UDC 656.6 DOI: https://doi.org/10.32515/2664-262X.2024.10(41).1.294-300

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Exploring opportunities to improve freighttransportation

The possibilities of freight transportation organization improving for the formation of an effective management model of the transport and logistics complex of the country are studied. The directions of improvement of freight transportation by sea transport are determined, as the one that performs the largest transport work on the transportation of goods. It is determined that the use of artificial intelligence in sea freight transportation will make it possible to control the temperature regimes in containers for storing the quality of their cargo, improve the transportation process by accelerating the selection of participants in the transport process, choosing the optimal transportation route, taking into account the shortcomings of past transport processes, speed up the conclusion of contracts for the transportation of goods, identify risks, monitor the health of the crew and provide it on time medical care. At the same time, ways to reduce environmental pollution in the operation of maritime transport have been identified, namely: the use of equipment that purifies exhaust gases on ships, the use of Panamax-type vessels using fuel that has a low content of sulfur and other harmful substances. Also, the development of the Arctic Northern Sea Route will make it possible to speed up cargo transportation from China to Northern Europe.
transport and logistics complex, multimodal transportation,sea transport, cargo

Statement of the problem. International freight transportation is the engine of any country's economy. As a rule, such transportation is multimodal. Freight traffic from China to Europe has increased 100 times over the past 10 years. To perform such transportation, sea transport is most often used. Today, maritime logistics is an integral part of the world market. It contributes to the reliable transportation of large-tonnage cargo over long distances to many countries. The main trend of the world transport market is the active introduction of information, telecommunication and computer technologies. Almost all modes of transport have felt the impact of digitalization and intellectualization. The global market of transport services is formed by fundamentally new management systems integrated into a single logistics information space. Therefore, the study of methods for improving the logistics of freight transportation is a topical topic of today.

Analysis of the latest research and publications. Logistics is constantly evolving. Every day, we see the rapid development of artificial intelligence, which is increasingly being implemented in the more complex infrastructures of our society. Its ability to quickly learn and develop encompassing large amounts of information shows a high potential for development in systems of legal structures [1]. The digitalization procedure is new for the transport market of Ukraine, therefore it requires the involvement of theoretical knowledge and practical experience of logistics services, transport, marketing, regional logistics, as well as regulatory, informational, financial and personnel support [2; 3]. The study of the development of container transportation infrastructure, logistics centers, seaports was carried out by G.E. Belyaeva, O.G. Pustovit [4], on the use of artificial intelligence in freight transportation systems - M. Maryenko, V. Kovalenko [5], M. Krenn [6].

Statement of the task. The purpose of this study is to identify directions for improving the organization of freight transportation for the formation of a new, more effective model of management of the transport and logistics complex of the country.

Statement of the main material. Identification of promising areas of transport management and logistics complex in the context of the global use of information support, which involves robotization, modeling and optimization of traffic flows, the use of big data, cyber systems and cybersecurity. This will make it possible to choose effective tools for the formation of the transport and logistics complex.

The use of artificial intelligence in freight logistics will be able to significantly improve the quality, speed, and productivity of deliveries around the world in the near future.

Today, there are cargo ships that use artificial intelligence equipped with special thermal sensors, thanks to which artificial intelligence can regulate the temperature in cargo containers. This idea was able to be implemented by CMA CGM, a company engaged in logistics deliveries in maritime logistics. In their real-time container cargo surveillance system, they use an AI-based "LoT" system. The "LoT" system (Fig. 1) is like a virtual connection between electronic devices. A network of LoT devices consists of smart devices that have access to the internet. To work, they use built-in systems: processors, sensors, equipment for collecting, sending and processing data received from their environment. Through an internet connection or other peripheral device connected to the network, data is exchanged between LoT devices. Further, all information is sent to the cloud server for analysis and processing. In some cases, devices communicate with other LoT devices and act based on information received from each other and with a combination of artificial intelligence. This is very important for vessels engaged in the transportation of food products, because the program can monitor the temperature of food products and at the right time raise or decrease it to further preserve the quality of products and thus not reduce their value in the sales market.

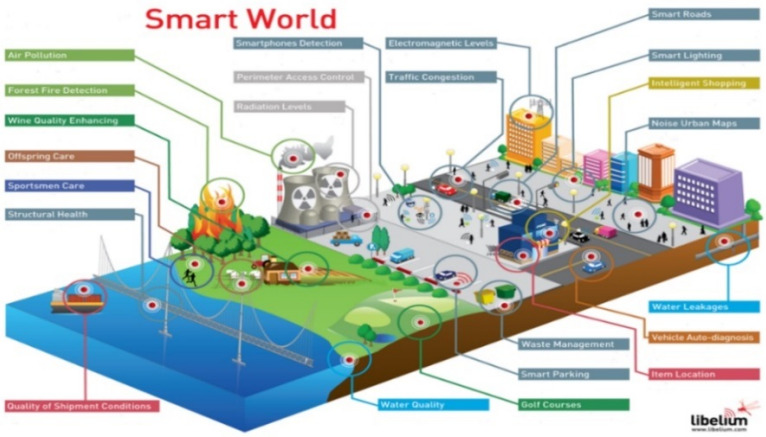


Figure 1 – Smart City Transport Networks in the LoT System

Source:[7]

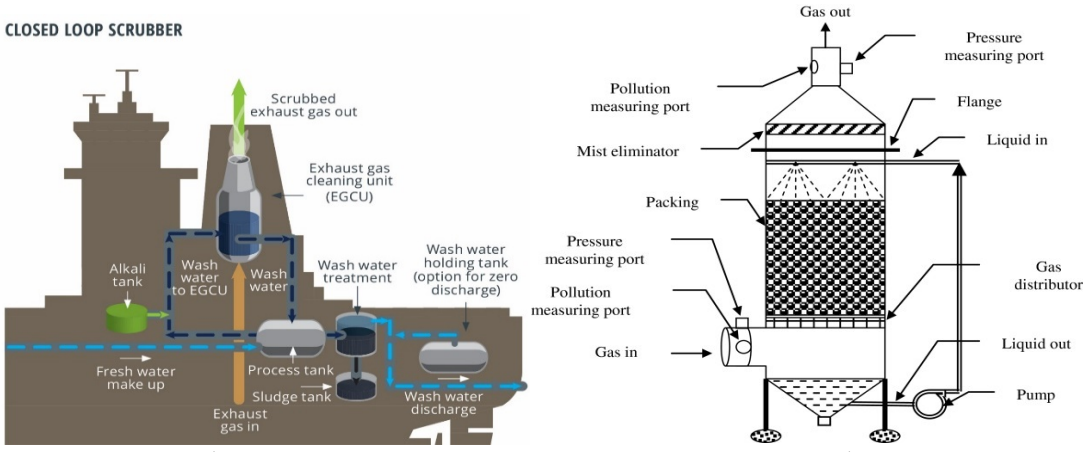
An important condition for ensuring the delivery of international goods is the perfect organization of multimodal transportation. Ensuring the integrity of the transportation process is achieved through the implementation of an effective management system. Artificial intelligence accelerates the selection of participants in the transport process and transshipment of goods; facilitates the process of concluding transportation contracts; optimally provides solutions for the planning and reservation of vehicles and routes; continuously monitors the execution of transportation; clarifies economic indicators regarding the choice of transport schemes and the use of modes of transport; contributes to a comprehensive risk assessment.

Artificial intelligence can quickly process information and find out the weather forecast, view current schedules of sales and demand for products in different territories, it is able to prescribe more optimal delivery schedules that will ensure less damage during the transportation of goods. Also able to quickly find new delivery strategies by analyzing the history of past freight transportation. With the help of artificial intelligence, a system for monitoring the health of the crew was implemented, which helped to monitor the state of its health, provide medical assistance if necessary, and timely identify mental health problems, which reduced the frequency of crew member changes, improved the quality of their health, and increased the safety of maritime transportation [8].

In 2020, in cooperation with the Port of Rotterdam and Konecranes, a company specializing in the production of cranes and automated systems for ports, Konecranes Gottwald Model 6 artificial intelligence cranes were developed. As a result, these cranes are capable of handling 125 tons of general and heavy project cargo, as well as containers. One difference is that the new cranes use an external 690V power supply, which will reduce operating costs while reducing noise and exhaust emissions for the sake of preserving the environment. By using this method of unloading and loading ships, the number of accidents was reduced, which is not uncommon in ports. The creation of such cranes sets new standards in the logistics service sector, which we should strive for [9].

Simultaneously with the development of transport and logistics complexes, society should take care of reducing pollution during the operation of transport.

Transportation of goods by water transport is one of the most efficient and economical types of transportation. But this method of transportation is harmful to nature. Therefore, since 2020, the Chamber of Shipping association has been working to minimize sulfur emissions. It is planned to reduce the level of sulfur emissions from the currently permissible 3,5% to 0,5%. This is part of an international program aimed at reducing emissions from any type of ship, any type of pollution, in order to establish generally accepted standards that would flexibly respond to modern conditions of maritime transportation [10]. The parties involved in the adoption of these standards should coordinate their efforts in order to take into account all the needs of the participants in the process and reduce the permissible standard indicators of pollutants to a single system that will contribute to the preservation of the environment. For this purpose, equipment will be installed to purify the atmosphere from harmful gases, as well as equipment that prevents fuel emissions. This includes the use of equipment known as a "scrubber" - a device that purifies exhaust gases on ships (Fig. 2). But there is also a drawback that cannot be ignored, namely: scrubber waste must also be disposed of with care.



а) б)

Figure 2 – The use of scrubber on a ship a) and the principle of their operation b)

Source:[11], [12]

The connection of the composition of sea vessels for cargo transportation to this system will be carried out in strict accordance with international requirements: a limited number of a certain type of vessels will be involved, namely, the Panamax type (Fig. 3).

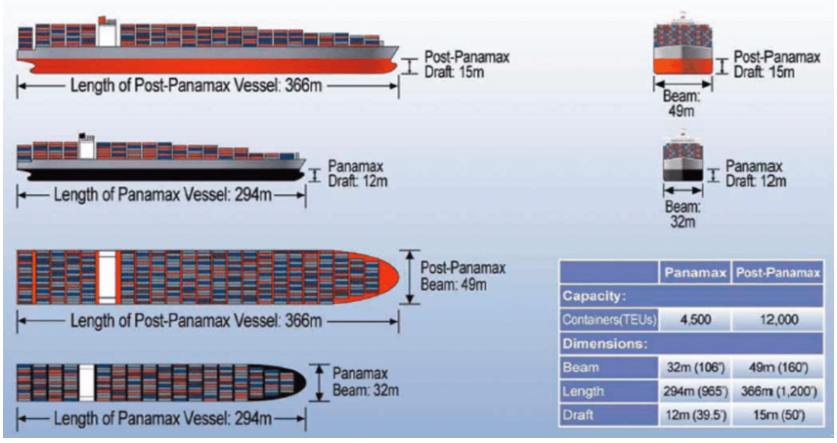


Figure 3 - Characteristics of Panamax type vessels.

Source: [13]

The fuel to be used on these vessels must be low in sulphur and other harmful substances. These measures are costly, but they will ensure that the environment is preserved. Old-type vessels will most likely not be able to function, since the use of new-type fuel on such vessels is impossible without the introduction of expensive modifications.

Also, for the effective functioning of transport logistics, it is necessary to attract new routes. Namely, for sea transportation, the Arctic Northern Sea Route is being explored. In 2024 , Chinese general cargo ships have found a new way to circumvent the problems in the Red Sea associated with attacks on ships by the Houthis, namely the possibility of using the route through the Arctic Northern Sea Route. New Shipping vessels used the new route through the Arctic Northern Sea Route, while using icebreakers in the summer months. But scientists note that climate change and melting ice sheets will soon make it possible to use this route all year round. This route from China to Northern Europe via the Arctic Northern Sea Route is shorter than the Northwest Passage, which connects the Atlantic Passage with the Pacific Ocean (Fig. 4). A shorter distance will give shipping lines the opportunity to compete with faster modes of transport. It is clear that reducing delivery times will lead to lower fuel costs, lower emissions and lower pollution that harm the environment. However, parts of the Northeast Passage and most Arctic routes have not yet developed infrastructure, limited opportunities for search and rescue operations.

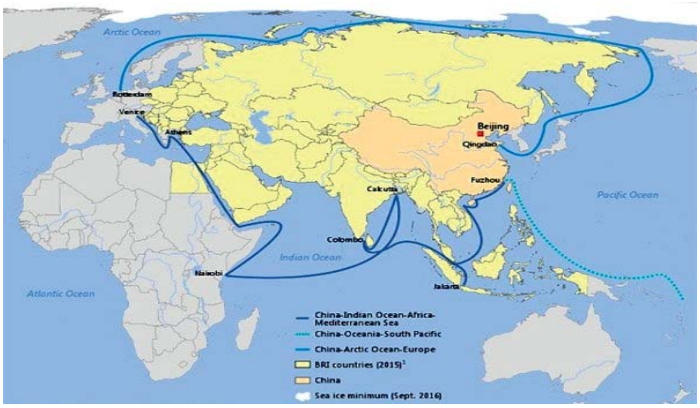


Figure 4 - The Arctic Northern Sea Route and the Northwest Passage connecting China to Northern Europe

Source: [14]

Active use of this route can facilitate cooperation between Europe and Asian countries. There is an option that most logistics companies will prefer the Arctic Northern Sea Route, due to its shorter route, which will facilitate the transportation of perishable products and urgent deliveries of goods. This route will be able to strengthen economic relations between Europe and Asian countries.

Conclusions. The possibilities of improving the freight transportation logistics for the formation of an effective model of management of the transport and logistics complex of the country are studied. The directions of freight transportation improvement by sea transport are determined, as the one that performs the largest transport work on the transportation of goods. Possible improvements are the application of artificial intelligence, the preservation of the environment and the development of new routes. This will improve the quality of cargo transportation, speed up the process of organizing and executing cargo transportation, as well as reduce the negative impact on the environment.

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Дослідження можливостей вдосконалення вантажних перевезень

Досліджено можливості вдосконалення організації вантажних перевезень для формування ефективної моделі управління транспортно-логістичним комплексом країни. Визначено напрями вдосконалення вантажних перевезень морським транспортом, як тим, що виконує найбільшу транспортну роботу з перевезення вантажів.

Визначено, що застосування штучного інтелекту в морських вантажних перевезеннях дасть змогу контролювати температурні режими в контейнерах для зберігання якості їх вантажу, вдосконалювати процес транспортування за рахунок прискорення вибору учасників транспортного процесу, вибору оптимального маршруту перевезення, враховуючи недоліки минулих транспортних процесів, пришвидшити заключення договорів на перевезення вантажів, визначати ризики, стежити за станом здоров'я екіпажу та надавати вчасно медичну допомогу.

Одночасно визначено способи зменшення забруднення навколишнього середовища при

експлуатації морського транспорту, а саме: використання обладнання, що очищає відпрацьовані гази на суднах, застосування суден типу Panamax, що використовує пальне, яке має низький вміст сірки та інших шкідливих речовин. Також освоєння Арктичного Північного морського шляху дасть можливість пришвидшити вантажні перевезення з Китаю до Північної Європи.
транспортно-логістичний комплекс, мультимодальні перевезення, морський транспорт, вантажі

Одержано (Received) 03.10.2024 *Прорецензовано (Reviewed) 17.10.2024*
Прийнято до друку (Approved) 28.10.2024

УДК 656.1, 711.5 DOI: https://doi.org/10.32515/2664-262X.2024.10(41).1.300-305

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Особливості регулювання руху транспортних засобів на специфічних ділянках вулично-дорожньої мережі міст з інтенсивним транспортним потоком

Проаналізовано та виявлено потенційно небезпечні ділянки вулично-дорожньої мережі міста Калгарі (Канада). Встановлено, що окремі ділянки вулично-дорожньої мережі формують перехресні транспортні потоки, які створюють конфліктні точки злиття, та перетинання. Невелика відстань між елементами розв'язокзалишає водіям недостатньо часу на здійснення маневру, що підвищує ризики утворення дорожньо-транспортних пригод. Розроблено рекомендації щодо регулювання дорожнього руху на вулично-дорожній мережі міст із високою інтенсивністю руху та швидкістю транспортного потоку. Запропоноване вирішення проблеми примикаючих транспортних потоків, що змінюють смуги руху на короткій ділянці вулично-дорожньої мережі.
вулично-дорожня мережа, організація дорожнього руху, дорожньо транспортна пригода, смуги руху, інтенсивність транспортного потоку.

Постановка проблеми.При інтенсивному розвитку великих міст будівництво транспортних розв'язок здійснюється поступово, вирішуючи транспортні проблеми та розвантажуючи вулично-дорожню мережуокремого мікрорайону, а не цілого міста в цілому. Таке будівництво зазвичай здійснюється в межах існуючої забудови міста. Формально транспортні розв'язки можуть вирішувати проблему перенаправлення транспортних потоків та відповідати усім встановленим нормативним показникам. Однак при цьому вони можуть створювати нові транспортні проблеми пов'язані з утворенням нових конфліктних точок транспортних потоківщо в поєднанні з обмеженим часом на прийняття рішення та здійснення маневру водіями транспортних засобів призводить до підвищення ймовірності утворення дорожньо-транспортних пригод.

Аналіз останніх досліджень публікацій.Особливо ця проблема загостюється із невпинним зростанням кількості індивідуальних транспортних засобів. Останні дослідження в цій сфері підкреслюють важливість зазначеної проблематики. У роботі