

IMPLEMENTATION OF MODERN TECHNOLOGIES TO ENHANCE LOGISTICS PROCESS EFFICIENCY IN ENTERPRISES

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In the current landscape of global competition and rapid technological development, the efficiency of logistics processes has become a key success factor for enterprises. Adopting modern technologies offers a strategic advantage, enabling companies to optimize supply chains, reduce costs, improve customer service, and maintain competitiveness. Tools such as management information systems, robotics, analytical platforms, and artificial intelligence allow for automation, improved forecasting, and faster operations, essential for competitiveness in today's dynamic market [1-6].

Integrating modern logistics technologies has become crucial for organizations striving to meet changing market demands and respond to challenges like supply chain disruptions and economic fluctuations. Enterprise Resource Planning (ERP) and Warehouse Management Systems (WMS) are foundational technologies in logistics, providing centralized resource management by integrating all business processes on a single platform. These systems consolidate data from procurement, inventory, warehousing, and transportation, enabling effective control and coordination, optimizing resource allocation, reducing processing costs, and improving communication [1].

While ERP systems are invaluable for optimizing inventory by maintaining optimal stock levels and streamlining procurement, they require significant capital investment and extensive personnel training. Similarly, WMS enhances warehouse operations by monitoring inventory levels, tracking goods in real time, and ensuring task accuracy, thus boosting productivity and reducing stockout risks. However, implementing these systems requires substantial investment and compatibility with existing ERP systems, often necessitating adjustments to warehouse layouts and workflows [1].

Robotic systems and automation, such as Radio Frequency Identification (RFID), accelerate processes and reduce human error. Robots in warehouses can perform repetitive tasks like picking and sorting, boosting operational speed and accuracy in order processing. RFID technology, a key part of modern logistics, allows for real-time tracking, providing faster and more precise inventory management, which improves responsiveness to customer demands. However, adopting robotic systems and RFID requires significant investments in equipment, infrastructure adaptation, and technical support [2-3].

Data has become a valuable asset in logistics, making analytical platforms essential for decision-making. These platforms enable companies to collect and analyze data across the supply chain, helping identify trends, predict demand, and address bottlenecks. Predictive analytics supports logistics managers in anticipating demand fluctuations and optimizing resources, reducing stockouts or overstocking. However, using these platforms demands specialized knowledge, which may require investment in training or hiring skilled personnel [4].

Advancements in artificial intelligence (AI) and machine learning elevate logistics operations by offering predictive capabilities and automation for complex processes. AI systems optimize route planning, fleet management, and resource utilization, improving delivery accuracy and reducing transportation costs. AI-driven algorithms enable automated decision-making in forecasting, stock replenishment, and pricing adjustments, helping companies manage inventory and respond to market changes effectively. However, AI implementation involves substantial investment, specialized personnel, and data security measures. Ethical considerations, like data privacy, are increasingly significant [5]. The advantages and disadvantages of the main technologies in logistics are presented in Table 1.

Table 1 – Comparison of the main technologies in logistics

Technology	Advantages	Disadvantages	Examples of Technologies/Systems
ERP Systems	Provides integration of all business processes on a single platform, which enhances inventory management efficiency, reduces data processing costs, and improves interdepartmental coordination. ERP systems enable close control over procurement, warehouses, and transportation, reducing human errors and enhancing data analytics for informed decision-making.	High implementation cost, including licenses, infrastructure, and consulting services. Requires extensive employee training to adapt to new processes and integration, which can slow down operations in the initial stages. Potential difficulties with integration into existing systems.	Global: SAP ERP (https://www.sap.com), Oracle ERP (https://www.oracle.com/erp), Microsoft Dynamics 365 (https://dynamics.microsoft.com). Ukrainian: IT-Enterprise ERP (https://www.it-enterprise.com), Master ERP (https://masterbuh.com), 1C ERP (https://1c.ua)
WMS (Warehouse Management Systems)	Optimizes warehouse management, improves task accuracy, and ensures more efficient use of warehouse space. Enhances productivity through quick access to information on stock availability, reducing order processing time. Helps avoid stock issues through precise inventory analytics.	High implementation and maintenance costs. Integration with ERP and other systems may require additional resources and time, especially if processes are already automated with other systems. Requires changes in warehouse processes, which may involve significant time and resources.	Global: Manhattan Associates WMS (https://www.manh.com), NetSuite WMS (https://www.netsuite.com), HighJump WMS (https://www.highjump.com). Ukrainian: Qguar WMS (https://assecobs.pl/en/qguar), IT-Enterprise WMS (https://www.it-enterprise.com)
Robotic Systems	Automates repetitive tasks such as picking, sorting, and packaging, reducing the need for physical labor and minimizing human error. Increases the speed of operations, especially in large warehouse complexes. Ensures continuity of work even under increasing order volumes, improving customer service.	High initial investment in robotic equipment and the need to adapt existing infrastructure. Requires regular maintenance and technical support to ensure reliable operation. May encounter resistance from employees due to concerns over job loss.	Global: Kiva Robots (Amazon) (https://robotics.amazon.com), GreyOrange (https://www.greyorange.com), ABB FlexPicker (https://new.abb.com/products/robotics). Ukrainian: Sypwai (https://sypwai.com), robotic packaging lines by Kondor (https://kondor-pack.com)
RFID Technologies	Enables fast inventory checks, provides accurate real-time tracking of goods, which significantly reduces time spent on inventory verification. Improves speed and accuracy of tracking, enhancing customer service and reducing risks of losses or errors in warehouse processes.	High cost of equipment, including RFID tags and readers, as well as infrastructure adaptation expenses to support RFID. Challenges with RFID integration with other logistics management systems, especially for large complex enterprises. Training may be needed for effective use.	Global: Impinj RFID (https://www.impinj.com), Zebra RFID (https://www.zebra.com), Alien Technology RFID (https://www.alientechnology.com). Ukrainian: RFID systems by Ukrainian Intelligent Systems (http://uis.com.ua), Smart Solutions (https://smartsolutions.ua)

Technology	Advantages	Disadvantages	Examples of Technologies/Systems
Analytical Platforms	Allows processing large volumes of data to identify trends, optimize processes, and detect potential problem areas in supply chains. Supports informed decision-making based on data analysis, reducing operational costs and enhancing efficiency. Helps forecast demand, preparing better for peak loads.	Requires specialized knowledge in data analysis and platform usage. Significant investment is needed to train staff or hire new specialists with relevant skills. Integration of analytical platforms with existing systems may be complex and costly.	Global: Tableau (https://www.tableau.com), IBM Watson Analytics (https://www.ibm.com/watson), Qlik Sense (https://www.qlik.com). Ukrainian: IT-Enterprise BI (https://www.it-enterprise.com), YouControl (https://youcontrol.com.ua)
Artificial Intelligence and Machine Learning	Automates complex decisions such as demand forecasting, resource optimization, and routing. AI considers multiple factors (weather conditions, road status, etc.), which contributes to effective resource management and cost reduction. Enhances responsiveness to market changes and reduces excess inventory.	Requires significant investment in implementation, algorithm development, and data protection. Staff must possess specialized knowledge to work with AI, which requires additional training or hiring specialists. There are ethical and data security concerns associated with AI use, especially when handling personal data.	Global: Google Cloud AI (https://cloud.google.com/ai), Amazon SageMaker (https://aws.amazon.com/sagemaker), Microsoft Azure AI (https://azure.microsoft.com/en-us/services/machine-learning). Ukrainian: SoftServe AI Solutions (https://www.softserveinc.com), Neurons Lab (https://neurons-lab.com)

Source: compiled by the author

The application of modern technologies in logistics significantly enhances enterprise efficiency by optimizing processes in inventory management, transportation, and warehouse operations. Each technology has distinct advantages that contribute to increased productivity and customer satisfaction. However, effective implementation requires a careful balance between capital investments, workforce training, and infrastructural adjustments. Organizations must recognize the long-term investment needed to maximize the benefits of these technologies and ensure that personnel are adequately trained to operate them. Moreover, integrating such advanced solutions may demand modernization of the current infrastructure, a significant challenge that necessitates support from technical experts.

A comprehensive approach that includes careful planning, adaptation of business processes, and continuous personnel development will enable enterprises to leverage these technologies effectively, thereby achieving maximum efficiency and sustaining competitiveness. This approach will not only optimize existing processes but also lay a foundation for further development and adaptation to changing market conditions, positioning companies to respond to future challenges with agility and resilience.

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ДОСЛІДЖЕННЯ ПЕРЕВЕЗЕННЯ ЗЕРНОВИХ ВАНТАЖІВ В УМОВАХ РИЗИКУ ТА НЕВИЗНАЧЕНОСТІ В УКРАЇНІ

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Специфікою зернових вантажів в Україні є їх сезонність, відсутність великих складських баз та висока собівартість зберігання продукції (витрати пов'язані з підсушуванням, перекиданням та боротьбою з гризунами). Через це більшість агропідприємств після збору врожаю майже одночасно викидає значні об'єми товарної продукції на світові чи внутрішні ринки. Все це максимально потужно завантажує транспортну інфраструктуру держави та вимагає від всіх ланок в ланцюгу логістичного маршруту ефективного та швидкого функціонування. Недостатність забезпечення транспортними засобами, їх технічна та технологічна недосконалість вимагає від логістів прийняття ефективних та доцільних рішень для руху зернових маршрутними коридорами. Створення математичних моделей дозволяє знайти резервні потужності в фронті руху вантажного транспорту з метою визначення кількості транспорту та подач рухомого складу, часу роботи механізмів та логістичних ліній руху територією держави згідно наявних законодавчих норм [1-3].

Ентузіазм та народногосподарські проблеми, що потребують урегулювання, є основним рушійним процесом для розвитку, розробки та становлення документальної бази