

DIGITAL TWINS IN LOGISTICS

Voronov G.A.

Belarusian State University of Informatics and Radioelectronics, Minsk, Republic of Belarus

Shulga O.N. – lecturer of the Department of Foreign Languages

Annotation. The logistics industry has undergone significant transformation over the years, thanks to advancements in technology. One of the most promising technologies disrupting the industry is digital twins. In this article, we explore the concept of digital twins in logistics, their benefits, and their potential impact on the industry.

Keywords: logistics, digital twin, virtual model, real-time insight, supply chain, simulation.

Introduction. Logistics is an essential function that involves the timely and efficient movement of goods and products from one place to another. The process is complex and depends on various factors such as inventory management, transportation, and supply chain management, among others. In recent years, the technology surrounding digital twins has gained traction in various industries, including logistics.

Main part. Digital twins are virtual models or simulations of physical objects, systems, or processes for testing and analysis. It is a tool that allows one to understand the intricacies of a system before its implementation. In logistics, a digital twin can help simulate processes and identify challenges before disrupting the supply chain. In this field, digital twins can be used to create a real-time digital representation of the supply chain, from raw materials to finished products. This means that logistics managers can use digital twins to monitor and optimize every aspect of the supply chain, from inventory management to transportation and delivery.

Digital twins in logistics come in various forms, including models of warehouses, transportation networks, and product tracking systems. By creating a virtual model of the logistics system, companies can carry out simulations, collect data and analyze the results for optimal performance. For instance, a digital twin of a warehouse can help in testing out different layouts, staff allocation, and discharging. This approach allows the identification of inefficiencies and areas that require improvements. Companies can deploy digital twins to map out their supply chain, anticipate disruptions like traffic congestion, and plan accordingly.

There are several benefits of using digital twins in logistics. One of the most significant advantages is that they provide a real-time view of the supply chain. This means that logistics managers can monitor the movement of goods in real-time, identify potential bottlenecks or delays, and take corrective action before they escalate into bigger problems. The ability to monitor the supply chain in real-time also allows managers to optimize the flow of goods and products, reducing lead times, and improving delivery times. Another benefit of using digital twins in logistics is that they can be used to simulate different scenarios. For example, logistics managers can simulate the impact of adverse weather conditions, transportation delays, or equipment breakdowns and adjust the supply chain accordingly. This means that they can prepare for potential disruptions and minimize their impact on the supply chain.

The potential impact of digital twins on the logistics industry is significant. Many experts believe that digital twins will transform the industry by providing new insights into the supply chain and enabling more precise control of logistics operations. For example, logistics managers can use digital twins to track the performance of individual assets, such as trucks or containers, and optimize their use. They can also use digital twins to identify areas of inefficiency in the supply chain and implement corrective action to improve efficiency. Moreover, digital twins can also help logistics companies to reduce costs by minimizing waste and improving productivity. By optimizing the flow of goods and products, logistics companies can reduce inventory costs, transportation costs, and labor costs.

Digital twins are transforming logistics by providing real-time insights into the supply chain and enabling more precise control of logistics operations. They offer numerous benefits, including real-time monitoring, scenario simulation, optimization of the supply chain, and cost reduction. Logistics companies that wish to remain competitive must embrace this technology. As a result, digital twins have become an integral part of the logistics industry, and their adoption is expected to continue growing in the coming years [1].

Being virtual replicas of physical objects or systems, digital twins are used to model and simulate their behavior. In the logistics industry, digital twins can be used to simulate and optimize supply chain operations. They can help companies to visualize, understand and analyze their operations in near-real-time, allowing them to make better decisions and improve their performance.

One of the key advantages of digital twins is the ability to anticipate and plan for potential disruptions or disruptions that may have occurred in the supply chain. By monitoring real-time data from sensors and other sources, companies can identify and address issues in the supply chain before they become critical. For example, companies can create digital twin models of their warehouses, distribution networks, and transportation systems. These models can be used to simulate different scenarios and test different strategies for optimizing operations. They can also be used to predict demand and optimize inventory levels.

Digital twins can also be used to improve the efficiency and safety of logistics operations. For example, they can be used to optimize the placement of goods in a warehouse or to optimize the routing of vehicles in a transportation network. They can also be used to monitor and optimize the performance of equipment and machinery, such as forklifts, cranes, and conveyor belts.

Cost savings is one of the significant benefits of digital twins in logistics. Simulating different scenarios helps in identifying inefficiencies or errors before implementing a new process, which saves money and resources. For example, developing a digital twin of transportation networks can help in identifying the shortest and most optimal routes for products, reducing the distance covered and fuel consumption, thereby reducing costs. Furthermore, digital twins in logistics can facilitate agile operations, which is crucial in keeping up with the rapidly changing business environment.

Overall, digital twins have the potential to transform the logistics industry by enabling companies to optimize their operations, reduce costs, and improve customer service [2].

Even though digital twin technology holds great promise, there are still some challenges that must be addressed. One of the biggest issues relates to data privacy and security. Given that virtual twins rely on data, they must be designed with adequate security measures to avoid data breaches. This includes the encryption of data, ensuring confidentiality, and regular updates of security protocols. Additionally, digital twins require a significant investment in time and resources to develop, and they may not be accessible to all logistics companies due to the cost.

Conclusion. Digital twins in logistics have many benefits, including cost savings, optimized operations, and improved supply chain performance. Despite some challenges, digital twins offer a practical approach for logistics companies seeking to streamline their processes and stay ahead of the curve [3]. Companies that seek to invest in digital twin technology must be mindful of the unique challenges and work towards building a reliable, secure and sustainable digital twin environment for their logistics operations. Ultimately, the use of digital twins in logistics will help companies achieve operational efficiency, cost savings, and profitability.

References

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