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DIGITAL TWINS AS A TRANSPORT LOGISTICS TOOL

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The article discusses digital trends for logistics transforming – digital twins. This trend contributes to the improvement of supply chains and affect transport operations in general. New technologies help companies to reduce costs, increase productivity and efficiency, and optimize maintenance.

In the modern world, there are more and more new technologies that are gradually being introduced into various areas of production, and logistics is no exception. Manual processing of information is replaced by computer, in the world there are automated systems that make it possible to simplify the process of work in enterprises. With the use of these technologies, production processes are optimized, data processing time is reduced and the efficiency of enterprises is increased. One of the such technologies is digital twin technology (see Fig.a) [1].



Fig. a. – Digital twins in logistics

A digital twin is a representation of a physical object, process or service, such as a jet engine or wind farms, or even larger items such as buildings or even whole cities and supply chains. The digital twin technology is used for copying processes in order to help company to predict how these processes will perform. These programs can integrate the Internet of things, artificial intelligence and software analytics to improve the results.

With the progress of machine learning and factors such as big data, these virtual models have become a big step in modern engineering to drive innovation and improve performance [2]. Creating digital twin can allow to avoid costly failures in physical objects, by using advanced analytical test processes and services, monitoring and predictive capabilities.

The lifecycle of a digital twin starts with experts in applied mathematics, data science researching the physics and operational data of a physical object in order to develop a mathematical model that simulates the original. The developers who create digital twins have a warranty that the virtual computer model can get feedback from sensors that gather information from the real world version. This lets the digital version simulate what is happening with the original version in real time, creating opportunities to collect insights into performance and any other potential problems.

A digital twin can be complex or simple, with differing amounts of data determining how clearly the model simulates the real world physical object [5]. The twin can be used with a prototype to offer feedback on the product as it can even act as a prototype in its own right to model what could happen with a physical object when built.

Since it can be used across a wide range of industries, from healthcare to automotive and power generation, it has already been used to solve a large number of problems. A digital twin allows users to explore solutions for product lifecycle increase, manufacturing and process improvements, and product development and prototype testing. A digital twin can virtually show a problem so that a solution can be invented and tested in the program rather than in the real world.

Aftermarket logistics services can be developed by linking digital twins of manufactured products with logistics services. With a digital twin of any physical object, such as goods or vehicles, the role of the logistics service provider can become extremely important, acting on insights from the virtual reality. For instance, if a vehicle receives damage and requires spare parts, the supply chain is able to react quicker (or even proactively) and more efficiently with notifications from the digital twin, detailing exactly the required parts and where they need to be sent.

Technology, Machine-building

Digital twins help companies to solve problems by simulating all assets in a complex supply chain. A company can make decision across multiple planning horizons:

- short-term planning and realization;
- sales and operations planning;
- longer-term planning.

Designing, monitoring, and managing packaging and containers creates a number of challenges for the industry. The growth of e-commerce such as packaging variety and driving up demand. This produces significant reduces operational efficiency through poor volume utilization. The application of material digital twins could help the development of better and more environmentally friendly packaging materials. In efforts to improve stability, companies are exploring the application of a range of new materials including compostable plastics and materials with a high percentage of post-consumer recycled content. Material digital twins can help companies understand and forecast the performance of new materials in packaging applications, can model material behavior under the temperature, vibration, and shock loads experienced in transit [4].

Digital twins could also help logistics participants manage container fleets more efficiently. Reusable containers are an industry standard in multiple logistics flows. They include standard ocean containers, reusable crates to transport car parts between factories, and containers for food and drinks delivery to retail stores and consumer homes.

Nowadays, the engineering, manufacturing, energy, and automotive industries are leading the way in impact digital twins to manage their most critical assets, followed by healthcare, logistics and even supply chain. As the necessary technologies continue to become more available, the logistics sector is only just now beginning its digital twin way and early examples of the first supply chain facilities using digital twins are beginning to appear. Perhaps more important for logistics professionals to consider in the near term is not how to use digital twins for direct management of supply chain operations, assets, and facilities but rather how to develop the supply chain [3].

For digital twins and their physical twins to work together optimally, there is an increasing need for logistics professionals to improve sensitivity, service quality, availability, and delivery accuracy to ensure the thing performs in optimal harmony with its intended design and performance.

Thanks to this trend, we can expect the technology to also be accepted for certifications such as security and environmental standards. In the future, products will be delivered with their digital twins. That will permit users, for example, to test and predict how modifications to an electric motor, a building's design, or a factory's production process will affect energy use and efficiency. Digital twins may become an integral part of our everyday lives by enabling individuals without previous technical knowledge to finally get simple answers to complex questions.

Customers today understand the value of digitalization, and are already ready to pay for both a physical product and a virtual one. Demand is growing, and tomorrow in highly competitive markets, it will be possible to sell only the product that has a digital twin.

The most successful retailers are those that are already recognizing and implementing technologies such as digital twins, artificial intelligence and machine learning – they are the ones that are staying ahead of the curve in tough times. If businesses are to survive and thrive in the new normal, they must implement the right enabling technology that will help them gain insights into their supply chains and make them more agile to respond to rapidly changing conditions [6].

Table 1. – Global digital twin market forecast

Year	Analysts' assessment
2019	\$ 1,9 bn
2023	\$ 16 bn
2025	\$ 32,3 bn

In conclusion, we can say that a new splash of interest in digital twins in the future will only grow. The first examples of the implementation of modern digital twins are already presented, and we can expect new ones from day to day. Some technology providers already have digital twins in their platforms, which allows to monitor the state of all processes in the enterprise. The Coronavirus pandemic has fueled wider adoption of digital twin technology. International research firm MarketsandMarkets estimates that the U.S. digital twin industry will grow from \$ 3.8 billion in 2020 to nearly \$ 36 billion by 2025, in part due to the COVID-19 pandemic.

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