

Summing up, it is possible to determine the limit values of these quantities at which the losses in regulated and unregulated traffic will be the same. By establishing this limit, it is possible to determine the critical traffic intensity at which the introduction of traffic light control is economically justified.

$$td(u)(N) = td(r)(N),$$

$$N = \text{function}(td(u), td(r)),$$

where N - critical traffic flow intensity for the economically justified installation of traffic lights, vehicles/hour;

td(u) - traffic delay at an unregulated intersection, s;

td(r) - traffic delay at a regulated intersection, s.

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WAYS AND TRENDS OF

MODERN TRANSPORT LOGISTICS DEVELOPMENT

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The modern world is developing very fast. Every day, humanity faces serious problems and challenges. But at the same time, we continue to develop modern

technologies that make our lives much easier and help solve both local and global problems.

Modern technologies are developing very rapidly, integrating into all areas of human activity, automating and simplifying all processes. Modern technologies make human activity much more efficient, but at the same time, they bring with them certain problems that humanity has already faced or will face in the future. Today I would like to consider the ways and trends in the development of transport logistics and analyze the problems that we, as future transport professionals, may have to face.

1. Application of artificial intelligence in transport logistics.

Artificial intelligence, this technology is gaining momentum every day. The possibilities of this technology are becoming more and more extensive, it is being used in many industries, and of course, transport logistics is no exception. I propose to consider how artificial intelligence can be applied in modern logistics.

One of the key applications of artificial intelligence in transportation logistics is route optimization. Thanks to machine learning and big data analysis, artificial intelligence is able to simultaneously take into account many factors, such as the current traffic situation, weather conditions, road conditions, and traffic delays. This allows the logistician to choose the most efficient routes, which shortens delivery times, reduces fuel costs, and increases the overall productivity of transportation companies.

Another important area is transportation demand forecasting. Artificial intelligence algorithms can analyze historical data, taking into account seasonality, economic indicators, and even social trends, which allows companies to better plan their operations. This can help optimize vehicle utilization, avoid downtime, and ensure efficient resource management. This will help people to plan their companies' work efficiently without spending a lot of time on a detailed analysis of the company's work.

Automation of warehouse processes is also one of the important aspects of using artificial intelligence. AI-powered systems can manage inventory, predict the need to replenish warehouses, and even coordinate the work of robotic systems for packing and

shipping goods. This significantly increases the efficiency of logistics centers and reduces the likelihood of human errors.

It is also worth mentioning the role of artificial intelligence in the field of transportation safety. Video analysis and facial recognition systems can be used to control access to cargo areas and monitor driver behavior, which reduces the risk of accidents and improves road safety.

However, the use of artificial intelligence has its own problems. One of the main threats is the possible reduction of jobs due to the automation of many processes. The introduction of AI may reduce the need for human staff at various levels of transport logistics, which will lead to the need to retrain employees and change approaches to employment in this area.

Nevertheless, it is important to understand that artificial intelligence is not a complete replacement for humans in transport logistics. On the contrary, it will become a powerful tool that will help specialists improve their work efficiency, optimize processes, and reduce the number of routine tasks. Transport logistics involves many non-standard and complex situations, where each transportation can be radically different from the previous one, which means that human activity will always be necessary for the effective functioning of transport logistics. People remain the key to making strategic decisions, analyzing complex situations, and managing non-standard cases.

Thus, artificial intelligence is significantly changing transportation logistics, making it more efficient, safe, and cost-effective. With the development of technology, we can expect even greater integration of AI in this area, which opens up new opportunities for automation and optimization of all processes.

I would also like to add some companies that are actively developing artificial intelligence technologies in logistics.

CMA CGM. The French shipping and logistics company CMA CGM has entered into a partnership with Google to implement artificial intelligence solutions in its global operations. The goal of the cooperation is to increase efficiency, optimize routes, manage containers and inventory, and reduce costs and carbon emissions.

WebbyLab. The Ukrainian company WebbyLab specializes in the development of artificial intelligence solutions, including consulting, software development, and integration of AI into various industries, including logistics.

DeepMind (a division of Alphabet). DeepMind is known for its research in artificial intelligence and machine learning. While their developments cover a wide range of applications, DeepMind's technologies can be integrated into logistics processes to optimize and improve efficiency.

These companies demonstrate different approaches to the implementation of artificial intelligence in logistics, contributing to the efficiency and automation of processes in this industry [1].

2. Application of blockchain technology in transport

Next, I would like to look at blockchain technology in transportation logistics. Modern logistics faces many challenges, such as the complexity of supply chains, fraud, as there are a lot of fraudsters in the logistics business, inaccuracies in documentation, and high cost of operations. The use of blockchain technology can significantly improve the efficiency, transparency, and security of logistics processes by ensuring data protection and automating transactions.

- Data transparency and security. Blockchain is a distributed database that ensures the immutability of records. In logistics, this technology allows you to record all operations in the supply chain, including the movement of goods, change of ownership, and verification of certificates of conformity. This allows companies to track the origin of products and avoid fraud.

- Smart contracts. Smart contracts automate the execution of transactions, reducing the need for intermediaries. For example, payments between suppliers and carriers can be made automatically after the delivery of goods is confirmed, which significantly reduces delays and improves trust between market participants.

- Real-time cargo tracking. The integration of the block chain with the Internet of Things (IT) allows you to record data on the condition of goods in real time. Sensors can record temperature, humidity, location, and automatically update

information in the block chain. This is especially important for the transportation of perishable goods.

- Reducing bureaucracy. The introduction of blockchain can reduce the number of paper documents and speed up the processing of goods at customs. Digitized documents stored in the block chain cannot be falsified, which helps fight smuggling and increases the level of trust between partners [2].

Let's consider the prospects for the development of blockchain technology in logistics. The use of block chain in the logistics sector is constantly expanding. In the future, we can expect:

Global adoption of blockchain standards to facilitate integration between different companies and governments. The development of decentralized logistics platforms that will bring together suppliers, carriers and customers without the need for intermediaries. Reducing the cost of logistics operations by automating processes and reducing human intervention. Improved supply chain resilience through quick access to reliable data and forecasting of potential risks.

It is also important to highlight the advantages and disadvantages of blockchain technology in logistics

We would like to highlight the following advantages: Transparency and security, the block chain allows you to track the entire path of the goods, which reduces the possibility of fraud. Process automation, the use of smart contracts eliminates the need for intermediaries and speeds up transactions. Cost reduction, block chain can cut administrative costs and reduce the need for paperwork. Optimization of logistics processes, providing accurate tracking of goods in real time.

Disadvantages. High cost of implementation, initial investments in the development of blockchain systems can be quite significant. The need to change business processes, many companies are not yet ready to switch to new technologies.

Limited transaction speed, traditional blockchain networks have problems with the speed of processing transactions under high load. Legal and regulatory barriers, the lack of clear international standards can complicate the implementation of the technology in different countries.

There are already large companies in the world that are actively implementing blockchain in their logistics processes, such as these companies:

- IBM Blockchain - offers solutions for cargo tracking, automation of logistics processes, and fraud reduction.
- Maersk - Together with IBM, we created the TradeLens platform, which provides transparency in international transportation.
- FedEx - uses blockchain to improve parcel tracking and data security.
- DHL - develops block chain systems to control the supply of medicines and medical supplies.
- Walmart - uses blockchain to track food and improve supply security.

Thus, blockchain technology has great potential for the logistics industry, ensuring the security, transparency and efficiency of operations. Despite certain challenges, its development and integration with other digital solutions can dramatically change the logistics industry in the coming years. Companies that are the first to implement blockchain in their processes will gain significant competitive advantages [3].

3. Cloud technologies, digital platforms and CRM systems in logistics

In today's globalized and digitalized world, cloud technologies, digital platforms, and CRM systems play a key role in the transformation of logistics processes. They ensure efficient supply chain management, resource optimization, and increased competitiveness.

Cloud technologies allow companies to store and process large amounts of data in remote data centers, providing real-time access to information from anywhere in the world. This helps to increase flexibility and efficiency in managing logistics operations. In particular, cloud platforms allow for the integration of data from various sources, providing a single information environment for all participants in the supply chain.

Advantages of using cloud technologies in logistics: Scalability, which means the ability to quickly adapt resources to changing business needs without significant investment. Cost reduction: No need to maintain your own IT infrastructure reduces operating costs. Enhanced collaboration: Providing seamless access to data for all

participants in the supply chain facilitates better coordination and interaction. Increased security: Modern cloud services provide a high level of data protection and backup.

Digital platforms are also developing rapidly. They combine various services and participants in the logistics process on a single technological basis, ensuring transparency, efficiency and optimization of operations. They automate warehouse (WMS), transportation (TMS), yard (YMS), and delivery management processes, which helps to reduce the human factor and increase the accuracy of operations [4].

The use of CRM systems in logistics. CRM (Customer Relationship Management) systems help logistics companies to effectively manage customer interactions, optimize sales, and improve service quality. The main advantages of implementing CRM systems in logistics processes include: Process automation: CRM allows you to automate order management, control over the fulfillment of obligations to customers, and contact management. Improved analytics: Thanks to CRM, companies can analyze demand, prioritize customer service, and predict future market needs. Personalization of services: systems help to segment customers and offer them individualized solutions, which increases satisfaction. Integration with other platforms: CRM integrates seamlessly with WMS, TMS, and ERP systems to ensure efficient information exchange between all parts of the logistics process.

Disadvantages of cloud technologies, digital platforms, and CRM in logistics. Despite their many benefits, there are challenges and risks to implementing these technologies: High initial costs: Although these technologies reduce costs in the long run, their implementation requires significant financial investments. Security risks: transferring confidential data to cloud services increases the likelihood of cyberattacks and information leaks. Dependence on providers: logistics companies depend on the stability of cloud services and updates to digital platforms. Difficulty of integration: in some cases, the introduction of new systems requires significant adaptation of the company's internal processes and staff training.

Examples of companies and platforms using cloud technologies, digital platforms, and CRM in logistics:

CoreTeka and Tocan Solutions: Ukrainian companies that develop and integrate digital platforms for managing warehouse and transportation operations.

"Nova Poshta is one of the leaders in the Ukrainian logistics market, using cloud solutions to ensure stable and fast operation of its services.

"Ukroshta, the largest cloud customer in Ukraine, is actively implementing cloud technologies to optimize its logistics processes.

Salesforce and Microsoft Dynamics 365: popular CRM systems that are actively used in the logistics industry to manage customer relationships and automate processes.

Thus, the integration of cloud technologies, digital platforms and CRM systems into logistics is an integral part of modern business. They increase efficiency, reduce costs, and improve interaction between supply chain participants, which ultimately contributes to customer satisfaction and increases the competitiveness of companies in the market [5].

Conclusion.

The introduction of the latest technologies is fundamentally changing transport logistics, making it more efficient, safe and environmentally sustainable. Artificial intelligence, block chain, and cloud technologies are driving automation, transparency, and optimization of all processes. However, along with technological advances, new challenges arise: from the need for employees to adapt to change to the high costs of implementation and cybersecurity

Despite these challenges, the prospects for the development of transport logistics look extremely positive. In the future, we can expect even deeper integration of artificial intelligence, expanded blockchain capabilities, and widespread use of cloud services. Companies that are the first to adapt to new technologies will gain significant competitive advantages. At the same time, the balance between automation and the human factor remains important, as even the most advanced algorithms cannot completely replace human flexibility and strategic thinking.

In general, modern transport logistics is moving towards digital transformation, and its further development will be determined by the speed of adaptation to new technologies and the

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5. (<https://mdes.khmnu.edu.ua/index.php/mdes/article/view/132?utm>) willingness of companies to invest in modernizing their processes.

HOW AUTONOMOUS VEHICLES ARE CHANGING PUBLIC TRANSPORT

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High-speed rail (HSR) is one of the most important developments in modern transportation. These trains can travel at speeds of 250 to 350 km/h (155–220 mph), which makes them much faster than regular trains. HSR systems are already popular in countries like Japan, China, France, and Germany. Many other countries are also planning to build their own high-speed networks.

High-speed trains are changing the way people travel, especially between big cities. They are often faster than flying when you include airport check-ins and security. They are also more comfortable than buses or cars. At the same time, HSR systems help reduce traffic on roads and lower pollution levels. As more people choose trains over planes or cars, high-speed rail is becoming an important solution for clean and efficient travel. This article will explain how HSR is helping improve transportation, support tourism, grow economies, and protect the environment.

High-speed rail (HSR) is more than just a mode of transportation; it is a catalyst for economic growth, social cohesion, and environmental sustainability. This article explores the multifaceted benefits of high-speed rail, focusing on its social, economic, and environmental impacts: