Digital technologies in transport logistics in Russia by the example of the European Union

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Abstract. At the beginning of the 21st century, the world is undergoing a global computerisation of both production and the global economy. Digitalisation is optimising costs and opening up new sources of income. Statistical observation has shown that the Russian Federation has a low Logistics Performance Index. Furthermore, there is an inequality in digitalisation in the constituent entities of the Russian Federation. The article examines the problems and prospects of digitalisation in the transport and logistics industry. The main problems are the lack of competent, professional staff, as well as inefficient management. The question of the transition from a more extensive model of transport and logistics infrastructure development using digital technology to an intensive model that improves the quality of services provided and, consequently, competitiveness arises. The most innovative technologies used by companies are identified. It is concluded that the use of digital technologies in the transport and logistics industry has a direct impact on the quality of services provided, ensures road safety, and contributes to the optimization of logistics processes.

1 Introduction

A transport and logistics system is a high-tech intelligent system that focuses on the development of the respective industry, innovation, technology and people skills.

Bahrami M., Abdolvand N., Rajae Harandi S. note "Due to the importance of monitoring the trac by means of checking speed limits, pollution check, and emergency response in case of road accident, Internet of Things (IoT) technology has emerged with a variety of ways in traffic management." [1].

However, with the general trend towards digitalisation, two main paths stand out: the training of artificial intelligence for vehicle interaction with pedestrians and stationary objects, and the infusion of infrastructure with accounting and information systems combined with intelligent transport systems. These days, the development of the second path is lagging behind due to the high cost of building new, world-class digital and intelligent infrastructure. As Savin G. notes in his study "In this situation the development of smart contracts is a necessary element for coordinating and organising transportation,

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which also provides effective transformation of the transport and logistics system, savings for economic operators and the city's environment improvement." [2].

As it was noted by Dmitry Medvedev at the meeting on digital transformation, in the field of freight transport the main task is to switch completely to digital management, while in the field of passenger transport the planned innovations will be implemented through the development of special services. Optimization of logistics processes, financial savings and increased competitiveness of the national transport industry are expected to be positive effects of the introduction of advanced technologies. Digitalization also contributes to the growth of economic entities' efficiency: interaction of companies from different spheres increases, creating the so-called synergetic effect, strengthening companies' position in the market.

1.1 Relevance

In the current context, digitalisation is a key element in the competitive success of transport companies. This is because of its direct impact on the speed and quality of services provided.

Akbar Ali, Nasir Ayub, Muhammad Shiraz, Niamat Ullah, Abdullah Gani, Muhammad Ahsan Qureshi said in their study, "Nowadays, with the rapid development becomes in technology due to the Internet of Things (IoT), vehicles have become modern. They gradually become more equipped with actuators, communication devices, Sensors like Global Positioning System (GPS), embedded computers, and mobile devices." [3]. With the development of digital technology, there are more opportunities to report on growing traffic issues such as congestion, heavy traffic and vehicle safety.

A. Sathyapriya, K. Sathiya, T. M. Sneha, D. Rohit Raja, and T. Manikandan, in an article, says "Road accidents are increasing every day and mortality is reaching hundreds of thousands around a year. So, it is necessary to implement technologies to prevent them from happening." [4].

Digital technology, particularly information technology (IT) and information systems (IS) that facilitate communication and decision-making processes, is recognised as a key factor in the efficiency of logistics systems. This is reflected in Patrizia Serra, Gianfranco Fancello, Riccardo Bozzo, and Andrea Zoratti, "An increasing number of ports have now independently initiated technological and digital upgrading, but mainly in the container sector." [5].

To guarantee good performance, time, resources and maintenance costs (the frequency of which is increasing due to increased usage) need to be optimised.

1.2 Literature review

This paper considers the works of foreign authors who study the issue of digitalization of the transport and logistics system. Studies in the field of digitalization of transport infrastructure include the works of groups of researchers around the world [1-12]. The works [1-3] reflect the development of digital technologies and the growing transport problems such as congestion, heavy traffic and vehicle safety. One of the in-depth studies is the work of scientists Mallikarjun Anandhalli Pavana Baligar Santosh S. Saraf, Pooja Deepsi who cite in their paper "The development of ITS has provided many technologies for transport management, vehicle control, collision avoidance systems, emergency management services, etc." [6].

In our view, the issue of digitalization of transport and logistics infrastructure is not sufficiently reflected in the literature. The transition to the use of digital technologies in
transport logistics is necessary. For example, the lack of monitoring of freight transportation leaves the problem of timely delivery unresolved.

1.3 Problem statement

The analysis of various scientific works in the area under study has revealed that the main problems hindering the digitalization of the transport and logistics industry are the low investment attractiveness of this sphere, unreadiness of companies to change, insufficient financial capabilities, lack of professional staff, vulnerability to cyber-attacks. The complex of measures aimed at computerization in the transport infrastructure is implemented at the expense of budgetary allocations.

However, an important problem in this environment is the low level of competitiveness of companies and the inability to compete on the international market.

1.4 Aim, objectives and hypothesis

This study aims to find current problems hindering the development of digitalisation in transport logistics.

The objectives are:
1. to analyze the state of transport and logistics infrastructure in the Russian Federation.
2. to describe the use of digital technologies in transport and logistics in the Russian Federation.
3. to identify the problems of digitalization of transport and logistics infrastructure in the Russian Federation.
4. to consider the prospects for the development of digital technologies in transport and logistics in the Russian Federation.

The hypothesis of the study is that the use of digital technologies in the transport and logistics industry directly affects the quality of services, ensures road safety and contributes to the optimization of logistics processes.

2 Methods

Relevant material on the topic from various sources was selected and used to write this paper. On the basis of these, the problems were analysed, ways of solving them were identified and conclusions were drawn. Empirical and theoretical research methods were used, namely method of analysis, method of analogy, method of comparison and method of induction. The current state of digital technologies in transport logistics in Russia was assessed. Based on the data obtained, the problems, solutions and conclusions were identified and analysed.

3 Results and discussion

The World Bank has developed the Logistics Performance Index (LPI) to assess the level of development of logistics systems in various countries. This indicator is calculated every two years on the basis of a survey of logistics operators, transport companies, manufacturers and others involved in foreign economic activity. Based on the results of the survey and the subsequent aggregation and ranking of the data obtained, the Logistics Performance Index is formed. It consists of 6 indicators, which are evaluated on a 5-point scale. These indicators are:
1. efficiency of trade and transport infrastructure;
2. responsiveness of customs and border clearance;
3. quality of the logistics services provided;
4. ease of arranging international delivery of goods;
5. compliance with the terms of cargo delivery;
6. cargo tracking.

See Table 1 for the leading EU countries with a logistics efficiency index score above 4.

<table>
<thead>
<tr>
<th>Country</th>
<th>LPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Germany</td>
<td>4.20</td>
</tr>
<tr>
<td>Sweden</td>
<td>4.05</td>
</tr>
<tr>
<td>Belgium</td>
<td>4.04</td>
</tr>
<tr>
<td>Austria</td>
<td>4.03</td>
</tr>
</tbody>
</table>

Russia ranks 75th in the 2020 Logistics Performance Index. Customs (2.42), international transport status (2.65) and cargo tracking (2.64) have the lowest scores. The problem is inefficient customs structures, weak infrastructure, lack of logistics technology, and unbalanced cargo flow.

One of the most affected areas during the COVID-19 pandemic was the international transport and logistics system. Various components, such as the closure of national borders, restrictions on movement, and a decline in demand and purchasing power, have been adversely affected. Within digitalisation, a combination of such factors has affected all aspects of transport and logistics infrastructure, from the use of private and public transport in cities to the transport of goods between countries.

There is a digitalisation inequality in the constituent entities of the Russian Federation. This is due to factors such as lack of necessary information and communication infrastructure, lack of qualified specialists (in IT and high-tech industries) and financing, and low development. In addition, many regions are now beginning the process of creating a regulatory environment to stimulate the spread of digital technology. Brunila O. P., Kunnaala-Hyrkki V., Inkinen T. in their work emphasize "digitalization is not without its difficulties especially in the early adoption phases." [7].

A significant leap in the development of intelligent logistics in the Russian Federation is the transition from individual solutions to platform solutions: the creation of the Association of Digital Transport and Logistics (CTL), co-founded by Business Lines, OAO Russian Railways, PAO Aeroflot - Russian Airlines, GC Avtodor, ZashitaInfoTrans, OOO RT-Invest Transport Systems, Glosav, has contributed to achieving this goal. According to Xu Sun, Hao Yu, Wei Deng Solvang, Yi Wang, Kesheng Wang "One of the most important factors for companies to not only survive but also thrive in today's competitive market is their logistics performance." [8].

Nowadays, the majority of transport and logistics companies, which are trying to save on the cost of maintaining their IT staff, use IT outsourcing, which is becoming increasingly popular in the IT industry. For example, according to a Tadviser estimate, the Russian IT services market grew from RUB 294.6bn to RUB 373.4bn between 2015 and 2019. As Peter M. N., Rani M. P. note in their article, "In recent years every technology has been integrated with the smart applications for moving towards the smart environment. Smart transport is involved in many applications." [9].

At the moment, the main successful areas of digitalisation are:
1. digitalisation of transport and logistics infrastructures;
2. robotisation of production processes;
3. automation of management processes.

Let us consider the main opportunities for the application of digital technologies in the transport sector in Table 2.

**Table 2. Digital technology opportunities in the transport sector.**

<table>
<thead>
<tr>
<th>Direction</th>
<th>Opportunities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Payment</td>
<td>Mobile payments via special apps</td>
</tr>
<tr>
<td>Document management</td>
<td>Electronic circulation of all documentation, data collection and storage in the cloud</td>
</tr>
<tr>
<td>Communication</td>
<td>Online conferences</td>
</tr>
<tr>
<td>Monitoring</td>
<td>Traceability of shipments</td>
</tr>
<tr>
<td>Transport</td>
<td>Unmanned systems</td>
</tr>
</tbody>
</table>

In order to introduce the new digital technologies listed in Table 2 into the transport system, direct involvement and monitoring by the government is required in the following areas:

1. development of integrated systems in freight and passenger transport, which will eliminate the management problems of the global freight delivery network;
2. specialised intelligent systems for tracking, organising safe and efficient delivery of freight and passengers.

Digitalisation needs to be combined with analytical algorithms to improve productivity and optimise business processes, which will also help in the development process of international transport companies. G V Nivaan, G Tomasila, Suyoto in their article note "transportation system must improve the quality of its services so that they can go hand in hand with technological advancements" [10].

At the moment, as part of the digitalisation of the economy, there are many digital technologies in the logistics services market to optimise costs and improve logistics services for the company (Figure 1).

![Fig. 1. Digital logistics processes.](image-url)
The innovative processes listed in Figure 1 contribute to increasing freight transport efficiency through rapid access to information on customers and carriers, goods, and services.

In transport and logistics, the Unified Digital Transport Platform (UDTP) is under development. This system will solve the following tasks:
- introduction of national transport logistics processes into the international transport system;
- development of digital standards;
- implementation of existing information resources;
- integrated monitoring of road infrastructure facilities;
- protection against monopolies in the global economy;
- transition to electronic document management;
- creation of new digital services for transport system management.

Dong D., Li Z. in their paper note "Current advances in technologies such as smartphones, machine learning, big data, and cloud analytics have enabled the collection and analysis of a great amount of field data from numerous users (e.g., drivers) while driving on roads." [11].

The implementation of transport infrastructure development projects in the framework of public-private partnerships started only in 2010. At the same time there is an unstable dynamics. Recently there has been a decline in investment activity. Investment in 2020 has almost halved compared to the previous year (from 1.38 billion roubles in 2019 to 0.7 billion roubles in 2020). The low investment appeal of this area is due to a number of difficulties: a high degree of depreciation of the fixed assets of transport sector organisations in the Russian Federation, a relatively long payroll period, and an imperfect regulatory framework for regulating public-private partnerships. Juan Manuel Castillo-Mingorance, Miguel Sol-Sánchez, Fernando Moreno-Navarro and María Carmen Rubio-Gámez in their paper note "In recent years, mobility has greatly increased with an increased use of infrastructures, which in turn requires greater investment to conserve their functionality and safety." [12].

Currently, budget funds are the main source of investment in infrastructure development. Consider the investments raised by the government in Figures 2, 3.

![Fig. 2. Number of public-private partnership projects, units.](image-url)
In view of the shortage of budgetary resources, it is necessary to involve private structures on the basis of a public-private partnership mechanism. However, in Russia, this form has not been widespread for a long time and is characterised by relatively low activity. This is confirmed by the data in Figures 2, 3.

According to the Transport Strategy of the Russian Federation to 2030, the digital transformation of the transport and logistics industry involves increasing the efficiency of the transport industry through the introduction of innovative technologies together with traditional tools. The development of transport infrastructure implies increased costs for the development of the transport and logistics sector. At the same time this option offers the most sophisticated management model for transport development and involves investment in high-tech projects. The main problems are a shortage of competent, professional staff, as well as inefficient management. The question arises of moving from a more extensive model of transport and logistics infrastructure development using digital technologies to an intensive model that improves the quality of services provided and, consequently, competitiveness.

A high threat is posed by cyberattacks, the number of which has increased significantly with the advancement of digitalisation in transport logistics. According to a study by Positive Technologies, the number of cyber incidents increased by 51% in 2020 compared to 2019, with 7 out of 10 attacks being targeted. At the same time, computers, servers and network equipment of government agencies and industrial enterprises were affected by the largest number of attacks. The distribution of cyber attacks by type and method is shown in Table 3.

With the growth of new technologies, cybercrime schemes are evolving, requiring an adequate level of information protection. The monitoring system developed at the federal level may not be sufficient. As we see in Table 3, organisations have a high proportion of cybercrime targets. On this basis, transport and logistics companies are forced to take the necessary security measures and develop a protection system themselves. All this, of course, brings with it the need for additional financial costs. A great deal of attention is now being paid to correcting legislative and infrastructural inadequacies, and pilot projects, national programmes and draft laws are being developed and implemented.
### Table 3. Distribution of cyber attacks by target, method and motive.

<table>
<thead>
<tr>
<th>Distribution of cyber incidents</th>
<th>Public institutions</th>
<th>Financial institutions</th>
<th>Industry</th>
<th>Health facilities</th>
<th>IT companies</th>
<th>Science and education</th>
<th>Trade</th>
<th>Other</th>
<th>Untethered</th>
<th>Individuals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total attacks</td>
<td>108</td>
<td>29</td>
<td>38</td>
<td>58</td>
<td>40</td>
<td>37</td>
<td>39</td>
<td>112</td>
<td>39</td>
<td>73</td>
</tr>
<tr>
<td>Computers, servers and networking equipment</td>
<td>94</td>
<td>26</td>
<td>66</td>
<td>48</td>
<td>33</td>
<td>28</td>
<td>28</td>
<td>84</td>
<td>28</td>
<td>23</td>
</tr>
<tr>
<td>Web resources</td>
<td>11</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>12</td>
<td>21</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Individuals</td>
<td>49</td>
<td>15</td>
<td>43</td>
<td>10</td>
<td>18</td>
<td>24</td>
<td>13</td>
<td>40</td>
<td>24</td>
<td>62</td>
</tr>
<tr>
<td>Mobile devices</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Others</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Use of HVE</td>
<td>68</td>
<td>18</td>
<td>58</td>
<td>43</td>
<td>26</td>
<td>20</td>
<td>22</td>
<td>62</td>
<td>26</td>
<td>38</td>
</tr>
<tr>
<td>Social engineering</td>
<td>49</td>
<td>15</td>
<td>43</td>
<td>40</td>
<td>18</td>
<td>24</td>
<td>13</td>
<td>40</td>
<td>24</td>
<td>62</td>
</tr>
<tr>
<td>Selecting credentials</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Hacking</td>
<td>41</td>
<td>12</td>
<td>24</td>
<td>14</td>
<td>16</td>
<td>7</td>
<td>16</td>
<td>50</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Exploiting web vulnerabilities</td>
<td>10</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>9</td>
<td>16</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Others</td>
<td>9</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Data capture</td>
<td>52</td>
<td>22</td>
<td>55</td>
<td>32</td>
<td>24</td>
<td>19</td>
<td>33</td>
<td>57</td>
<td>27</td>
<td>51</td>
</tr>
<tr>
<td>Financial gain</td>
<td>39</td>
<td>10</td>
<td>19</td>
<td>39</td>
<td>16</td>
<td>19</td>
<td>13</td>
<td>56</td>
<td>9</td>
<td>22</td>
</tr>
<tr>
<td>Hacktivism</td>
<td>24</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td>10</td>
<td>9</td>
<td>2</td>
<td>16</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Cyber warfare</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unknown</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### 4 Conclusions

1. Statistical observation has shown that the Russian Federation has a low Logistics Performance Index. Also, there is an inequality of digitalisation in the RF constituent entities. The areas of digitalisation in the Russian Federation are:
   - mobile payments through special applications;
   - electronic circulation of all documents, data collection and storage in the cloud;
   - online conferences;
   - the ability to track cargo;
   - unmanned systems.

2. The study found that there are a number of factors holding back the digitalisation of the transport and logistics industry:
   - unpreparedness of companies to change;
   - inadequate financial resources;
   - lack of professional staff;
   - vulnerability to cyber-attacks.

3. Thus, the key components of unprofitability and low profitability of the transport and logistics system are outdated transport technology, low productivity, high financial costs of repair work, and digital vulnerability. Budget funds are the main source of investment in transport infrastructure development. Investment has dropped from RUB 1.38 billion in 2019 to RUB 0.7 billion in 2020. The low investment appeal of this area is due to a number of difficulties: a high degree of depreciation of the fixed assets of Russian transport sector organisations, a relatively long payroll period, and an imperfect regulatory framework for
public-private partnerships. An important problem in these conditions is the low level of competitiveness of companies and their inability to compete on the international market.

4. According to the "Transport Strategy of the Russian Federation until 2030", the digital transformation of the transport and logistics industry involves a global increase in the efficiency of the transport industry through the introduction of innovative technologies together with traditional tools. In order to eliminate cyber incidents, a special system for monitoring the security of transport information infrastructure and data transmission, processing and storage services needs to be created. This system will integrate information about all attacks on transport infrastructure information security, detect failures and immediately notify the executive authorities of unauthorised access to the functioning of transport infrastructure.

5. Because of the direct impact of digitalisation on the speed and quality of services provided, it acts as a key element in the competitive success of transport companies. The lack of necessary information and communication infrastructure is a negative factor in the development of transport and logistics infrastructure. Digital technology is now recognised as a key factor in the efficiency of logistics systems. Innovative processes contribute to more efficient freight transport through rapid access to information on customers and carriers, goods and services. The main challenge nowadays is to move entirely to digital management.

References