

Trends and problems of innovative development of Russian shipping enterprises

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Abstract. The article deals with the trends and problems of innovative development of shipping enterprises. Innovative development in shipping is considered as a set of technical, industrial, organizational, managerial and commercial innovations aimed at improving the efficiency and competitiveness of transport enterprises. The dynamics of shipping functioning in the Russian Federation for 2015-2021 are analyzed. It is stated that the activities of shipping enterprises are strongly influenced by global processes. The main global trends that need to be considered in the innovative development of shipping enterprises are highlighted. At the present stage of development, the main global world trends in shipping are the fourth industrial revolution, high rates of container transportation development, the construction of increased capacity ships, the concept of sustainable development, the green economy, lean production. The factors negative for the pace of innovative development of shipping enterprises are systematized. Key areas for the rapid implementation of innovations at shipping enterprises are identified.

1 Introduction

Transition to an innovative economy favoring the development of high-tech industries is one of the priority development fields for modern Russia. Current competitive conditions impose new requirements on the forms, methods, mechanisms of innovative development of shipping enterprises, whose activities are crucial for the state economy development being a fundamental link in the transport system functioning.

The port infrastructure, terminals and ships update is positive for stimulating the trade partnership of maritime powers. Innovation is pivotal to the development of the maritime industry and is a reliable strategy for improving operational efficiency. To gain market advantages, maritime transport enterprises need to use the available material resources and immaterial opportunities. Therefore, it is very important not only to provide a correct and objective assessment of the initial state of the enterprises and the outcomes of implemented innovation activities, but also to determine guidelines for further innovative development.

2 Results and Discussion

Innovative development in maritime transport is a set of technical, industrial, organizational, managerial and commercial innovations aimed at improving the efficiency and competitiveness of transport enterprises.

The enterprise's innovative activity is an element of the long-term planning strategy. The innovative activity of shipping enterprises should aim to increase the

efficiency of using all production resources, increasing the enterprises competitiveness in the context of global processes and improve navigation and labor safety. The activities of maritime transport infrastructure, transport networks and facilities affect almost all types of innovations: product, procedural, advertising, administrative [1].

The exponential growth of digital data via the Internet has been one of the hallmarks of recent years. This has come amid the expansion of big data analytics, artificial intelligence, cloud computing and new digital platforms for implementing various business processes.

Maritime transport is strongly influenced by global world processes. At the present stage of development, the main global world trends in shipping are the fourth industrial revolution, high rates of container transportation development, the construction of increased capacity ships, the concept of sustainable development, green economy, lean production.

The circumstances surrounding the COVID-19 epidemic in 2019-2021 have caused an objective need to expand the scope of digital technologies.

Maritime transport enterprises need to consider all possible risk factors:

- changes in supply chain structure;
- fluctuations in the pattern “consumption of – demand for” world goods;
- global measures in sustainable development and low-carbon economy;
- consequences of trade protectionism and the policies of several states.

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The slowdown in the development of the world economy has contributed to the decrease in the growth rate of international maritime trade and the volume of

production activities of Russian shipping enterprises (Table 1).

Table 1. Outcomes of maritime transport functioning in the Russian Federation for 2015–2021 [2].

Indicators	2015	2016	2017	2018	2019	2020	2021
Volume of international shipping, billion tons	10.0	10.3	10.7	10.8	11.1	10.6	12.0
Growth rate, %	–	3.0	3.9	0.7	2.9	–4.1	12.9
Volume of cargo transportation by sea in the Russian Federation, million tons	19.0	24.6	26	23.2	23	24.7	23.5
Growth rate, %	–	29.5	5.7	–10.8	–0.9	7.3	–4.7
Freight turnover of maritime transport of the Russian Federation, billion t-km	37	42.8	50.0	37.0	36.524	42.5	42.7
Growth rate, %	–	15.7	16.8	–26.0	–1.3	16.2	0.5
Transshipment volume of seaports, million tons	677	722	786	817	840	820.8	835.2
Growth rate, %	–	6.6	8.9	3.9	2.8	–2.3	1.8
Ship calls to the seaports of the Russian Federation, units	83,298	81,346	95,888	90,571	87,685	89,047	85,215
Growth rate, %	–	–2.3	17.9	–5.5	–3.2	1.6	–4.3

Despite industry problems, the Russian maritime shipping market has not been significantly harmed. In 2020, compared to 2019, only the transshipment volume in seaports decreased (by 2.3%). Experts consider the general decline in the Russian economy, OPEC restrictions on oil exports, and changes in the situation on the coal export markets to be among the reasons for the decline in cargo turnover. The volume of cargo transportation by sea in the Russian Federation at the end of 2020 increased by 7.3% and reached 24.7 million tons compared to 2019; cargo turnover – by 16.2%; port turnover – by 1.6%. The development of port-industrial clusters with transport logistics in the Russian Federation, as well as an increase in the quality level of ports functioning management using logistics terminals, enabled to increase the indicators [3].

Unlike the previous period and against the background of the growth of the global shipping market in 2021, the volume of cargo transportation by sea in the Russian Federation decreased by 4.7% compared to the level of 2020 and showed a slight increase in cargo

turnover. The volume of transshipment of the SP RF increased slightly (by 1.8%) and it was impossible to achieve pre-crisis volumes, since the number of ship calls to the ports decreased.

According to the statistical observations of the Federal State Statistics Service of the Russian Federation, the level of innovative activity in transport is traditionally lower (separate statistics for maritime transport are not maintained) than in the whole country. Specifically, it equaled 2.8% in 2019, 4% in 2020. As well, the share of innovative goods, work, services in the total volume of shipped goods, work performed, services is lower (amounting to 0.5% in 2019 and 1.2% in 2020) [4].

Table 2 outlines the use of various information technologies, software and information security tools in transport organizations in Russia. It was compiled by the author based on the data from “Digital Economy 2022” [5].

Table 2. Use of digital technologies, software tools and security tools in organizations engaged in transportation and storage (in percentage of total number of organizations).

Digital technology	Transport and storage	Total in Russia
Use of digital technologies		
Cloud services	25.7	20.1
Technologies for collecting, processing and analyzing big data	21.0	22.4
Digital platforms	14.8	17.2
Geoinformation systems	15.8	13.0
Internet of Things	13.6	13.0
RFID technologies	12.1	10.8
Artificial intelligence technologies	3.7	5.4
Industrial robots (automated lines)	3.4	4.3
Use of software and information security tools		
Electronic document management systems	45.7	53.8
Financial calculations in electronic form	33	41.8

Providing access to databases through global information networks	11.7	22.1
Tutorials	18.5	15.3
Means of digital electronic signature	64.7	63.6
Regularly updated antivirus software	65	63.6
Soft hardware that prevents unauthorized access of malware	48.4	44.7
Spam filter	42.2	40.4
Encryption tools	37.8	38.5
Computer intrusion detection systems or network	34.2	32
Means for automating the processes of analysis and control of the security of computer systems	26.8	27.2

The data presented in Table 2 show that main digital technologies used in transport enterprises are cloud services (25.7%), technologies for collecting, processing and analyzing big data (21%). Artificial intelligence technologies are used by only 3.7% of enterprises.

It should be noted that there are practically no fully robotized (automated) production processes at enterprises.

The greatest development is noted regarding the following software and information security tools: digital electronic signature tools (64.7%), anti-virus programs (65%), electronic document management system (45.7%).

Let us highlight the factors impeding the pace of innovative development of shipping enterprises in the Russian Federation and classify them as follows: 1) international; 2) all-Russian; 3) industry.

International factors include: the crisis caused by COVID-19; the international sanctions against the Russian Federation, which suspended the work of the scientific and technical sphere; a decline in world oil and gas prices, which caused a decrease in the country's budget revenue.

The general Russian factors are the following:

- predominance of defense complex developments in the R&D structure;
 - low financing of innovative activities of enterprises due to a high degree of innovative risks, large volumes of investments and long payback periods;
 - imperfection of the regulatory framework of the Russian Federation, the absence of special laws regulating the innovations introduction, as well as the difficulty of registering the results of intellectual activity;
 - shortage of personnel with the necessary qualifications, staff's fear of innovation and low motivation, as well as the lack of innovative systems for training specialists;
 - insufficient volume of high-quality consulting support from the scientific community and insufficiently developed decision support tools in the field of innovation management.
- Industry factors include:
- imperfection of the industry regulatory framework – a number of issues have not been worked out, for example, personal data protection, regulation of relations between data owners, users and IT solutions developers (important for the development of MaaS systems), the issue of liability for accidents involving autonomous and unmanned vehicles and etc.;

- shortage of information infrastructure – lack of correct data and timely updated maps, on-board computing systems, networks for transmitting and receiving data does not contribute to the wide distribution and use of unmanned vehicles;
- development of capacities in a predominantly extensive way, that is, through the introduction of new terminals and ports with limited use of digitalization;
- fragmentation and lack of data and common data exchange standards for building integrated mobility and improving the efficiency of intelligent transport systems, it is important to establish the process of collecting data from traffic sensors on the streets, vehicles, user applications) and data transmission;
- insufficiency of railway and road infrastructure;
- shortage of port capacities in certain directions and cargo flows.

Let us single out the main directions of innovative development in maritime transport of the Russian Federation:

- 1) the smart port concept;
- 2) the unmanned navigation concept [6];
- 3) the e-Navigation concept [7, 8];
- 4) introduction of digital technologies in the processes of transportation, reloading and storage of goods;
- 5) introduction of software tools and artificial intelligence for processing large databases, predicting a possible collision of ships;
- 6) development of navigation safety systems;
- 7) development of aids to navigation equipment in the seaports waters and approaches to them;
- 8) introduction of BIM technologies for 4D visual modeling of construction, reconstruction and modernization of facilities in the transport complex.

The technologies creating the greatest impact on the competitiveness of shipping enterprises include artificial intelligence technologies, big data analytics, cloud computing, autonomous vehicles and digitalization of core business processes.

Big business and companies with state participation are the main driving forces of innovation [9]. According to the report of the analytical center under the Government of the Russian Federation, the shortage of highly qualified personnel is the main barrier to innovation. For example, the authors propose to introduce advanced training courses and employer-sponsored education of personnel in applying the

Internet of Things in the activities of sea port terminals [10].

The key factors in accelerating the processes of innovation in maritime transport are the more active state participation in these processes and the development of forms of public-private partnership [11].

State support of technological solutions and industry-specific R&D is the most demanded instrument of state policy among participants in the transport market.

3 Conclusion

To ensure the rapid introduction of innovations at the shipping enterprises of the Russian Federation, it is necessary to identify a number of key areas:

- develop the innovation market (demand, supply, competitive environment, government order);
- develop an effective mechanism for regulating the innovation market (creating competitive advantages in certain areas). In this regard, it is necessary to have a circumspect legal and regulatory policy to stimulate business innovation;
- develop new professional competencies in educational standards for training specialists and introduce special educational programs for training specialists who are not only capable of operating technical facilities, but also ready to effectively use software products and digital technologies in maritime transport.

Thus, the volatility of the global market and the export orientation of Russian foreign trade form new requirements for innovation management in the maritime industry. In the context of the crisis caused by the COVID-19 pandemic and the expected reduction in funding sources, further state support for research and development, innovation in the maritime transport sector should become a priority for the Russian Federation.

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