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Digital Technologies of Transportation and Logistics Systems Visibility

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ABSTRACT

The article discusses the introduction of digital traceability technologies in transport and logistics systems, examines the legal framework for digital labeling and traceability of goods, substantiates the platform management concept of transport and logistics systems. According to this concept, the focal point of the transport chain is not the logistics operator, but an integrated digital platform management of transport and cargo flows, uniting all participants and providing a high degree of s transparency and traceability through the supply chain, evaluated the efficiency of the transport and logistics systems based on extensive use of modern digital information and communication technologies, with which it is possible to control orders to carry out the planning, organization, monitoring and control throughout the delivery procedure of goods

KEYWORDS:

digital marking, traceability, transport and logistics system, supply chain management, digital platform.

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In today's economic environment, in order to ensure the flexibility of supply chains, many companies transfer part of their business processes to outsourcing, which often leads to loss of control and ability to track the performance of various logistics operations. It is possible to solve this problem by introducing modern digital technologies for end-to-end traceability of supply chains, including transportation and logistics services at the stage of delivering goods from manufacturers to end consumers.

Traceability is a procedure of continuous monitoring of the material flow movement in supply chains in real time. It is necessary for the further formation and development of an efficient logistics system of delivery of goods, including internationally. Digital traceability involves working with extensive arrays of structured and unstructured data, establishing integration processes and inter-organizational logistical coordination between supply chain entities, as well as designing and implementing modern digital systems that automatically, quickly and safely process incoming orders for the transportation of goods to ensure availability goods to intermediate the final consumers.

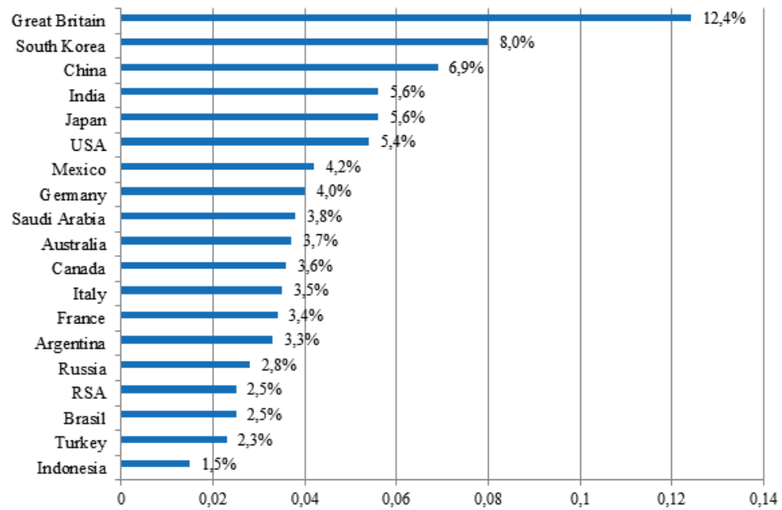
The methodical basis of the study was the platform concept of the development of digital economy, statistical and comparative analysis, scientific analysis and synthesis, graphic methods and generalization.

In recent years, the evolutionary-revolutionary nature of economic development is associated with the advent of breakthrough technologies and digitalization. In Russia, digitalization is regulated and maintained at the legislative level (Ordinance, 2017, Ordinance, 2017).

Digital platforms are the quintessence of the modern tools of the digital economy, because they integrate a significant number of innovative technologies and provide users (producers, intermediaries, consumers) with access to various digital tools, which predetermines a qualitative change in business practices (Keshelawa, Khaet, 2018). With regard to transport and logistics systems, it can be stated that the focal point in the supply chain is now not the entity itself (logistic operator), but an integrated digital transport and cargo management platform uniting all participants and providing a high degree of transparency and cross-cutting traceability of the supply chain.

In the context of global competition, the ability to innovate is becoming a new factor in the development of transport and logistics infrastructure and an effective way to overcome crisis trends. Digital technology management of transport and logistics processes are innovative themselves. For now, their implementation is facing administrative and legal barriers, but they will certainly become a catalyst for radical changes in the economy, organization and coordination of the delivery of goods, change of technical regulations for admitting rolling stock to the carriage of goods and passengers, and transform rules and practices indirectly related to logistics , in particular environmental requirements, rules of transport and cargo insurance, the practice of dealing with the consequences of traffic accidents, the specifics of customs control (Balchik, Kalinina, Barykin, 2018). In addition, innovative technologies of Industry 4.0, in particular, the Internet, big data, artificial intelligence also serve as catalysts for digital transformation, which allows building a sequence of dominant paradigms

Fig.1. The share of the digital economy in the GDP of countries G20, %



of industrial revolution: mechanization - technologization - digitalization - intellectualization.

To achieve these goals, there is a need to move as quickly as possible from analog technologies, on the basis of which most of the transport logistics business processes are still implemented into the digital environment. Digitization of the economy in general and the transport and logistics sector in particular raises a number of controversial issues, for example, the level of digitization of the economy in the overall structure of Russia's GDP is still quite far behind the indicators of the industrialized countries of the world (Fig. 1) (Banke, Butenko, Mishenina etc., 2017).

According to B.Yu.Titov, an expert from Stolypin Growth Economy Institute, in terms of the development of digital economy, Russia lags behind the leading states, there is an imbalance between the digitalization of the state, including the creation of new "fiscal" information systems, and the development of private initiatives in this area (Russia, 2018).

Today, for the functioning of transport and logistics systems, it is necessary to apply modern digital information and communication technology to manage orders, plan, organize, monitor and control all procedures for the delivery of goods in real time.

Proliferation of digital technologies encourages transport companies to analyze their market opportunities and explore the competitive environment to determine potential growth opportunities. Technology and models innovations related to digitalization are transforming the transport industry in terms of increasing its efficiency and increasing the capacity to form modern transport logistics architecture (Management, 2016).

The digital transport logistics ecosystem provides access to interactive web technologies, through which you can directly connect to the transportation and warehousing system, plan enterprise resources, carry out any kind of interaction with contractors (suppliers, intermediaries, consumers). In this case, the information flow has an advance on the delivery process, that is, it does not appear as a derivative of the material flow, but is the main flow in the transport and logistics system. After connecting to the service, the user will be able to calculate the cost of transporting the goods, immediately send a request for organizing the delivery of goods and then monitoring the transportation process both domestically and internationally.

At the end of 2018, the World Bank has compiled a logistics efficiency rating in various countries of the world (Transportation, 2018) (see Table). The methodology for determining the place in the rating on a five-point scale takes into account the efficiency of the customs authorities, the state of the transport and logistics infrastructure, the speed of international transportation, the timeliness of delivery and the ability to track cargo. At the moment, Russia takes the 75th position in the ranking among 160 countries, following Costa Rica and Paraguay and slightly ahead of Benin and Montenegro. Oddly enough, the lowest indicators (97th place) in our country refer to customs administration efficiency (2.42 points) and supply chain traceability (2.65 points). By the parameter "international transportation", Russia ranked 96th (2.64 points). Ii is also

World country ranking of logistics efficiency for 2018

Country	Rank	Cumulated measure, points	Percentage of leader's cumulated measure, %	Customs		Infrastructure		International transportation		Logistics quality		Traceability		Timeliness	
				Rank	Points	Rank	Points	Rank	Points	Rank	Points	Rank	Points	Rank	Points
Germany	1	4,20	100,0	1	4,09	1	4,37	4	3,86	1	4,31	2	4,24	3	4,39
Sweden	2	4,05	95,4	2	4,05	3	4,24	2	3,92	10	3,98	17	3,88	7	4,28
Belgium	3	4,04	94,9	14	3,66	14	3,98	1	3,99	2	4,13	9	4,05	1	4,41
Austria	4	4,03	94,5	12	3,71	5	4,18	3	3,88	6	4,08	7	4,09	12	4,25
Japan	5	4,03	94,5	3	3,99	2	4,25	14	3,59	4	4,09	10	4,05	10	4,25
Netherlands	6	4,02	94,3	5	3,92	4	4,21	11	3,68	5	4,09	11	4,02	11	4,25
Singapore	7	4,00	93,6	6	3,89	6	4,06	15	3,58	3	4,10	8	4,08	6	4,32
Denmark	8	3,99	93,5	4	3,92	17	3,96	19	3,53	9	4,01	3	4,18	2	4,41
England	9	3,99	93,3	11	3,77	8	4,03	13	3,67	7	4,05	4	4,11	5	4,33
Finland	10	3,97	92,7	8	3,82	11	4,00	16	3,56	15	3,89	1	4,32	8	4,28
Russia	*75*	*2,76*	*54,9*	*97*	*2,42*	*61*	*2,78*	*96*	*2,64*	*71*	*2,75*	*97*	*2,65*	*66*	*3,31*

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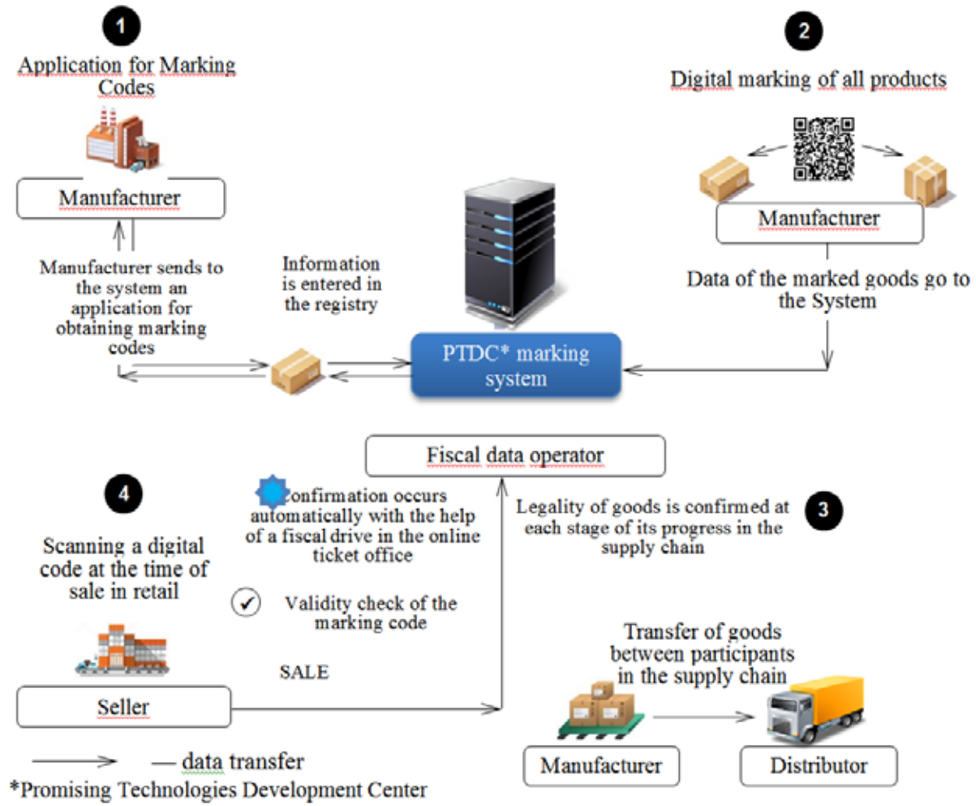

Fig. 2. Unified National Digital Marking and Traceability System

necessary to improve the work in the field of ensuring the timeliness of delivery, infrastructure development and logistics quality (3.31, 2.78 and 2.75 points and 66, 61 and 71th places, respectively).

In practice, the improvement of components as a whole, specified in Table. 1, is quite a complicated and difficult task, because cargo owners often do not have complete information about the goods movement and cannot track their cargoes online, which may indicate technical unpreparedness of transport and logistics systems subjects to complete and even partial transition to digital cargo delivery technologies. Participants in the process of transport and logistics services do not always receive alerts about the shipment of goods, their location and time of arrival at their destination in time. The current situation significantly reduces the quality of trade and supply chain management.

The supply chain tracking technology helps to quickly respond to changes, allowing interested users, including suppliers, logistics operators, consumers, to take action and change demand, redirect the material flow and respond to any changes in the supply chain. The integration of digital traceability tools and systems allows different parts of the supply chain to obtain accurate information on current stocks, incoming orders and goods being in transit in real time.

One of the directions of state regulation of transport and logistics processes is the introduction of digital traceability technologies as the Unified National Digital Marking and Traceability System developed by the Center of the Development of Promising Technologies (Unified, 2019) (Fig. 2). In December 2017, the President of Russia V.V. Putin approved the decision of the Government to create the Unified National System of Continuous Marking of Goods till 2024. The Center for Development of Promising Technologies was designated as the operator of the project, which is a joint project of USM Technology (50%), Rostec State Corporation (25%) and Elvis Plus Group (25%), established on the basis of state & private partnership and acts as an authorized operator, assigning each product a unique code (DataMatrix or marking of a different type) so that the manufacturer or importer places it on the packaging of the goods. It is assumed that by 2024 the system will cover most industries, primarily the production of tobacco products, medicines, clothing, shoes, baby food, etc.

The DataMatrix code is divided into two parts: an identification code that determines the position of the goods in the system and a single product catalog, and a verification code, or a crypto-tail that is generated by the operator using domestic cryptography technologies. Due to fixation of movement at every stage in the Honest Sign system, the availability of goods that do not have permits for the use of the specified trademark or are registered with infringement of copyright, and the possibility of the goods reappearing on the market, including expired ones, is excluded. The digital marking code is unique and easily applied to any package. Placing the DataMatrix code on the packaging of the product ensures effective counteraction to counterfeit and smuggling, protection to conscientious and law-abiding entrepreneurs and consumers, and tax collection.

On April 8, 2018, the Government of the Russian Federation approved the list of goods that are subject to mandatory marking. From March 2019, they will mark tobacco products, from July 2019 – shoes, from December 2019 – perfumes and toilet water, some light industry goods, in particular, coats, short coats, raincoats, jackets, knitted blouses, windbreakers, jerseys, table, bedding, kitchen, toilet linen, cameras and flashlights, tires and pneumatic tires, from January 2020 – medicines (National System, 2019).

Introduction of this system involves obtaining benefits for all interested parties (the win-to-win model):

- Consumers will be assured that they acquire certified, legal and high-quality products, they are provided with protection of life and health, the tools of public control and the protection of their rights are active.
- Entrepreneurs will be able to predict revenue growth and competitiveness in the market, optimize business processes and reduce total logistics costs, access information about product movement in supply chains.
- At the state level, scenarios for reducing the share of the illegal market can be implemented and labor productivity indicators increased, tax and customs duties can be increased, budget savings associated with ensuring control over commodity markets are ensured.

Digital marking operators can be considered as an additional source of primary data for the information infrastructure of digital economy. Retailers have already introduced digital marks. With their help, retailers automate the process of determining the item, price and other product attributes. Expanding the use of digital marking of transported goods, assigning unique digital codes to them will solve many problems of supply chain management regulation, including improving the quality of traceability of transport and logistics systems (Lipuntsov, 2018).

The digital marking system will allow you to track the state of objects (location inside the cargo compartment, the presence of damage, ad hoc movements, theft), as well as environmental parameters such as temperature, humidity, pressure, etc. In addition, digital marking will provide an opportunity to control all events occurring at individual stages of management of the integrated material flow both in direct and reverse supply chains, including:

- origin of raw and other materials;
- processing of raw materials and ingredients, production of intermediate products, semi-finished products and components, manufacture of final products;
- delivery and distribution of products, including domestic and cross-border trade;
- intermediate and final consumption of products, including installation, configuration, testing;
- warranty and after-sales service, minor and major repairs;
- aggregation and disaggregation of products in the framework of reverse logistics;
- destruction of products and recycling of raw materials.

Traceable objects are physical or digital objects for which information about the origin, destination, or location is needed. In logistics, such objects are products (for instance, medicines, consumer goods, electronic household appliances), logistic primary and integrated cargo units (for instance, boxes, pallets, containers), as well as equipment and other assets (for example, sea vessels, trucks, railcars, forklifts, stackers, etc.).

As part of the transport and logistics process, tracked objects can be transformed. For instance, in supply chains, a marked box with a specific consignment note was moved to a specified destination in a cargo unit formed on one pallet, in a distribution center it could be redistributed to another pallet and sent with another consignment note to a new destination. The tracking system should provide for reorientation of the material flow and ensure that all production, trade, storage and other features of the logistics of cargo flows are taken into account and correctly reflect all possible changes.

Currently, the ideology of pass-through digital traceability of marked goods is supported by the Non-Commercial Organization European Article Numbering (EAN), established in 1973, with its headquarters in Brussels (Belgium) (Association, 2019). It includes national organizations representing European countries. The association deals with standardization of bar coding and logistic units accounting, implements the GTIN (international code for marking and logistic units accounting), an identification system, which should replace the American UPC and European EAN, in order to increase the efficiency of supply chains in the retail sector.

Digital traceability technologies are also extremely important from the point of view of transport and logistics services for foreign economic activity. On the one hand, in international shipments, traceability is determined by documentary accounting and control of product movement at all stages of turnover, starting with the customs import procedure. On the other hand, in a broader sense, traceability can be viewed as a mechanism of state control of foreign economic activity through the use of modern digital information technologies, adaptation of the customs system to information technology control instead of actual (Vorotyntseva, Tultseva, 2018). Thanks to the transition to digital form, trade procedures will be simplified, there will be opportunities for more active use of electronic commerce.

In perspective, digital transformation will also affect the integrated EAEU market: the development of the digital market will facilitate the free movement of goods, services, capital and labor. On the territory of the EAEU Member States, the acquisition, storage, use, transportation and sale of goods included in the list will be governed by an agreement on the implementation of a pilot project on the introduction of marking of goods with control (identification) marks. Trade of goods without marking or with violation of the established procedure

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for applying control marks will be prohibited, which will also increase the transparency of supply chains and increase the efficiency of business processes in transport and logistics systems (Andreeva, 2018).

Digital traceability technologies are being introduced in the field of wood accounting and transactions with it. Since 2015, the Unified State Automated Information System, created primarily to control the turnover of alcoholic and alcohol-containing goods, has also been used to account for wood turnover (Federal Law, 2013). The wood accounting system was launched to ensure that the control and supervisory authorities of the Russian Federation received in a timely manner information about the volumes of wood turnover both in Russia and abroad, from the point of export and import. The provisions of the Law presuppose the availability of all accompanying documentation for sale, transportation and storage of wood. For example, transportation of wood by any type of transport, including based on a contract of carriage, should be carried out if there is an accompanying document that specifies the information: owner, consignor, consignee, wood carrier, its volume, species (breed) and assortment composition, points of departure and destination, number of declaration of timber transactions (in case if transactions were made with the specified wood), the number of the state license plate of the vehicle on which the transport i.e. wood (in case it's transported by a car) (Federal Law 2013, Art. 50.4). The safety, reliability and legality of transport and logistics and other operations are confirmed by information entered into the automated wood accounting system and certified by an electronic digital signature.

Thus, thanks to digital traceability technology, broad prospects are opening up for automatization and algorithmizing basic business processes in logistics, improving predictive analytics in terms of optimizing logistic flows and transport routes, increasing the utilization efficiency rate of transport and logistics company assets. Although the advantages of digital traceability in supply chains are obvious, the development of this technology is hampered by an insufficiently developed regulatory framework, technological unwillingness of transport and logistics companies to introduce modern digital technologies in the delivery of goods.

REFERENCES

1. Andreeva, L. V. (2018). Sozdanie sistemy proslezhivaemosti tovarov v evrazijskom ehkonomicheskom soyuze celi perspektivy organizacionno-pravovaya osnova // Mezhdunarodnoe sotrudnichestvo evrazijskikh gosudarstv, politika ekonomika, pravo. 2(15):70–78. [Andreeva, L. V. (2018). Creating a system of traceability of goods in the Eurasian Economic Union: goals, prospects, legal framework // International cooperation of Eurasian states: politics, economics, law. 2(15):70–78. (In Russ.).].
2. Associaciya avtomaticheskoj identifikacii GS1 (2019). [Association of automatic identification GS1 (2019). (In Russ.).]. http://www.gs1ru.org.
3. Banke, B., Butenko, V., Mishenina, D. i dr. (2017). Rossiya onlajn: chetyre prioriteta dlya proryva v cifrovoj ekonomike // BCG [Banke, B., Butenko, V., Mishenina, D. et al. (2017) Russia Online: Four Priorities for a Breakthrough in the Digital Economy. *BCG*. (In Russ.).]. http://image-src.bcg.com/Images/Russia-Online_tcm27–178074.pdf.
4. Balchik, E. A., Kalinina, O. V., Barykin, S. E. (2018). Investicii v innovacionnye logisticheskie tekhnologii // Strategicheskie resheniya i risk-menedzhment. 4 (107):48–53. [Balchik, E. A., Kalinina, O. V., Barykin, S. E. (2018). Investment in innovative logistics technologies. *Strategic decisions and risk management*. 4 (107):48–53. (In Russ.).]. DOI: https://doi.org/10.17747/2078-8886-2018-4-48-53.
5. Vorotynceva, T. M., Tulceva, A. S. (2018). Proslezhivaemost tovarov kak mekhanizm regulirovaniya mezhdunarodnoj torgovli // Marketing i logistika. 5(19):22–31 [Vorotyntseva, T. M., Tultseva, A. S. (2018). Traceability of goods as a mechanism for regulating international trade. Marketing and Logistics. 5 (19):22–31. (In Russ.).].
6. Edinaya nacionalnaya sistema cifrovoj markirovki i proslezhivaemosti (2019). [The Unified National Digital Marking and Traceability System (2019). (In Russ.).]. https://crpt.ru/materials/.
7. Keshelava, A. V., Haet, I. L. (2018). Predmet cifrovoj ekonomiki i rol cifrovykh instrumentov // Cifrovaya ekonomika cifrovye ekosistemy. [Keshelava, A. V., Khayet, I. L. (2018). The subject of the digital economy and the role of digital tools. *Digital economy, digital ecosystems*. (In Russ.).]. http://spkurdyumov.ru/digital_economy/predmet-cifrovoj-ekonomiki-i-rol-cifrovyx-instrumentov/.
8. Lipuncov, Yu. P. (2018). Ispolzovanie informacionnoj infrastruktury cifrovoj ekonomiki dlya povysheniya kachestva statisticheskikh dannykh // Statistika i ehkonomika. T. 15. № 4. S 77–86 [Lipuntsov Yu. P. (2018). Using the Information Infrastructure of the Digital Economy to Improve the Quality of Statistical Data. Statistics and Economics. 15 (4);77–86. (In Russ.).].
9. Nacionalnaya sistema cifrovoj markirovki (2019). [National Digital Marking System (2019). (In Russ.).]. https://local sign.rf/.
10. Postanovlenie Pravitelstva RF ot 28.08.2017 № 1030 «O sisteme upravleniya realizaciej programmy „Cifrovaya ehkonomika Rossijskoj Federacii Pravitelstvo Rossii"». [Decree of the Government of the Russian Federation of 28.08.2017 No. 1030 «On the management system of the implementation of the Digital Economy of the Russian Federation program. *Government of Russia*. (In Russ.).]. http://government.ru/docs/29003/.
11. Rasporyazhenie ot 28.07.2017 № 1632-r «Ob utverzhdenii programmy „Cifrovaya ehkonomika Rossijskoj Federacii"» // Pravitelstvo Rossii. [Order of 28.07.2017 No. 1632-p „On approval of the program" «Digital Economy of the Russian Federation». *Government of Russia*. (In Russ.).]. http://government.ru/docs/28653/.
13. Rossiya ot cifrovizacii k cifrovoj ekonomike (2018) // Institut ehkonomiki rosta im. P.A. Stolypina [Russia: from digitalization to a digital economy (2018). *P.A. Stolypin Institute for the Economics of Growth*. (In Russ.).]. http://stolypin.institute/wp-content/uploads/2018/09/issledovanie_tsifrovaya-ekonomika-14-09-18-1.pdf.

14. Upravlenie cepyami postavok uchebnik 2016 /V. V. Shcherbakov i dr. M.: Yurajt. 209 s. (Ser. 58. Bakalavr. Akademicheskij kurs) [Supply Chain Management: textbook (2016), ed. V.V. Shcherbakov et al. M.: Yurait Publishing House. 209 p. (Ser. 58. Bachelor. Academic course). (In Russ.).].
15. Federalnyj zakon ot 2812 2013 № 415-FZ O vnesenii izmenenij v Lesnoj kodeks Rossijskoj Federacii i Kodeks Rossijskoj Federacii ob administrativnykh pravonarusheniyakh // Rossijskaya gazeta [Federal Law of 28.12.2013 № 415-ФЗ «On Amendments to the Forest Code of the Russian Federation and the Code of the Russian Federation on Administrative Offenses». *Rossijskaya gazeta*. (In Russ.).]. https://rg.ru/2013/12/30/drevesina-dok.html.
16. Transportation and Logistics in a Changing (2019). In: World: The Journey Back to Profitable Growth, Boston: Boston Consulting Group. 57–58.

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