reduce the impact of their activities on climate change.
- Green Port Master Plan Development: In March 2024, the Port of Constanța organized a workshop to analyse and revise its Green Port Master Plan. This plan is a dynamic roadmap guiding the port towards carbon neutrality and sustainable development.
- Participation in the PIONEERS Project: The Port of Constanța participates in the PIONEERS (PORTable Innovation Open Network for Efficiency and Emissions Reduction Solutions) project to optimize port operations and implement renewable energy and mobility solutions. One of the outcomes of the project will be the calculation of the port activities carbon footprint, as well as implementation of an online platform to collect data from port actors related to GHG emissions.

C. Stakeholders involved

- Logistic company
- Maritime transport connected services providers part of the group
- Port Administration

The Port Administration is interested in reducing the carbon footprint and is encouraging such practices. Logistic companies are concerned into aligning with port environmental policies as well as in obtaining an increased efficiency in the use of resources.

3. IMPLEMENTATION

A. Description of the adopted practice

This study explores the strategies for improving operational efficiency and promoting sustainable resource use in a port logistic platform and warehouse, namely at LIFE LOGISTICS S.R.L. Located in Constanta South Port Agigea, and having over 15 years of experience, Life Logistics provides

complete warehousing and handling services, owning and operating one of the most modern logistic platforms within Constanta Port.

The company operates exclusively on the port platform of Constanta Port and provides 2PL and 3PL logistic services. Currently, the company operates in Constanta South a long-term leased area of approximately 40.000 sqm developed from greenfield where it built covered logistic warehouses of 6.000 sqm. Also, in Constanta North Port, the company runs an area of about 5.000 sqm where it has built a covered warehouse of approximately 2.000 sqm.

Furthermore, Life Logistics built these logistic platforms strategically, near the terminals where all containerized transport carriers operate also, being located in the South sector at 250 sqm from DP World terminal and in the North sector at 150 sqm from SOCEP terminal. Life Logistics relies on extensive experience in handling specialized types of goods such as palletized goods, sensitive and valuable cargo, paper rolls, white goods, oversized and project cargo, pipes, roils and coils, as well as on the adequate equipment to handle them.

All in all, Life Logistics has constantly invested in its logistic platforms and warehouses evolving from a simple company with about 15 employees in an integrated logistic platform with nearly 100 employees.

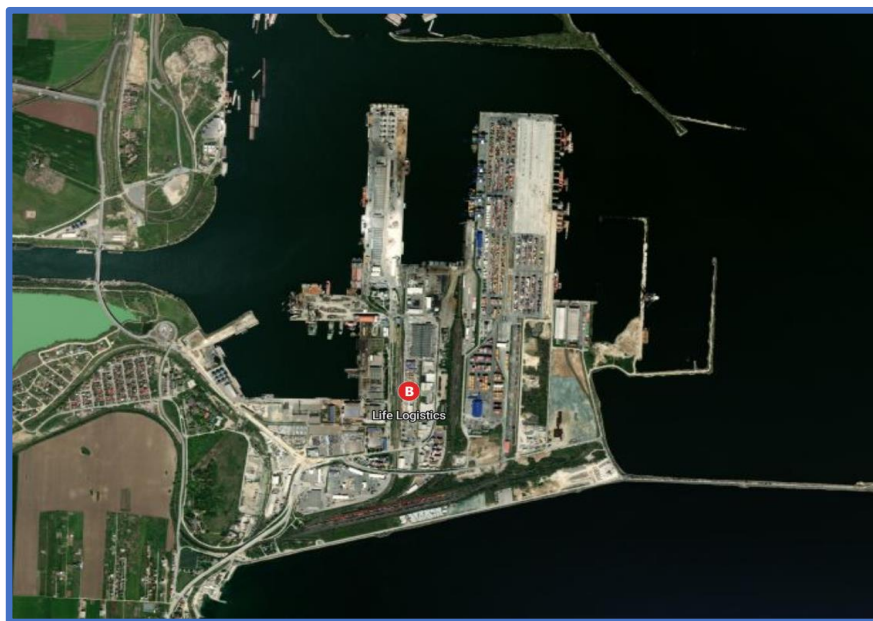


Fig.1 Aerial photo of the terminal in the Port of Constanta

Life Logistics strongly believes that the future of the company lies in innovation and evolution through sustainability, therefore the adoption of their GO GREEN policy has turned into a success. The company's proactive approach to sustainability and operational efficiency is reflected in initiatives such as the adoption of WMS (warehouse management system), the implementation of ARL LIFE DEPOT terminal system (through which the route of each container is tracked from arrival until departure), the maximizing usage of natural light (up to 80%), solar panels for indoor and outdoor lighting, solar power generator, full electric vehicles for employees, own electric charging stations, migration from diesel to full electric forklifts, and the list goes on.

Life Logistics constantly invests in digitalization, and this is perfectly reflected in the adoption of MANTIS – WAREHOUSE MANAGEMENT SYSTEM, through which it is tracked the route of each cargo from warehouse arrival until departure. As the market becomes more competitive and customers more demanding, requiring accurate and real-time information, Life Logistics needed to have the

adequate information-technology tools to support the business and build reliability, control and flexibility into the warehouse operation.

The company decided to implement this intelligent warehouse management system to automate processes and to optimize efficiency within the warehouse. Also, when implementing MANTIS-WMS the company established clear rules to be followed such as: ensuring that all the key people are available during the implementation phase, the appointing of users with training capabilities, developing a training agenda for all employees and also decided to run in parallel their existing system until the new one is fully operational, all the functionalities have been tested and any eventual issues have been solved. This strategic move that enabled Life Logistics to automate its warehouse activities providing real-time tracking of cargo through barcode scanning and mobile terminals, positioned the company as the first in Constanta South Agigea Port to utilize such a system.

Therefore, the introduction of this technology has significantly improved warehouse productivity, reduced costs and increased customer satisfaction. MANTIS WMS manages stocks accurately, processes data quickly and coordinates movements into the warehouse improving competitiveness and generating benefits such as:

- real-time stock visibility and traceability
- improved productivity
- reduction in miss-picks
- automatic replenishment
- reductions in returns
- accurate reporting
- improved responsiveness
- remote data visibility
- minimized paperwork
- minimized unproductive labour
- improved customer service
- costs reduction
- accurate stock records
- reduced errors



Fig.2 Life Logistics terminal

Consequently, the company opted for MANTIS-WMS due to the fact that it works in real-time, provides instantly inventory updates and it also comes with a user-friendly interface. As a result of implementing MANTIS – WMS, Life Logistics has benefited from significantly improved accuracy, efficiency and productivity being an important step towards the introduction of automation to further improve operational efficiency.

Another clear example of the company's path to automation represents the ARL LIFE DEPOT terminal system that provides accurate tracking for each container from its arrival until departure.

This specialized system can also display whether the container has been moved between terminals, as per below picture. This is an advanced warehouse management and automation system that integrates real-time tracking, AI-driven optimization and automated decision-making to improve warehouse efficiency. Basically, it analyses movement patterns and operational data providing real-time analytics leading to an increased order fulfilment speed by 30% and to an improved warehouse space utilization by 25%.

Also, by adopting EDI streamlined communications and thus replacing the traditional paper-based communication has automated the exchange of documents and inventory reports reducing manual data entry and human errors. Another benefit of EDI streamlined communications is reflected by cost savings because it eliminates costs associated with paper, printing and manual processing, reducing also administrative overhead and operational expenses. The communication system easily integrates with WMS (Warehouse Management System) and TMS (Transportation Management System) improving supply chain responsiveness through the coordination between warehousing, shipping and distribution channels.

Therefore, through real-time visibility and tracking, the system enables effective data sharing between warehouses, suppliers and logistic providers.

Environmental impact represents a constant concern for Life Logistics, the company's GO GREEN policy being reflected in its evolution, promoting and implementing sustainable solutions such as the production of energy through photovoltaic panels, electric forklifts, full electric vehicles for employees and own electric charging stations. With direct access to railway, the company looks forward a multimodal future:

-  own rail connected terminal: 18000 sqm
-  rail connected warehouse: 1800 sqm
-  simultaneous processing capacity: 22 rail carriages

The introduction of a VGM automated scale within the logistic platform and warehouse, has come with significant advantages for the company in terms of compliance with safety regulations as the International Maritime Organization (IMO) mandates VGM verification for all containerized shipments under the SOLAS (Safety of Life at Sea) convention.

An automated scale ensures that all shipments comply with weighting regulations, thus avoiding penalties and cargo delays. Furthermore, in order to provide real-time data transfer, the scale has been integrated with WMS (Warehouse Management System) and TMS (Transportation Management Systems). The VGM automated scale comes with instant notifications and alerts if a container exceeds weight limits, enabling quick corrective actions and considerably optimizing stacking and storage within the warehouse.

All in all, the VGM automated scale ensures a smooth supply chain flow, working seamlessly with ERP systems (Enterprise Resource Planning), port terminals, shipping lines and customs platforms.

In order to ease the procedures, the company developed its own container maintenance station improving operational efficiency, allowing for faster turnaround times and reducing its dependency on third party services. Before establishing the in-house container maintenance station, the company faced several logistical and operational challenges, such as delays in container repairs, increased operational costs, limited control over repair quality and standards, inefficiencies in tracking and scheduling container maintenance.

Consequently, Life Logistics' container maintenance station strengthened logistic operations and ensured long-term sustainability in container management:

- cost efficiency – significant cost reduction by eliminating third-party repair fees; spare parts inventory for efficient repairs
- faster turnaround times – containers are repaired and returned to service quicker, improving fleet availability
- quality control – direct oversight ensures high maintenance standards and compliance with industry regulations
- increased container lifespan – regular maintenance prevents deterioration, allowing containers to remain in service longer; sustainable practice reducing the need for frequent container replacements
- better compliance and safety – ensure containers meet international shipping standards (ISO, CSC, IICL) and minimizes the risk of cargo damage due to faulty containers

B. Technologies used (if applicable)

Please see description in section A.

C. Competencies required

The introduction of **Warehouse Management Systems (WMS)** and **Verified Gross Mass (VGM) automated scales** in logistics and port operations requires workers to develop new competencies. These include:

WMS-Specific Competencies:

- **System Navigation & Data Entry** – Ability to input and retrieve data from WMS interfaces efficiently.
- **Inventory Control & Accuracy** – Understanding system-based stock management, cycle counting, and minimizing discrepancies.
- **Automated Picking & Packing** – Operating WMS-integrated picking technologies like RF scanners, voice-picking, or robotics.
- **Integration with IoT & AI** – Familiarity with smart sensors, predictive analytics, and automated tracking tools.
- **Warehouse Layout Optimization** – Using system recommendations for efficient product slotting and storage.
- **Troubleshooting & System Recovery** – Identifying and resolving software and hardware integration issues.

VGM Automated Scale Competencies:

- **Regulatory Compliance & VGM Protocols** – Understanding SOLAS (Safety of Life at Sea) regulations and accurate weight recording requirements.
- **Automated Weighing System Operation** – Using digital scales integrated with WMS for real-time weight verification.
- **Data Interpretation & Transmission** – Ensuring accurate weight data is transmitted to customs, shipping lines, and warehouse systems.
- **Equipment Calibration & Maintenance** – Performing routine checks and troubleshooting scale inaccuracies.
- **Safety & Load Balancing** – Ensuring cargo weight distribution aligns with vessel and transport regulations.

Cross-Functional Digital & Analytical Skills:

- **Data Analysis & Decision Making** – Leveraging reports from WMS and VGM for process improvements.
- **Cybersecurity Awareness** – Understanding data protection measures to secure warehouse and shipment records.
- **Automation & Robotics Coordination** – Managing interactions between automated systems and human workflows.
- **Operational Efficiency Strategies** – Using system insights to optimize port and warehouse throughput.

4. COLLECTED DATA

A. Before implementation

Not available data regarding environmental related indicators before implementation of best practice.

B. After implementation:

The company is under process of collecting data in order to perform a carbon footprint audit, as well as to establish sustainability KPIs.

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

A. Initial investment required

No available information.

B. Key savings or economic impact

- ◆ Automated processes reduce manual work in inventory management, picking, packing, and order fulfilment.
- ◆ Employees can focus on higher-value tasks, improving productivity.
- ◆ Improved warehouse slotting reduces the need for additional storage space.
- ◆ Reduces costs associated with expanding or renting additional warehouses.

- ◆ WMS enables accurate demand forecasting, preventing overstocking.
- ◆ Reduces capital tied up in unsold inventory and lowers insurance/storage expenses.
- ◆ Real-time tracking prevents theft, misplacement, and damage.
- ◆ Minimizes waste due to expired or obsolete stock.
- ◆ WMS automates order picking, reducing processing time and improving accuracy.
- ◆ Faster shipping means improved cash flow and customer satisfaction.
- ◆ Automation eliminates human errors in stock counting, order entry, and dispatching.
- ◆ Prevents costly delays due to incorrect shipments or misrouted goods.
- ◆ VGM automated scales speed up weight verification, reducing bottlenecks in ports.
- ◆ Faster processing reduces demurrage and detention fees.
- ◆ Accurate cargo weight from VGM prevents overloaded or underutilized containers, optimizing fuel consumption.
- ◆ Consolidation of shipments reduces the number of trips, lowering fuel and maintenance.
- ◆ WMS optimizes delivery routes and load balancing, cutting fuel and driver costs.
- ◆ Improved shipment accuracy reduces returns and associated costs.
- ◆ WMS helps optimize warehouse lighting, heating, and cooling, reducing electricity expenses.
- ◆ Automated forklifts and conveyors reduce fuel/electricity consumption.
- ◆ Better inventory management minimizes expired goods and unsellable products.
- ◆ Encourages sustainable packaging and recycling, reducing waste handling expenses.

Estimated Savings Potential (*Industry Averages*)

- ❖ **Warehouse Labor Cost Reduction** → 20-30%
- ❖ **Inventory Holding Cost Reduction** → 15-25%
- ❖ **Freight & Transportation Cost Savings** → 10-20%
- ❖ **Reduction in Regulatory Fines & Compliance Costs** → 50-80%
- ❖ **Faster Order Processing & Fulfilment Time** → 30-50%

c. Contribution to environmental goals

Reduced Carbon Emissions

Optimized Transportation Efficiency – WMS ensures optimal load consolidation, reducing the number of trucks, ships, and trips required, thereby cutting fuel consumption and CO₂ emissions.

Accurate Cargo Weight Measurement – VGM scales prevent overweight shipments, improving fuel efficiency and reducing unnecessary fuel burn during transport.

Reduced Engine Idling at Ports – Automated scheduling and weight verification reduce congestion, minimizing idle time and associated emissions.

Energy Conservation & Sustainable Warehousing

Smart Warehouse Layouts – WMS minimizes unnecessary movement of goods, reducing energy consumption from forklifts and conveyor systems.

Integration with Energy-Efficient Systems – WMS allows automation of energy-saving measures, such as smart lighting, HVAC optimization, and renewable energy integration.

Less Need for New Warehouses – By improving space utilization, WMS reduces the need for warehouse expansion, preserving land and natural resources.

Waste Reduction & Resource Optimization

Minimized Product Damage & Spoilage – WMS ensures better inventory tracking, reducing loss due to expiry, mishandling, or improper storage.

Less Packaging Waste – WMS optimizes packing methods to reduce excess packaging materials and promote sustainable alternatives.

Digital Documentation – Both WMS and VGM reduce paper waste by digitizing records, invoices, and compliance reports.

Compliance with Environmental Regulations & Sustainability Goals

Alignment with Global Emission Standards – The use of WMS and VGM helps businesses comply with green logistics policies such as IMO decarbonization targets and ISO 14001 environmental standards.

Enhanced Carbon Footprint Monitoring – Real-time data from WMS helps companies track, report, and reduce greenhouse gas emissions.

Improved Supply Chain Transparency – Digital tracking ensures that sustainable practices are enforced across the supply chain.

Circular Economy & Recycling Advancements

Better Reverse Logistics Management – WMS supports returns, refurbishing, and recycling processes, extending product life cycles.

Improved Waste Segregation & Recycling Tracking – Warehouses can track materials for efficient recycling, reducing landfill contributions.

More Efficient Use of Raw Materials – Data-driven demand forecasting minimizes overproduction, reducing resource depletion.

6. CONCLUSIONS

A. Success of the green practices

By improving efficiency, reducing waste, and optimizing transportation, **WMS and VGM automation contributed directly to a more sustainable logistics ecosystem**. These technologies enable businesses to reduce their environmental impact while maintaining operational efficiency, making their implementation a **clear success for environmental sustainability**.

B. Lessons learned

The implementation of **Warehouse Management Systems (WMS)** and **Verified Gross Mass (VGM) automated scales** in logistics and port operations has led to several **lessons learned** in reducing environmental impact and mitigating climate change. These lessons include:

1. Energy Efficiency & Reduced Carbon Footprint

- **Optimized Warehouse Layout & Storage** – WMS-driven slotting minimizes unnecessary movements, reducing fuel and electricity consumption.
- **Automated Picking & Robotics** – Reduces reliance on diesel forklifts, leading to lower CO₂ emissions.
- **Smart Lighting & HVAC Integration** – WMS can optimize energy use by adjusting lighting and climate controls based on activity levels.

2. Reduction of Wasted Resources

- **Minimized Overproduction & Stockpiling** – Real-time inventory tracking prevents overordering and waste.
- **Efficient Space Utilization** – Better warehouse planning reduces the need for new facilities, preserving land and resources.
- **Sustainable Packaging Insights** – WMS can recommend eco-friendly packaging and optimal packing methods to minimize material waste.

3. Improved Transportation & Emissions Reduction

- **Optimized Route Planning** – WMS and VGM integration ensure shipments are efficiently consolidated, reducing unnecessary trips.
- **Accurate Cargo Weight Management** – VGM scales prevent overweight shipments, improving fuel efficiency and reducing emissions.
- **Data-Driven Load Balancing** – Properly distributed container weights enhance transport efficiency, reducing fuel burn.

4. Paperless & Digital Transformation

- **Electronic Documentation & Reporting** – WMS and VGM eliminate paper-based tracking, significantly reducing paper waste.
- **Automated Billing & Customs Clearance** – Speeds up processes and cuts down on the environmental impact of printing and physical storage.

5. Waste Reduction in Port & Warehouse Operations

- **Prevention of Cargo Loss & Damage** – Better inventory control reduces spoilage and damage, minimizing disposal of unsellable goods.
- **Sustainable Disposal & Recycling** – WMS helps track and manage waste, promoting responsible disposal and recycling initiatives.

6. Enhanced Regulatory Compliance & Sustainability Metrics

- **Carbon Emission Tracking** – WMS provides data on warehouse and transportation emissions, supporting sustainability goals.
- **Green Logistics Strategies** – Insights from WMS and VGM help companies align with eco-friendly shipping and regulatory frameworks like IMO's decarbonization targets.
- **Improved Supply Chain Transparency** – Digital records enhance traceability, ensuring suppliers adhere to sustainability standards.

c. Next steps

- ◆ Conduct a **carbon footprint audit** using WMS analytics.
- ◆ Set clear **sustainability KPIs** (e.g., % reduction in emissions, waste, and energy use).
- ◆ Invest in **AI & automation** to further optimize logistics and reduce inefficiencies.
- ◆ Train employees in **green logistics best practices** using WMS and VGM data insights.

7. ANNEXES

d. Include relevant supporting materials