

Original article

UDC 658.788.5

doi: 10.46684/2024.4.5

## Technological solutions in the field of transport logistics

Sergey N. Glagolev<sup>1✉</sup>, Ivan A. Novikov<sup>2</sup>, Alexander S. Troshin<sup>3</sup>

<sup>1,2,3</sup> Belgorod State Technological University named after V.G. Shukhov (BSTU); Belgorod, Russian Federation

<sup>1</sup> rector@intbel.ru✉; <https://orcid.org/0009-0004-3437-5836>

<sup>2</sup> ooows@mail; <https://orcid.org/0000-0001-5322-9640>

<sup>3</sup> as\_troshin@inbox.ru; <https://orcid.org/0000-0001-8910-7282>

**ABSTRACT** Transport logistics is the dominant process of supply, which includes planning, execution and control of the movement of goods and services. The study examines the processes of digital transformation of the Russian transport and logistics industry. A number of current trends are analysed, such as electronic transportation documents (for all modes of transport), the development of delivery systems and logistics of marketplaces, and the beginning of large-scale commercial operation of unmanned aircraft systems. It is noted that special software and AI reduce data processing time and can perform those tasks that were previously performed by people, thereby speeding up logistics processes and reducing related costs. It is quite obvious that processes that previously required a significant time can be optimised by reducing it. The use of methods of analysis and synthesis, comparisons and generalizations in combination with a systematic approach to the study allowed us to consider the processes of digital transformation of the transport and logistics industry and their fusion on the effectiveness of logistics processes from different points of view and approaches. The demand for digitalisation in the transport and logistics system is due to the constantly growing need for the delivery of goods, regardless of the geographical distance between the counterparties. The use of modern technologies in transport logistics is likely to be able to scale supply chain processes with a significant reduction in time lag. IT technologies are the key to improving the efficiency and competitiveness of transport logistics. The paper substantiates the need to implement advanced IT solutions that will allow companies to optimise their logistics operations, improve the quality of customer service, and reduce costs.

**KEYWORDS:** transport logistics; transport flow; supply chains; information technology; management system; digital integration

**For citation:** Glagolev S.N., Novikov I.A., Troshin A.S. Technological solutions in the field of transport logistics. *BRICS Transport*. 2024;3(4):5. <https://doi.org/10.46684/2024.4.5>.

Научная статья

## Технологические решения в сфере транспортной логистики

С.Н. Глаголев<sup>1✉</sup>, И.А. Новиков<sup>2</sup>, А.С. Трошин<sup>3</sup>

<sup>1,2,3</sup> Белгородский государственный технологический университет им. В.Г. Шухова (БГТУ им. В.Г. Шухова); г. Белгород, Россия

<sup>1</sup> rector@intbel.ru✉; <https://orcid.org/0009-0004-3437-5836>

<sup>2</sup> ooows@mail; <https://orcid.org/0000-0001-5322-9640>

<sup>3</sup> as\_troshin@inbox.ru; <https://orcid.org/0000-0001-8910-7282>

**АННОТАЦИЯ** Транспортная логистика является доминантой процесса поставок, который включает планирование, выполнение и контроль перемещения товаров и услуг. Рассматривается цифровая трансформация российской транспортно-логистической отрасли. Анализируется ряд актуальных трендов: электронные перевозочные документы (на всех видах транспорта), развитие систем доставки и логистики маркетплейсов и начало массовой коммерческой эксплуатации беспилотных авиационных систем. Специальное программное обеспечение и искусственный интеллект сокращают время обработки данных и могут выполнять задачи, ранее выполняемые работниками, тем самым ускоряя логистические процессы и снижая соответствующие затраты.

© S.N. Glagolev, I.A. Novikov, A.S. Troshin, 2024

© Translation into English "BRICS Transport", 2024

Очевидно, что процессы, ранее требовавшие значительного временного интервала, могут быть оптимизированы в части его сокращения. Использование методов анализа и синтеза, сравнений и обобщений в совокупности с системным подходом к изучению позволило с разных точек зрения и подходов рассмотреть процессы цифровой трансформации транспортно-логистической отрасли и их влияние на эффективность логистических процессов.

Востребованность цифровизации в транспортно-логистической системе обусловлена перманентно растущей потребностью в доставке товаров независимо от географической удаленности контрагентов. Применение современных технологий в такой сфере как транспортная логистика с большой долей вероятности способно масштабировать процессы цепочки поставок со значительным сокращением временного лага. IT-технологии являются ключом к повышению эффективности и конкурентоспособности транспортной логистики. Обоснована необходимость внедрения передовых IT-решений, которые позволят компаниям оптимизировать свои логистические операции, повысить качество обслуживания клиентов, а также снизить расходы.

**КЛЮЧЕВЫЕ СЛОВА:** транспортная логистика; транспортный поток; цепочки поставок; информационные технологии; система управления; цифровая интеграция; транспортные перевозки

**Для цитирования:** Глаголев С.Н., Новиков И.А., Трошин А.С. Технологические решения в сфере транспортной логистики // Транспорт БРИКС. 2024. Т. 3. Вып. 4. Ст. 5. <https://doi.org/10.46684/2024.4.5>.

## INTRODUCTION

Transport logistics is rightly perceived as a dominant component of the supply process which involves planning, execution and control of the movement of goods and services between counterparties. Much importance is attached to coordination of various activities, including transportation, warehousing, inventory management and distribution, to ensure timely delivery of products to potential consumers.

Transport logistics is an integral part of the national economic system at all of its hierarchical levels. Without using it, the performance of the communication processes between producers and consumers does not seem possible. The development of transport and logistics systems is a guarantee of the competitiveness of the state both in the national and global markets.

## POSSIBILITIES OF TRANSPORT LOGISTICS

Transport logistics allows business entities to optimise deliveries, reduce transport costs and improve inventory management [1].

An analysis of the freight transportation market has shown the trends towards its expansion, which is reflected in official statistics. In 2021, the global freight traffic was estimated at \$14.85 bln; and by 2030, according to expert forecasts, it will amount to \$21.08 bln with a CAGR (Compound Annual Growth Rate) of 4 %.

The following parameters should be taken into account in the framework of actions to address the issue of differentiating the modes of goods transportation:

- the nature of the product;
- the distance to be covered;
- the urgency of delivery.

As practice shows, the commonest modes of transport are air, sea, road, and rail.

Air transport is appropriate for expensive and urgent transportations, while sea transport is good for

significant volumes that do not have priority requirements in terms of urgency.

Road transport is used for short- and medium-distance transportation, while rail transport is suitable for the transportation of bulk goods over significant geographical distances.

When addressing the task of minimizing transport time and costs, business entities develop approaches to optimise future routes. Transportation Management Systems (TMS) and software are used to optimise routes, to plan and improve transport routes, which helps to reduce transport costs, shorten the time lag of goods delivery and increase the satisfaction of potential consumers.

Revolutionary changes in the transport and logistics system are initiated by technological solutions which have become possible due to the scientific and technological advances: from the automation of inventory management to the use of artificial intelligence (AI) algorithms within route optimisation.

With the increasing complexity and unpredictability of the external environment, it is expedient for business entities to initiate the practical implementation of advanced technologies, including data analytics, AI and automation, within the shortest time possible.

Such technological solutions are designed to address the tasks of tracking and monitoring in real time, of sound demand forecasting, optimised inventory management, and reducing an order processing lag, which ultimately leads to increased satisfaction of potential consumers and optimization of the core operations.

The field of transport and logistics systems is currently witnessing growth of technology offers designed to address the problems of optimising and rationalising the existing operations within the evaluation criteria. From AI to autonomous vehicles, these trends are radically changing the ways goods are transported, tracked and managed [2, 3].

Let us consider the most important technological solutions in the transport logistics industry.

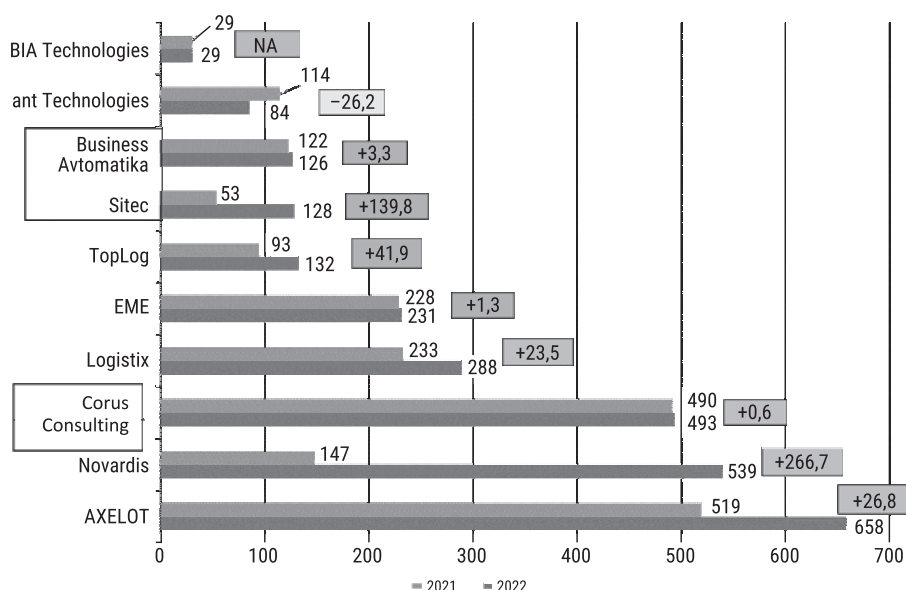


Fig. Major suppliers of warehouse management systems in Russia in terms of revenue in 2022, RUB mln

### 1. Automation of warehouse management processes.

A Warehouse Management System (WMS) is a software solution providing an overview of the enterprise's inventory and making it possible to manage order fulfilment at all stages of delivery from the distribution centre to the store shelf.

WMS solutions also enable companies to maximise the use of labour, space and equipment investments through coordinating and optimising resources and material flows. These systems are designed to support the needs throughout the global supply chain, including distribution, manufacturing, and capital-intensive businesses, as well as service companies [4, 5].

In the context of the present dynamic, multi-channel, complex economy, consumers initiate the possibility of purchasing goods without being bound to time and geography.

To solve these problems, warehouse management software designed to optimise fulfilment operations is used.

Import substitution has become an integral part of the development strategies of business entities, influencing the choice of WMS solutions. It is obvious that with foreign suppliers having left the market, domestic companies have an opportunity to put their own solutions into practice in the new competitive field of the WMS market [6].

In 2022, for example, the growth of the Russian market of WMS systems amounted to 25 % or 3.1 bln

roubles, which is due to import substitution processes with the account of the reorganisation procedures in the format of mergers and acquisitions (M&A). Such strategic decisions have created prerequisites for strengthening the competitive position of domestic business entities in the core markets with a possibility of achieving the emergence effect.

Of particular note is the fact of growth of the cost of labour force involved in warehousing operations, which is due to the current migration outflow.

Despite the current unfavourable external factors, the Russian WMS market has generally maintained its position and has favourable prospects for further development. It was noted that the support of the Government and the Ministry for Digital Technology, Communication and Mass Media had a positive impact on the entire IT industry<sup>1</sup> (Fig.).

The main trend in 2023 was an increase in demand for domestic WMS as part of their substitution for previously used foreign products.

2. Use of transport flow management systems. A Transport Management System (TMS) is a software package that helps logistics companies to manage and optimise transport operations, which includes such functions as route planning, load optimisation, carrier selection, freight auditing, and payment. A TMS enables companies to increase transportation efficiency, reduce costs and improve customer service through transparency and control of shipments<sup>2</sup> [7].

<sup>1</sup> Decree of the President of the Russian Federation of 02.03.2022 No. 83 "On measures to ensure the accelerated development of the information technology industry in the Russian Federation".

<sup>2</sup> Order of the Government of the Russian Federation of 03.11. November 2023 No. 3097-r "On approval of the strategic direction in the field of digital transformation of the transport industry of the Russian Federation until 2030".

Sometimes referred to as a transportation management solution or transportation management software, a TMS provides visibility of daily transport operations, trade standards compliance documentation and information, and timely delivery of freight and goods. A transportation management system also optimises the shipping process and makes it easier for businesses to manage and optimise transport operations by land, air or sea.

Transportation management systems are mostly used by companies that need to ship, transport and receive goods on a regular basis, including:

- manufacturers;
- distributors;
- e-commerce companies;
- retailers.

Companies providing logistics services include both providers of comprehensive third-party logistics services and providers of system-integrated logistics services (3PL and 4PL), as well as providers of traditional logistics service (LSP).

The transport management system considered finds its practical application in business entities regardless of their industry, be it construction, biomedical, etc.

### 3. Goods monitoring and tracking technology.

Modern technologies have revolutionised goods tracking and monitoring, offering new approaches to supply chain management and transport logistics. Such innovative solutions are initiating changes in the way goods are transported, monitored and managed, regardless of the geographical factor.

One of the most significant achievements is integration of IoT (Internet of Things) devices. Such sensors and connected devices are embedded in shipping containers, trucks or warehouses ensuring collection and transmission of real-time data, monitoring temperature, humidity, GPS (Global Positioning System) location and events related to impacts or unauthorized access, ensuring the integrity and security of goods throughout their route. IoT-based goods tracking systems provide detailed information on the condition of the goods, allowing for proactive decisions and reducing losses due to spoilage or theft.

The blockchain technology has also become a turning point in goods tracking, offering a secure and unalterable register to record every stage of the supply chain, from production to delivery. Its claimed transparency and reliability increase accountability and ongoing control, reducing cases of fraud and disputes. Smart contracts built on blockchain automate payment and compliance processes, optimising transactions and reducing paperwork [8].

Artificial Intelligence and machine learning are used to analyse large volumes of data generated by goods tracking systems. Predictive analytics can forecast potential delays, optimise routes and identify patterns in

goods behaviour, which improves the economic efficiency and profitability of transport and logistics systems.

Drones and autonomous vehicles currently being of significant interest provide fast and cost-effective last-mile delivery and access to remote or inaccessible geographical areas. These technologies both speed up the delivery process and reduce the environmental impact of logistics operations [9].

It can be stated that the transformation processes taking place in transport logistics contribute to its progressive development and lead to the achievement of positive results. The Internet of Things, blockchain, AI, and automation processes increase the transparency, efficiency, and safety of the transportation industry, benefiting both business entities and potential consumers by ensuring timely, reliable, and safe goods delivery.

4. Processes of practical application of analytical data in making relevant management decisions.

Companies show an appropriate interest in data analytics, which can be considered as a global trend. Big data analysis has a steady demand in various spheres of activity, having proved its appropriateness and relevance within the framework of economic activity.

In practical application, these tools offer great opportunities for solving the problem of improving the efficiency of supply chains in transport and logistics activities, directly affecting performance in this area.

The efficiency of logistics processes largely depends on the information component, which predetermines the relevance of approaches based on big data analysis.

According to experts' estimates, Big Data management systems and their effective implementation for the transport industry will bring its benefits.

Big Data is a concept used to describe a considerable amount of both organised and unstructured data that emerges due to the increasing use of social networks, mobile devices, and the Internet of Things in real time [10].

The complexity of coordinating a multitude of interrelated processes in the area under consideration contributes to the formation of problem areas with negative consequences.

Thus, in order to level out such phenomena, it is expedient to apply Big Data tools in practice, including within the framework of supply chain management, by creating a comprehensive and responsive network of strategic management of material, information and financial flows; inventory control aimed at maintaining an optimal balance of supply and demand, while minimising storage costs and ensuring product availability; optimising logistics processes of transportation, warehousing and distribution; and ensuring timeliness and reducing the lead times. The predominant goal should be to create a sustainable, flexible and economically effective system adapted to changes in market conditions and providing appropriate value to all stakeholders [11].



It is reasonable to highlight a number of advantages of using IT in the transport and logistics industry, including:

- achievement of economic efficiency, manifested in the fact that permanently improving freight exchange platforms guarantee that trucks will have the appropriate load; automated warehouse management leads to reduced labour costs, reducing the degree of inconsistency in cargo handling; and AI-based route optimisation reduces time intervals for goods delivery;
- saving financial resources through efficient planning of goods delivery processes, resulting in lower fuel costs. We should note the role and importance of electric vehicles which are to a certain extent not subject to the stated phenomenon due to their functional difference;
- improved data security because cloud and fog computing significantly reduce the likelihood of hacking into information processing systems. On the other hand, blockchain-based tracking ensures that the data collected about a shipment, from the sender to delivery, is true and accurate.

The following trends are predictable within the frames of transport logistics development in the near future (2024–2025)<sup>3</sup>:

- continuation of digital industry-specific trends of 2022–2023;
- national adaptation of the world's best practices;

- responding to short-term and long-term industry-specific challenges.

The current trends, the development of which will be continued, include:

- import substitution;
- cybersecurity and data protection; and
- development of digital competencies of companies.

In the context of the development of digital technologies, cybersecurity issues are of primary significance. This is confirmed by the interest on the part of business entities that can be currently observed in the subject area, due to the growing scale of cybercrime and cyberterrorism penetrating the ongoing business processes<sup>4</sup> [12].

## CONCLUSION

We can confidently state that modern technological solutions are an integral part of the transport and logistics industry, contributing to its progressive development in the long term.

These trends and tendencies will continue to grow, creating a solvent demand on the part of all stakeholders. The key to successful development of the transport logistics industry is a timely response to the current changes and practical use of modern achievements of scientific and technological progress in the relevant segments and areas of activity.

## REFERENCES

1. Altukhova A.A. Prospects for the development of Russian logistics in modern conditions. *Alley of Science*. 2023;1(3):(78):205-208. EDN HGFVWW. (In Russ.).
2. Arabyan M.S., Frolova A.V. Outsourcing as an instrument of customs logistics. *Customs Business*. 2023;2:2-4. DOI: 10.18572/2071-1220-2023-2-2-4. EDN BWTUGC. (In Russ.).
3. Shepelin G.I., Nikitin V.A. Benefits of integrating artificial intelligence into logistics. *StudNet*. 2022;5(6):181. EDN JQSFUJ. (In Russ.).
4. Novikov I.A., Glagolev S.N., Novikov A.N., Shevtsova A. Information technologies and management of transport systems development of the approach to assessing adaptation of the intersection transport model. *IOP Conference Series: Materials Science and Engineering*. 2019;632(1):012052. DOI: 10.1088/1757-899x/632/1/012052
5. Tiverovsky V.I. Development of warehouse logistics at the present stage. *Transport Technician: Education and Practice*. 2023;4(2):161-168. DOI: 10.46684/2687-1033.2023.2.161-168. EDN HLMWJV. (In Russ.).
6. Golubchik A.M. Sanctions realities of international goods distribution logistics: sea transport. *Logistics Today*. 2022;2:106-109. DOI: 10.36627/2500-1302-2022-2-2-106-109. EDN NBXPTH. (In Russ.).
7. Ageikin A.M. Development of the direction of LTL transportation in the market of innovative logistics. *Actual problems and prospects for the development of the economy: Russian and foreign experience*. 2022;1(39):63-66. EDN IPTTHW. (In Russ.).
8. Nyrov A.V., Aleynik A.O. Blockchain technologies in logistics. *Student Bulletin*. 2023;26-3(265):65-66. EDN ITJFFU. (In Russ.).

<sup>3</sup> Transport Strategy of the Russian Federation for the period up to 2030 (approved by the Order of the Government of the Russian Federation of 22.11.2008 No. 1734-r, as amended on 11.06.2014).

<sup>4</sup> Resolution of the Government of the Russian Federation of 16.11. November 2015 No. 1236 "On the establishment of a ban on the admission of software originating from foreign countries for the purposes of procurement to meet state and municipal needs" (as amended and supplemented by RF Government Resolutions of March 23, 2017 No. 325; December 20, 2017 No. 1594; November 20, 2018 No. 1391; March 30, 2019 No. 383; July 20, 2021 No. 1226; August 8, 2022 No. 1393; December 28, 2022 No. 2461; November 30, 2023 No. 2044).

9. Mashnenkov D.V. Prospects for the use of UAV in logistics. *Innovations and Investments*. 2023;6:168-171. EDN TIZXTO. (In Russ.).

10. Perelomova V.D. Using Big Data in logistics. *Research Center "Vector of Development"*. 2022;7:448-452. EDN BIYXPM. (In Russ.).

11. Novik A.A., Ponomarenko L.V. Efficiency of information technology application in logistics. *Science Issues*. 2022;3:110-113. EDN KYCOBY. (In Russ.).

12. Kordonov E.V. Cybersecurity in digital marketing and logistics: vulnerabilities, tools and prospects. *Accounting and Control*. 2022;10:24-30. EDN IKGNLQ. (In Russ.).

## ЛИТЕРАТУРА

1. Алтухова А.А. Перспективы развития российской логистики в современных условиях // *Аллея науки*. 2023. Т. 1. № 3 (78). С. 205–208. EDN HGFVWW.

2. Арабян М.С., Фролова А.В. Аутсорсинг как инструмент таможенной логистики // *Таможенное дело*. 2023. № 2. С. 2–4. DOI: 10.18572/2071-1220-2023-2-2-4. EDN BWTUGC.

3. Шепелин Г.И., Никитин В.А. Преимущества интеграции искусственного интеллекта в логистику // *StudNet*. 2022. Т. 5. № 6. С. 181. EDN JQSFUJ.

4. Novikov I.A., Glagolev S.N., Novikov A.N., Shevtsova A. Information technologies and management of transport systems development of the approach to assessing adaptation of the intersection transport model // *IOP Conference Series: Materials Science and Engineering*. 2019. Vol. 632. Issue 1. P. 012052. DOI: 10.1088/1757-899X/632/1/012052

5. Тиверовский В.И. Развитие складской логистики на современном этапе // *Техник транспорта: образование и практика*. 2023. Т. 4. № 2. С. 161–168. DOI: 10.46684/2687-1033.2023.2.161-168. EDN HLMWJV.

6. Голубчик А.М. Санкционные реалии логистики международного товародвижения: морской транспорт // *Логистика*

сегодня. 2022. № 2. С. 106–109. DOI: 10.36627/2500-1302-2022-2-2-106-109. EDN NBXPTH.

7. Агейкин А.М. Развитие направления перевозок сборных грузов на рынке инновационной логистики // *Актуальные проблемы и перспективы развития экономики: российский и зарубежный опыт*. 2022. № 1 (39). С. 63–66. EDN IPTTHW.

8. Ныров А.В., Алейник А.О. Блокчейн-технологии в логистике // *Студенческий вестник*. 2023. № 26–3 (265). С. 65–66. EDN ITJFFU.

9. Машненко Д.В. Перспективы использования БПЛА в логистике // *Инновации и инвестиции*. 2023. № 6. С. 168–171. EDN TIZXTO.

10. Переломова В.Д. Использование Big Data в логистике // *Научно-исследовательский центр «Вектор развития»*. 2022. № 7. С. 448–452. EDN BIYXPM.

11. Новик А.А., Пономаренко Л.В. Эффективность применения информационных технологий в логистике // *Вопросы науки*. 2022. № 3. С. 110–113. EDN KYCOBY.

12. Кордонов Е.В. Кибербезопасность в цифровом маркетинге и логистике: уязвимости, инструментарий и перспективы // *Учет и контроль*. 2022. № 10. С. 24–30. EDN IKGNLQ.

## Bionotes

**Sergey N. Glagolev** — Dr. Sci. (Econ.), Professor, Rector; **Belgorod State Technological University named after V.G. Shukhov (BSTU)**; 46 Kostyukova st., Belgorod, 308012, Russian Federation; ID RSCI: 297660, Scopus: 42661387200, ResearcherID: AES-9134-2022, ORCID: 0009-0004-3437-5836; rector@intbel.ru;

**Ivan A. Novikov** — Dr. Sci. (Eng.), Professor, Director of the Transport and Technology Institute; **Belgorod State Technological University named after V.G. Shukhov (BSTU)**; 46 Kostyukova st., Belgorod, 308012, Russian Federation; ID RSCI: 636558, Scopus: 7202658080, ResearcherID: T-5540-2017, ORCID: 0000-0001-5322-9640; ooows@mail;

**Alexander S. Troshin** — Dr. Sci. (Econ.), Associate Professor, Head of the Department of World Economy and Financial Management; **Belgorod State Technological University named after V.G. Shukhov (BSTU)**; 46 Kostyukova st., Belgorod, 308012, Russian Federation; ID RSCI: 636701, Scopus: 56669519200, ResearcherID: M-2277-2016, ORCID: 0000-0001-8910-7282; as\_troschin@inbox.ru.

## Об авторах

**Сергей Николаевич Глаголев** — доктор экономических наук, профессор, ректор; **Белгородский государственный технологический университет им. В.Г. Шухова (БГТУ им. В.Г. Шухова)**; 308012, г. Белгород, ул. Костюкова, д. 46; РИНЦ ID: 297660, Scopus: 42661387200, ResearcherID: AES-9134-2022, ORCID: 0009-0004-3437-5836; rector@intbel.ru;

**Иван Алексеевич Новиков** — доктор технических наук, профессор, директор транспортно-технологического института; **Белгородский государственный технологический университет им. В.Г. Шухова (БГТУ им. В.Г. Шухова)**; 308012, г. Белгород, ул. Костюкова, д. 46; РИНЦ ID: 636558, Scopus: 7202658080, ResearcherID: T-5540-2017, ORCID: 0000-0001-5322-9640; ooows@mail;

**Александр Сергеевич Трошин** — доктор экономических наук, доцент, заведующий кафедрой мировой экономики и финансового менеджмента; **Белгородский государственный технологический университет им. В.Г. Шухова (БГТУ им. В.Г. Шухова)**; 308012, г. Белгород, ул. Костюкова, д. 46; РИНЦ ID: 636701, Scopus: 56669519200, ResearcherID: M-2277-2016, ORCID: 0000-0001-8910-7282; as\_troschin@inbox.ru.

Contribution of the authors: the authors contributed equally to this article.

The authors declare no conflicts of interests.

Заявленный вклад авторов: все авторы сделали эквивалентный вклад в подготовку публикации.

Авторы заявляют об отсутствии конфликта интересов.

Corresponding author: Sergey N. Glagolev, rector@intbel.ru.

Автор, ответственный за переписку: Сергей Николаевич Глаголев, rector@intbel.ru.

The article was submitted 08.10.2024; approved after reviewing 02.11.2024; accepted for publication 28.11.2024.

Статья поступила в редакцию 08.10.2024; одобрена после рецензирования 02.11.2024; принята к публикации 28.11.2024.