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**DIGITAL INNOVATIONS IN THE FORMATION OF SUSTAINABLE DEVELOPMENT OF
THE INFRASTRUCTURE COMPLEX OF MARITIME TRANSPORT**

Filipishyna Liliya¹, Lomakina Olena²

¹Doctor of Economics, Professor

Professor of Economics and Organization of Production

Admiral Makarov National University of Shipbuilding,

Pervomaisk branch, Pervomaisk, Ukraine,

ontariofilpi@ukr.net

²Candidate of Law, Associate Professor

Head of the Department of Administrative and Constitutional Law

Admiral Makarov National University of Shipbuilding,

Mukolaiv, Ukraine

lomakina1616@gmail.com

Abstract. The work is devoted to the study of modern trends in the development of digital technologies on the formation of sustainable development of the infrastructure of maritime transport. The analysis of features of development of sea industry in the conditions of digitalization of economy and inclusion of world port operators in processes of the industry 4.0 is carried out. Modern macroeconomic tendencies and prospects of sustainable development of maritime transport of Ukraine are determined.

Keywords: transport system, innovations, digital technologies, logistics, maritime infrastructure, management, maritime transport.

The modern trend of the world transport market is the active introduction of information, telecommunication and computer technologies. To date, all modes of transport have felt the impact of digitalization and intellectualization. The market of world transport services is formed by fundamentally new management systems integrated into a single logistics information space [1]. Based on foreign experience, Ukraine is intensifying the processes of innovative development of transport systems. It is proved that the use of integrated information and intellectual technologies is an important reference point on the way to the rapid integration of domestic enterprises into global logistics processes, where Ukraine will be able to implement transport policy. To implement the chosen direction, a number of legislative documents were adopted at the state level, such as: "National Transport Strategy of Ukraine for the period up to 2030", "Strategy for Integrated Border Management for the period up to 2025", "Maritime Doctrine of Ukraine for the period up to 2035", "Strategy for the development of seaports of Ukraine for the period up to 2038" [1-4]. According to the adopted documents, the modern development of the country's transport complex should take into account not only the need to adapt to EU standards, technical conditions, management principles, in addition, innovation and high technology are crucial for the formation of a new, more efficient model of transport and logistics Of Ukraine.

The current state of implementation of digital innovations in the infrastructure of maritime transport is sufficiently studied and discussed in the scientific community, namely: V. Alkema, V. Dybska, A. Dligach, N. Chukhrai, G. Platukha, V. Skitska, O. Sumtsa, N. Tarnavska, L. Frolova, S. Uvarova, and others [6,7,8,9,10].

Deepening the role of integration of different modes of transport according to the concept of a single operator of mixed transport and the spread of outsourcing require ensuring the reliability and efficiency of information exchange in modern logistics systems between different modes of transport. The transport and distribution system under the conditions of digitalization is a large complex macrologistic system, which combines water transport enterprises, shipowners, railways, motor transport, aviation in a single information space [7,9].

Logistics of sea freight includes a system of procedures and actions aimed at organizing the delivery of goods by sea. Moreover, it is planned to involve intelligent autonomous vessels, digital waterways, intelligent ports integrated into intelligent multimodal transport systems in modern schemes of interaction. The digitalization procedure is new for the transport market of Ukraine, so it requires the involvement of scientific and methodological tools based on theoretical knowledge and practical experience of transport, marketing, regional logistics, logistics services, as well as information, financial, personnel and regulatory support [5- 6].

The general structure of integrated logistics in the introduction of artificial intelligence and the latest information technologies involves the acquisition of broad links, which extend to industry, trade, agriculture, multinational corporations, transport and distribution system of regions and states, the consumer market.

The main condition in integrated logistics is the perfect organization of multimodal transportation, door-to-door delivery. Ensuring the integrity of the local transport network is achieved through the introduction of an effective management system for the entire transportation complex. Artificial intelligence accelerates the choice of participants in the transportation and transshipment of goods; facilitates the process of concluding transportation contracts; optimally provides solutions for planning and reserving vehicles and routes; carries out continuous control of performance of transportations; finds out economic indicators on the choice of transport schemes and the use of modes of transport; contributes to a comprehensive risk assessment [7,9].

As an integral part of the logistics transport infrastructure, the seaports of Ukraine provide a high export potential of cargo (ferrous metals, coal, iron ore concentrate and grain). The available cargo handling facilities and the favorable location of seaports provide transit cargo flows, which is the basis for attracting private investment and digitalization of port logistics. Ukraine's maritime industry has a strong potential among the world's leading countries: 38 state-owned enterprises with a turnover of about UAH 10 billion per year, 5,000 sectoral entities. However, the capacity utilization of Ukrainian seaports in 2018 is 43% (transshipment 135.2 million tons), in 2019 - 51% (transshipment 160 million tons) [5, 4,10].

According to modern trends, the system of transport management in the context of digitalization should take into account global market trends, analyze and prioritize the development of ports. Analysts say that in 2020, the global shipping industry has accelerated the digitization of all stages of cargo operations. Port intellectualization involves the integration of a wide range of advanced technologies: artificial intelligence, cloud computing services, blockchain technology. Currently, flexible online logistics platforms have already been introduced in most developed countries - Denmark, Switzerland, the United Arab Emirates, France, Germany, Turkey, China [4-5].

Smart ports interact with the information systems of ships and other national and foreign ports, create conditions for the provision of services on the principle of "single window", increase the efficiency of management of sea and mixed transport. Positive results are achieved by integrating navigation systems, shore networks, ship information and telecommunication systems, networks of surface and underwater sensors into a single system. Significant advantages of the intellectualization of maritime transport are the emergence of opportunities to optimize routes while reducing costs energy resources, improving the accuracy of forecasting and routing, taking into account the conditions of transportation. The interaction between different modes of transport becomes continuous and more reliable due to the constant connection with marine-based systems, coastal control centers. In this case, the control of transportation processes is remote, and in some cases autonomous through the established intelligent sensors [6].

Today, in Ukraine it is extremely necessary to make management decisions on the implementation of intelligent information and telecommunications system. The system should include: an automated control center, a subsystem for intelligent analysis and display of data and information, a network of port sensors and actuators that are integrated through wired and wireless access networks with infrastructure elements of the main intelligent multimodal transport system. Such systems should be built as an open system based on network protocols, standardized interfaces, application software products.

Thus, the implementation of programs for the introduction of digital innovations in the infrastructure of maritime transport will solve many problems, strengthen the competitiveness of port infrastructure, expand the possibilities of logistics supply chains, namely: increasing port security and environmental protection; the noise level of the port is reduced and the efficient use of energy is increased; the implementation of the concept of "green" ports is accelerating; the procedure for the use of electronic document management in the transshipment of imported loaded containers from the sea to road and rail transport is being improved; logistical risks are reduced and optimal planning takes place; monitoring of the current situation and registration of information in real time is improved; working conditions and safety of the crew are improved, energy efficiency of ships and quality of services are increased; the efficiency of integrated logistics chains (intermodal and multimodal) supplies increases.

Thus, modern sustainable development of seaport infrastructure must take into account not only the need to adapt to EU standards, technical conditions, management principles, etc., but also the fact that innovation and high technology are crucial for the formation of a new, more efficient model of road transport management in Ukraine.

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Цифрові інновації у формуванні сталого розвитку інфраструктурного комплексу морського транспорту

Філіпішина Лілія Михайлівна¹, Ломакіна Олена Анатоліївна²

¹ Національний університет кораблебудування імені адмірала Макарова, Первомайська філія, м. Первомайськ, Україна,

² Національний університет кораблебудування імені адмірала Макарова, м. Миколаїв, Україна.

Анотація. Робота присвячена дослідженню сучасних тенденції впливу розвитку цифрових технологій на формування сталого розвитку інфраструктурного комплексу морського транспорту. Проведено аналіз особливостей розвитку морської галузі в умовах цифровізації економіки та включення світових портових операторів до процесів індустрії 4.0. Визначено сучасні макроекономічні тенденції та перспективи сталого розвитку морського транспорту України.

Ключові слова: транспортна система, інновації, цифрові технології, логістика, морська інфраструктура, управління, морський транспорт.

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OPUSS PROJECT: FIRST RESULTS AND ROADMAP OF DEVELOPMENT

Zhukov Yu. D.¹, Zivenko O. V.²

¹*Doctor of Sciences (tech.), professor,
"C-Job Mykolaiv" LLC, Mykolaiv, Ukraine
ORCID: 0000-0002-7454-8007*

y.zhukov@c-job.com.ua ;

²*Candidate of Sciences (tech.), associate professor,
Admiral Makarov National University of Shipbuilding, Mykolaiv, Ukraine,
ORCID: 0000-0002-1539-8360
oleksii.zivenko@nuos.edu.ua*

Abstract. The current state of one of the foremost demanding challenges to humanity, namely pollution of rivers and the world's oceans by plastic debris, is analysed in short. The authors' attention is focused on the solution of ocean cleaning from the point of view of ship architects, using a classical approach to the so-called external task of ship design, i.e., on the method of the corresponding fleet (ships system) design. Some results of the first work package of the OPUSS R&D Project and the draft roadmap of its development are presented.

Keywords: plastic debris, maritime logistic, circular economy.

Introduction. One of the foremost demanding challenges to humanity nowadays is long lasting and drastically progressing pollution of rivers and the world's oceans by plastic debris [1, 2]. More than five trillion plastic particles currently are floating in oceans five largest convergence zones and about 300 million tons of plastic is produced yearly, resulting in accelerating oceans' pollution [3, 4] (Fig. 1). On the other hand, many companies started making products from recycled materials to bring their environmentally friendly practices to the forefront [5, 6].