Digital transformation of maritime cargo shipping in international business

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Abstract. The present stage of progress of economy is marked by digital transformation of various branches and introduction of new technologies to improve the efficiency of functioning of various participants of the global market. This transition poses new goals and new challenges for companies. The below article explores the benefits of shipping companies moving into the digital economy. New digital technologies should improve and optimize various business-processes of the company. Also digital technologies deduce the companies on a new technological level that will allow them to expand the supply market and will increase the number of partners who will be assured of safety of a transported cargo. Key words: Digital, digital transformation, maritime cargo shipping, management, international business

Introduction

In modern conditions of transition to a digital economy, the maritime cargo shipping industry cannot remain aloof from the introduction of new technologies. It is connected not only with the development of digitalization, but also with the more efficient functioning of the maritime cargo shipping system itself.

Digital tools are a set of technologies that help an organization to build its strategic plans, to reveal its capabilities and weak points, and find ways to solve problems related to global market challenges [1]. Digital tools are actively changing the rules in a market economy, providing companies that can quickly adapt to changing conditions with competitive advantages and new approaches to improving their positions in markets, even creating new requirements for the logic of regulating international economic relations [2].

Acting in 2018, Susan Berdsli, the chief analyst at consulting firm ABI Research, engaged forecasting of the market, told: “Alongside with consolidation and pressure upon profits, long-standing players should adapt and work with partners inside and outside of branch, from start-ups to leaders in the field of technologies of communication, AI, etc., Including a competition, for the coordination of so necessary standardization. Recent examples include purchase by company Wärtsilä Transas of intellectual marine ecosystem support and an artificial intellect (AI), as well as deal Orange Business Service with Cargotec for smart cargo

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handling” [3]. That is introduction of an artificial intellect in work of the companies, engaged marine cargo shippings, has been going on for several years. Various scientists consider different aspects of the digitalization of maritime transport, for example, O.N. Panamareva [4] and E.P. Kechagias [5] study transportation cybersecurity in connection with the increasing implementation of information technology in logistics. And digitalization in the transport industry is carried out by such scientists as N.N. Masyuk, I.V. [6], Edvard Tijan, Marija Jovi´c, Sa´sa Aksentijevi´c, Andreja Pucihar and others [7, 8]. Many authors, including T.B. Mordvinova, have a rather negative attitude towards the digital transformation of maritime cargo shipping [9], due to the fact that automation of business processes will lead to job cuts. But at the same time, companies cannot refuse the achievements of digitalization, since the introduction of technology into the process of sea cargo shipping significantly increases work efficiency [10, 11]. Therefore, in our article we will look at the tools for digital transformation of maritime cargo shipping of bulk-oil cargoes.

Materials and methods

There are quite a lot of technologies in the system of digital transformation of marine bulk-oil cargo shippings, but we shall consider only a few of them, because not all technologies existing in logistics and even in area of marine cargo shippings, approach marine bulk-oil transport.

For efficient operation and management of bulk-oil tankers it is possible to use following modern digital technologies (Figure 1):

1. Electronic tracking and monitoring systems. Sensors and GPS technologies are used to track the location of oil tankers, control storage and transportation conditions for cargo, and monitor marine environmental conditions.

2. Digital trading platforms. There are digital trading platforms which allow customers and suppliers of bulk-oil cargoes to find each other quickly and effectively and to agree about transportations, as well as to trace process of their performance.

3. Programs to optimize routes and logistics. By means of the analysis of data there is a generation of routes and a choice of the most effective way of delivery of bulk-oil cargoes that allows to reduce transit time and shipping expenses.

4. Automated systems for managing warehouses and terminal operating systems. The implementation of digital management systems for warehouse and terminal operating systems allows us to accelerate processes of loading/unloading of bulk-oil cargoes, to optimize use of warehouse resources and to reduce risks of the human factor when performing port operations.

5. Blockchain technologies. Blockchain systems are used to register and track transactions with bulk-oil cargoes, as well as ensure the safety and protection of transportation data from unauthorized access and falsification.

Introduction of the above digital technologies helps to improve efficiency and a security of marine cargo transportations of bulk-oil cargoes, as well as provides a transparency and the control over all stages of delivery.
Let’s take a closer look at each of the above technologies:

1. **Electronic tracking and monitoring systems.**
   - Tracking the location of bulk-oil tankers. With the help of GPS technology and special sensors installed on the ship, you can trace its location in real time. This allows you to control the vessel’s route, check its safety and operational efficiency, and also prevent possible accidents or illegal manipulation of oil cargo. For example, now tracking the route of a ship is very important due to problems with the passage of ships in the Red Sea and through the Bab el-Mandeb Strait. Sensors can also prevent an accident, as they help monitor the level of vessel’s deterioration.
   - The control of conditions of storage and transportation of a cargo. By means of the gauges established in containers or on the vessel, it is possible to trace temperature, humidity, pressure and other parameters of an environment that will allow to prevent damage or loss of the goods, ensure their high-quality and safe transportation.
   - Monitoring marine environmental conditions. Using special sensors, you can monitor the state of the marine environment, including the level of water pollution, petrochemicals content, water temperature, density, etc. This information allows to respond operatively to possible ecological accidents, to undertake measures on protection of the marine environment and to supervise activity of the oil-extracting companies.

2. **Digital platforms for cargo transportation management**
   There are some digital platforms which specialize on management of marine cargo transportations. They provide complex decisions for chartering, routings and tracking of cargo transportations, providing safety and efficiency of shipments.

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Fig. 1. Digital technologies used in the field of maritime cargo transportation.
Such platform is Veson IMOS (Integrated Maritime Operations System) provides possibilities for management of various types of cargoes, including bulk-oil, and provides precise planning routes, automation of processes and management of risks.

Also, an example of a digital platform for management of marine cargo shipping is Navigate Response, specializing on management of crisis situations and operative reaction to emergencies in marine branch. The given digital platform provides operative tracking and management responding on bulk-oil accidents and allows responding and coordinating in a timely manner actions on liquidation of outflow of oil.

There are also Russian platforms which can be used for marine transport:
- SHEDEX. A cloud-based program for optimizing logistics, developed specifically for Russian business.
- Smart Logistics. Online service for the operational work of freight forwarding companies.
- CyberLog. Online business management system in the field of cargo transportation.
- Megalogist. A program on the 1C platform for complex automation of transport logistics.
- 1C:TMS Logistics. A comprehensive solution for automating transport logistics.

By means of the given platforms it is possible to solve problems of automation of delivery of a cargo, to plan routes, to supervise performance of flights in online-mode, to spend analysis KPI and profitability of delivery [12].

3. Programs to optimize routes and logistics.

For example, the company, engaged in bulk-oil cargo shippings, can use data about weather conditions, the traffic, expense of fuel and other factors influencing for a while and cost of transportation. These data can analyze algorithms and predict optimum routes for each separate trip, considering all the factors influencing process.

4. Automated systems for managing warehouses and terminal operating systems.

One of the popular platforms used by both Russian and foreign companies is AIS marine traffic, with which you can track the location of the vessel in real time and adjust its route.

Automated Warehouse Management Systems (WMS) and Terminal Operating Systems (TOS) are specialized software solutions designed to optimize and improve the efficiency of logistics processes in warehouses and ports.

Warehouse management systems are designed to automate warehouse operations, such as receiving, storing, picking and shipping goods. They allow to optimize the use of warehouse resources, manage warehouse operations, track goods in real time and increase staff productivity.

Terminal operating systems are designed to automate port processes such as cargo acceptance and dispatch, cargo-warehousing management, documentation processing, terminal management and other port operations.

Both of these systems can be used to improve the efficiency of logistics operations, reduce order lead times, improve inventory accuracy, reduce operating costs, improve customer service and provide transparency and control over logistics processes. They can also integrate with other management systems, such as transportation management systems and inventory management systems, to ensure synchronization and coordination of the entire supply chain.

5. Use of blockchain technologies to ensure data transparency and security.

Smart-contracts allow automating performance of terms of deals and providing a transparency and reliability of execution of contracts.

As an example, consider the following situation: an oil transportation company enters into a smart contract with a charterer to rent an oil tanker for a certain period of time. In this case, the smart contract includes conditions on the amount of oil transported, the route, payment terms and terms of execution of the contract. In addition, a smart contract may
provide for automatic execution of delivery and payment terms based on the fulfillment of certain conditions, for example, delivery of cargo to the port of destination.

- Decentralized registries: With their help, it is possible to store the information on cargoes and operations with them in the distributed type that provides data security and eliminates the possibility of falsification or alteration of information.

One example of the use of decentralized registries in the maritime transportation of oil cargo would be the use of blockchain technology to track and record each stage of oil transportation. Blockchain technology makes it possible to create an unforgeable digital record containing information about each barrel of oil, its location, transportation conditions, dates, etc. This reduces the risk of fraud, theft or counterfeit goods.

Another example of the use of decentralized registries in maritime cargo shipping could be the management and monitoring of the condition of vehicles and equipment. For example, smart containers equipped with sensors and IoT technologies can record oil cargo shipping conditions, such as temperature, humidity, shock, etc. Monitoring results can be stored in decentralized registries, which will allow understanding and preventing possible problems during the transportation process.

- Tokenization allows to present bulk-oil cargoes in the form of digital tokens that simplifies tracking and the control of their moving and deals with them.

A digital token is a form of digital asset that is used in a variety of industries, including marine cargo shipments. In the context of bulk-oil cargo shipments, a digital token can be an electronic document that confirms ownership of a certain amount of oil or petroleum products.

Digital tokens can be used in maritime cargo shipments of bulk-oil cargo to simplify the processes of compliance with cargo accounting and monitoring, as well as to improve transparency and a security of transactions. For example, digital tokens can be used to automate the processes of verification and confirmation of ownership of the cargo, as well as to ensure tracking the movement of goods and monitoring their quality.

Thus, digital tokens can provide more effective and safe way of management of bulk-oil cargoes in marine cargo transportations that can lead to decrease in risks and improvement of operational efficiency.

- Cryptographic methods of protection of data provide enciphering the information and protection against not authorized access to data about bulk-oil cargoes.

Some of these methods may include:

- Encryption algorithms are used to protect cargo information from unauthorized access, so even if the data falls into the hands of criminals, they will not be able to read it.
- Digital signatures are used to confirm the authenticity and integrity of cargo information, which helps prevent data from being falsified or changed during transmission.
- Virtual private networks (VPN) are used to transfer cargo data between various transportation participants, providing protection against interception and eavesdropping.
- Blockchain technologies are used to create a continuous and unambiguous chain of information about cargo, which simplifies tracking and provides protection against data falsification.
- Authentication and access control is used to control access to cargo data to ensure that only authorized persons have access to the information.

## Conclusion

Thus, owing to introduction of the above-described innovations in the company, engaged marine cargo transportations of bulk-oil cargoes, it is possible to provide a security of data at marine cargo transportations and to accelerate and simplify managerial process by it. Digital technologies make possible transparent and safe system of registration and tracking of all operations with bulk-oil cargoes that will allow to raise a management efficiency logistics
and supply, as well as will help to lower various risks and will improve operational efficiency of the company.

In general, the implementation of one, several or all of the digital solutions can optimize ship repair costs, reduce ship downtime or secure contract data, which will help companies avoid unexpected costs and optimize some business processes, which will have a positive impact on the overall efficiency of the organization.

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