

strong foundation for my future professional activity.

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TECHNOLOGY'S IMPACT ON MODERN LOGISTICS OPERATIONS

Maslich N. A., student,

Kharkiv National Automobile and Highway University

In the current context of global economic development, logistics plays a key role in ensuring the effective functioning of businesses and national economies. Whereas logistics processes were previously viewed primarily as a support function related to the transportation and storage of goods, today they have taken on strategic importance, determining the competitiveness of businesses in the market.

The relevance of this study stems from the rapid development of digital technologies and their active implementation in supply chain management. In the context of globalization and increasing competition, effective management of logistics processes has become a key factor in a company's success. The use of technologies such as artificial intelligence, the Internet of Things, blockchain, and automated logistics systems contributes to the optimization of supply chains, cost reduction, and improved operational efficiency. At the same time, their implementation is accompanied by a number of challenges, including the need for highly qualified personnel, significant financial costs, and cybersecurity risks [1].

Logistics operations are a set of interrelated processes aimed at the efficient movement of physical, informational, and financial flows within the supply chain. Key processes include transportation, warehousing, inventory management, order processing, and information support.

In traditional logistics, these processes were mostly performed manually with limited use of information technology. Modern market conditions require integrated systems based on digital technologies and automated solutions. The use of modern information systems enables real-time monitoring and management of logistics operations, increasing the efficiency of supply chains and the transparency of processes.

The modern development of logistics systems is inextricably linked to the adoption of innovative digital technologies, among which the Internet of Things (IoT), artificial intelligence (AI), blockchain, and digital logistics platforms play a key role. Their use helps improve the efficiency of material flow management, reduce costs, and enhance the quality of logistics services.

The Internet of Things (IoT) plays a vital role in transforming logistics operations by enabling real-time data collection and processing. The use of sensors, GPS trackers, and RFID tags allows for precise tracking of cargo at every stage of the supply chain, enhancing control and transparency in transportation. IoT also enables monitoring of transport conditions (temperature, humidity, etc.), which is critical for perishable goods, and helps automate routine operations and reduce errors. For example, Amazon uses IoT solutions to automate warehouse processes: robots and sensors optimize the movement of goods and speed up their processing. Walmart uses IoT sensors to track the condition and location of goods in real time, which improves inventory management. In Ukraine, Nova Poshta is implementing IoT to track packages and monitor processes at sorting centers, which increases delivery accuracy.

Artificial intelligence (AI) is a vital tool for optimizing logistics processes. Its use enables the analysis of large volumes of data, demand forecasting, and the optimization of inventory and delivery routes, taking into account traffic, weather conditions, and time constraints. AI is also used to automate warehouse operations and improve the efficiency of resource management. In practice, Walmart uses AI to optimize delivery

routes, which reduces costs and improves shipping schedules. FedEx uses the FedEx Surround platform to monitor shipments and predict delays. The Ukrainian company Rozetka uses AI for demand analysis and inventory management, which improves customer service efficiency [2].

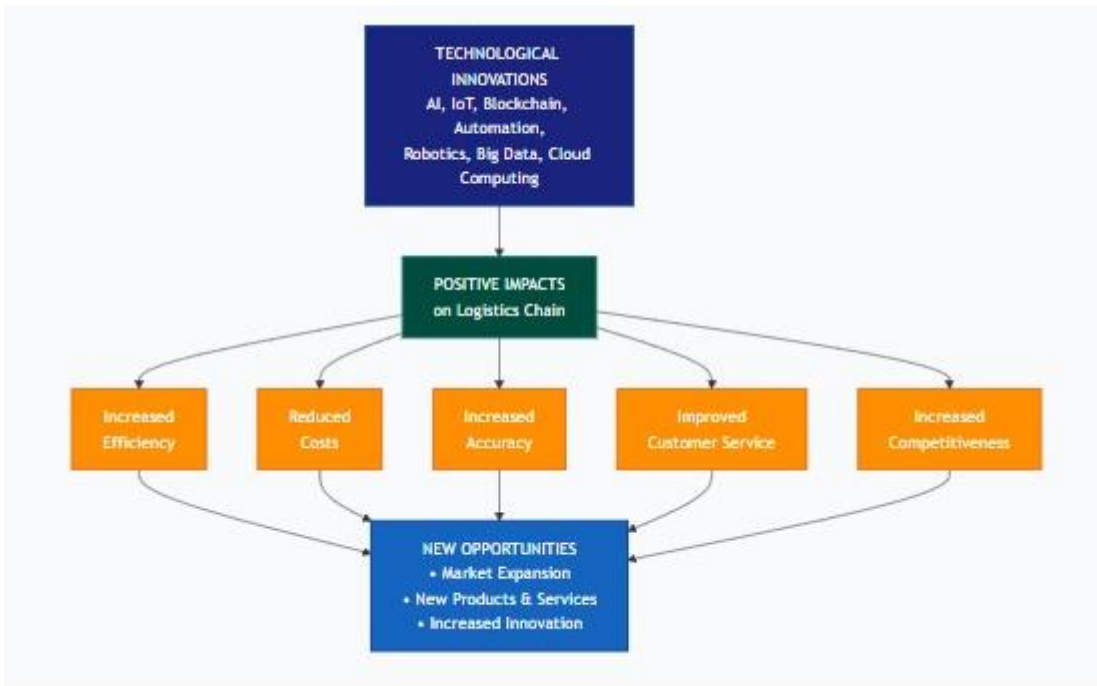
Blockchain technology ensures a high level of security and transparency in logistics processes by creating immutable records of all transactions in the supply chain. This makes it possible to track the movement of goods, reduce the risk of fraud, and build trust among participants. In addition, blockchain supports the use of digital certificates and smart contracts to automate mutual settlements. Specifically, IBM has implemented the IBM Food Trust platform to track the origin of food products, and DHL uses blockchain in combination with IoT to monitor transport conditions using “smart pallets.”

Digital logistics platforms integrate all participants in the supply chain into a single information environment. They enable the coordination of shipments, route optimization, and real-time order tracking, while also improving information exchange among process participants. In Ukraine, Nova Poshta is developing its own digital ecosystem, which enables real-time shipment tracking and delivery management, thereby enhancing service quality and process transparency.

Thus, the integration of IoT, AI, blockchain, and digital platforms forms the foundation of modern logistics systems, ensuring their flexibility, adaptability, and competitiveness. The comprehensive implementation of these technologies creates the conditions for the further development of intelligent transport and logistics systems.

The technological trends outlined above improve efficiency, reduce costs, and strengthen competitiveness in logistics. The implementation of innovations has a significant positive impact on both individual companies and the entire logistics chain (pic. 1). In today’s environment, technology determines the main directions of the industry’s development, ensuring improved efficiency and effectiveness of logistics processes, specifically:

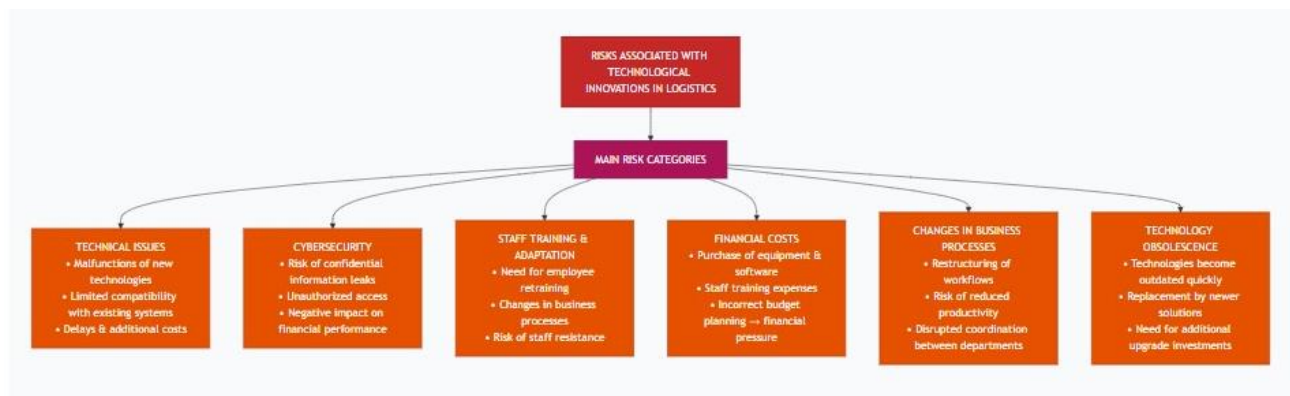
Picture 1. The impact of implementing technological innovations in logistics



All these effects reflect the significant impact of technological innovation in logistics and confirm the importance and necessity of continuous development and the use of the latest technologies in this field. Accordingly, companies that decide to invest in technological innovations can expect a significant increase in efficiency and competitiveness in the market.

While the implementation of technological innovations in logistics offers numerous advantages, it also entails risks that must be taken into account and effectively mitigated (pic. 2).

Picture 2. – Risks associated with the implementation of technological innovations in logistics



According to Picture 2, the greatest risks associated with the implementation of technological innovations in logistics are:

- technical issues. New technologies may experience malfunctions or have limited compatibility with existing systems, which can lead to delays and additional costs for troubleshooting;

- cybersecurity. The use of digital solutions increases the risk of confidential information leaks and unauthorized access, which can negatively impact the company's financial and operational performance;

- staff training and adaptation. Implementing technology requires retraining employees and changing business processes. Insufficient preparation can reduce efficiency or cause resistance among staff;

- financial costs. Investments in technology include the purchase of equipment, software, and staff training. Incorrect budget planning can create financial pressure;

- changes in business processes. Integrating new technologies may require restructuring business processes. Failed changes can lead to reduced productivity and disrupted coordination between departments;

- technology obsolescence. Not all innovations remain relevant in the long term. Technologies can quickly become obsolete or be replaced by newer solutions, requiring additional investments for upgrades [3].

Managing these risks requires careful planning, analysis, and control. Companies must employ risk management strategies and have contingency plans in place to ensure the successful implementation of technological innovations in logistics. It is also important to conduct thorough assessments and testing before implementing new technologies, as well as to ensure continuous monitoring and updates after implementation.

The study found that modern digital technologies play a decisive role in the transformation of logistics operations. Their integration enhances the efficiency of material flow management, improves the quality of logistics services, and creates conditions for more flexible and adaptive supply chain operations.

A practical analysis has shown that leading international and Ukrainian

companies are actively implementing innovative technologies in their operations, which allows them to optimize transportation, warehousing, and inventory management processes. This helps to increase the competitiveness of enterprises and strengthen their market positions. At the same time, the implementation of technological innovations is accompanied by a number of challenges, which necessitates a comprehensive approach to risk management and strategic planning of the digital transformation process.

The prospects for the further development of logistics are linked to the expanded use of intelligent systems, automation, and the integration of digital solutions into unified information ecosystems. Thus, the effective implementation of modern technologies becomes a key factor in ensuring the sustainable development of enterprises and enhancing their competitiveness in the context of globalization.

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THE LAST-MILE LOGISTICS REVOLUTION: DRONES, ROBOTS AND THE FUTURE OF URBAN DELIVERY

Malofeev M. D., student

Voronova Y. M., Associate Professor

Kharkiv National Automobile and Highway University

INTRODUCTION Ask anyone who has ever waited at home for a parcel and they will tell you: the last mile is the most frustrating part of delivery. For logistics companies, it is also the most expensive. Last-mile delivery — the final step that brings a package from a local distribution centre to the customer's doorstep — accounts for