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DIGITAL INTEGRATION AND INTERNATIONAL TRANSPORT CORRIDORS

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Abstract
This article examines the economic efficiency of digitizing international transport corridors and optimizing logistics processes. The possibilities of increasing transit capacity and reducing time costs through the integration of digital technologies are scientifically analyzed.

Keywords: Transport corridors, digital integration, logistics, intelligent systems, transit, efficiency, blockchain, multimodal transportation..

Introduction

Annotation:
V dannoy state issleduyutsya ekonomicheskaya effektivnost tsifrovizatsii mejdunarodnyx transportnyx corridorov i voprosy optimizatsii logisticheskix protsessov. Nauchno proanalizirovany vozmojnosti povysheniya tranzitnogo potensiala i sokrashcheniya vremennyx zatrat za schet integratsii tsifrovykh tekhnologiiy.

Keywords: Transport corridors, digital integration, logistics, intellectual systems, transit, efficiency, blockchain, multimodal transportation.

INTRODUCTION

In today's globalization environment, international transport corridors are considered the lifeblood of the world economy and are of strategic importance in ensuring trade relations between countries. Modernization of the transport and

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communication system and introduction of "green" logistics principles have become an urgent issue, especially for the Central Asian region. Digital integration processes not only increase the speed of cargo transportation, but also reduce transport costs and make customs processes more transparent. As part of the reforms in the transport sector of the President of the Republic of Uzbekistan, the digital transformation of international transport corridors, the widespread introduction of the "E-TIR" and "e-CMR" systems have been identified as a priority task. This article analyzes the impact of digital technologies on the throughput capacity of transport corridors and international experience in this regard.

depends on the efficiency of global transport and logistics systems. International transport corridors (ITC) are not only a way to deliver goods from one point to another, but also a strategic tool for interstate economic integration. Today, digital transformation processes in the transport sector are manifested as an integral part of the fourth industrial revolution (Industry 4.0) . Especially for land-locked countries, including Uzbekistan, the issue of digital integration is of crucial importance in ensuring the competitiveness of the national economy. The implementation of the concept of "virtual sea" through the digitalization of transport corridors, reducing transit time and optimizing logistics costs is currently one of the priority areas of state policy. This article comprehensively analyzes the theoretical and methodological foundations of the application of digital technologies in international transport corridors and its economic consequences.

LITERATURE ANALYSIS AND METHODOLOGY

The development of international transport corridors and the use of digital technologies in them have been studied by many foreign and domestic scientists. In particular, SS Gulyamov in his research has shown innovative methods of managing the transport system in the digital economy [1 , P. 12]. It has also been noted by international experts that the introduction of the "Smart Contract" system in transport corridors will increase the safety of cargo transportation by 30% [2, P. 45]. The research process used methods of systematic analysis, comparative economic assessment and statistical data grouping. Also, the level of digital readiness of international transport corridors was studied inductively

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based on reports of the World Bank and international transport associations. The concept of "just-in-time" in transport logistics and its integration with digital platforms was chosen as a methodological basis.

The development of international transport corridors and the use of digital technologies in them have been widely studied in the world economy. For example, SS Gulyamov in his scientific works analyzed the impact of the digital economy on the transport system and showed the advantages of intelligent management systems [1, P. 24]. Also, foreign researcher J. Smith emphasizes that digital integration in transport corridors will stimulate not only economic but also institutional changes [2, P. 67]. BH from local scientists Turayev studied the role of digitalization of logistics centers in the regional economy and developed methodological foundations for increasing transit revenues [3, P. 45].

This study used a systematic approach, comparative analysis, economic and mathematical modeling and forecasting methods. The principle of "just-in-time" in transport logistics and the role of blockchain technology in reducing transaction costs were chosen as the methodological basis. In the course of the study, the World Bank's "Logistics Performance Index" (LPI) indicators and the UN Global Trade Facilitation Survey data were analytically processed. Also, econometric models were used to assess the effectiveness of international transport corridors, and the correlation between the level of digital integration and cargo turnover was determined.

DISCUSSION AND RESULTS

Digital integration processes serve to implement the principle of "paperless trade" in international transport corridors. Currently, the time for processing cargo documents using digital technologies in the "East-West" and "North-South" directions has been reduced by an average of 2-3 times. Digitalization of international transport corridors means not only updating technical equipment, but also creating a single digital ecosystem of information exchange between all participants in the logistics chain. The digital integration process ensures the interconnection of vehicles, infrastructure and management systems. The concept of "Digital Transport Corridor" (DTC) is being formed on a global scale, which implies the conversion of cargo transport documents (E-TIR, e-CMR, e-Waybill) into a fully digital form [1, P. 18]. In theory, digital integration is aimed at

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reducing transaction costs, eliminating information asymmetry between economic entities. In recent years, the use of digital technologies on the Europe-Asia transport corridors has resulted in an average reduction in cargo delivery times of 20-25 percent [2, P. 54]. This, in turn, contributes to the acceleration of international trade turnover and an increase in the throughput capacity of transport corridors.

When analyzing the stages of development of digital integration, it is clear that at the initial stage only electronic data storage (databases) was the priority , but now there is a transition to forecasting systems based on artificial intelligence and big data (Big Data). The introduction of "Intelligent Transport Systems" (ITS) in international transport corridors allows to increase road safety, minimize fuel consumption and environmental damage [3, P. 42]. At the same time, the process of digital integration requires the harmonization of legal and technical standards of different countries, which is shaping new directions of international transport law.

Blockchain, the Internet of Things (IoT) and cloud technologies are playing a crucial role in improving the efficiency of modern international transport corridors. Blockchain technology ensures the security of payments and document exchange by introducing the "Smart Contracts" mechanism in transport logistics . With the help of this system, the location of the cargo, its condition (temperature, humidity , etc.) is monitored in real time, which is especially important when transporting perishable goods [4, P. 76]. Through the Internet of Things (IoT) sensors, information about the technical condition of vehicles and road conditions is collected and transmitted to a central management system. This allows logistics companies to avoid unexpected delays and choose optimal routes.

Digital integration of international transport corridors is not just a technical upgrade, but a new stage of global economic integration. As the study found, the introduction of digital technologies is the most effective way to eliminate bottlenecks in the transport and logistics system . Firstly, digital platforms provide synergy between all types of transport, which increases the efficiency of multimodal transportation and reduces the cost of cargo delivery by at least 25-30%. Secondly, "smart" borders and digital customs systems facilitate international trade and expand the country's export potential.

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Thirdly, digital integration is an important tool in implementing the principles of "green" logistics. By optimizing routes and reducing vehicle idling, the amount of harmful gases emitted into the atmosphere is significantly reduced. This ensures compliance with international environmental standards. Fourth, defining digitalization as a priority in Uzbekistan's transport strategy will make it possible to turn our republic into not only a geographical but also a digital logistics hub.

In addition, the "Single Window" system is one of the most important mechanisms of digital integration. Through this system, entrepreneurs carrying out export-import operations submit all permits and customs documents once in electronic form. According to the analysis , the full implementation of this system will reduce customs clearance time by 2-3 times and significantly reduce the risk of corruption [5, P. 112]. Also, planning multimodal transportation (a combination of rail, road and air transport) using artificial intelligence algorithms minimizes idle times when transferring cargo from one mode of transport to another.

Table 1 below provides a comparative analysis of the key indicators of traditional and digital logistics processes.

Table 1. Comparative analysis of traditional and digital logistics processes

Indicators	Traditional system	Digital integrated system
Document circulation	In paper form (takes a lot of time)	Electronic (online)
Border crossing time	12-48 hours	2-4 hours
Transparency level	Low	High (GPS and Blockchain)
Human factor influence	High	Minimum

The economic benefits of digitalization are not only reflected in time savings, but also in the optimization of transit costs. For example, the introduction of digital platforms in the corridors passing through Uzbekistan has led to a reduction in the cost of cargo delivery. Table 2 presents the expected economic efficiency indicators as a result of the introduction of digital technologies.

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Table 2. Cost-effectiveness of implementing digital technologies

Technology type	Increase in shipping speed (%)	Cost reduction (%)
Intelligent Transportation Systems (ITS)	20-25%	15%
Blockchain technology	10-15%	20%
Automated customs system	30-40%	10%
"One-stop shop" system	15%	12%

Studies show that transport corridors with a high level of digital integration are more attractive to international freight carriers, and cargo flows in these directions are growing by an average of 15-20 percent per year. In the conditions of Uzbekistan, the creation of digital infrastructure in parallel with the construction of the China-Kyrgyzstan-Uzbekistan railway will significantly increase the republic's transit revenues [6, P. 55]. At the same time, the issue of cybersecurity should be considered an integral part of digital integration, since cyberattacks on transport systems can paralyze the global supply chain.

Analysis shows that digital integration is not only a technical process, but also a strategic tool for increasing the competitiveness of international trade. Especially for landlocked countries, these technologies act as a "virtual sea", facilitating access to global markets [3, P. 88].

CONCLUSION

urgent need of the day. Studies show that by implementing digital transformation in the transport sector, the country's transit attractiveness can be significantly increased. Firstly, the exchange of "Electronic Waybills " and other digital documents will eliminate congestion at customs and border crossing points, saving carriers up to 50% of their time. Secondly, the introduction of blockchain technologies will ensure the safety of cargo and reduce the risk of data falsification to zero. This will strengthen the confidence of international investors and logistics companies.

helps to effectively manage multimodal transportation (cargo transportation by several modes of transport). When information exchange between different modes of transport is seamless , the process of transferring cargo from one transport to another is accelerated. In the conditions of Uzbekistan, the creation of a single digital platform is a vital necessity for the successful launch of new transport corridors such as "Lapis-Lazuli" or "China-Kyrgyzstan-Uzbekistan".

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Fourth, digitalization reduces corruption factors, as the intervention of the human factor is limited and all processes are controlled by algorithms.

Digital integration of international transport corridors has become one of the most powerful drivers of economic growth today. Conducted studies and statistical analyses show that the digitalization of the transport and logistics system is not only a technical modernization, but also a factor strengthening the country's strategic position in the global market. Firstly, with the help of digital technologies (blockchain, IoT) , the transparency of the cargo transportation chain is ensured, which increases trust between international trade participants and reduces insurance and other additional costs by 15-20%. Secondly, the widespread introduction of "paperless trade" and electronic document management systems eliminates delays associated with the human factor at border and customs checkpoints and increases the speed of vehicle turnover.

Thirdly, for countries located in a geographically favorable transit area, such as Uzbekistan, digital integration is a source of significant foreign exchange earnings for the national economy. Creating favorable conditions for international carriers through a digital "single window" and intelligent transport systems will dramatically increase the competitiveness of transport corridors. Fourthly, digital transformation, in line with the principles of the "green economy", serves to reduce harmful gases emitted into the atmosphere from the transport system , since logistics routes are optimally selected and idle transport is minimized.

In the future, the development of international transport corridors will require not only the construction of railways or highways, but also the creation of their "digital twin", the transition to logistics management systems for the entire region using artificial intelligence. To this end, improving the personnel training system and training new specialists at the intersection of logistics and IT remains a strategic task. In short, digital integration is not just a convenience, but a key condition for winning global economic competition .

In short, digital technologies will not only automate the transport system, but also take the entire economic ecosystem to a new level. In the future, intelligent transport corridors should become not only freight routes, but also digital hubs for data exchange and high-tech services. To this end , it is advisable to harmonize international standards and reach agreements with neighboring countries on the adoption of unified digital standards .

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