Research on the Effective Level of Customs Protection Using Blockchain Technologies in Railway Transport (Case Study of Ukraine)

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Abstract

Improving the efficiency of customs control in transport has always been a crucial task for the economic development of countries. With the advent of cutting-edge technologies, particularly blockchain, new opportunities have emerged to enhance this process. Blockchain provides high security and data transparency, which is critically important for customs control and logistics. In this article, we will examine examples of the use of blockchain technologies in customs control in railway transport, their advantages and development prospects, as well as explore the effective level of customs protection using blockchain technologies in railway transport (case study of Ukraine).
KEY WORDS: *railway, customs protection, blockchain technologies*

1. Introduction

The first country to use blockchain technologies in customs control was Estonia. In 2012, the Estonian Customs launched a pilot project that utilized blockchain technology to ensure the security and reliability of exchanging electronic customs documents between customs authorities and companies. This improved the efficiency of customs control and reduced the costs of document processing. Subsequently, Estonia has used blockchain technologies in other areas, such as electronic voting and medical data accounting [1].

Another example is the Trade Lens platform, developed by IBM and Maersk. It was launched in 2018 and enables the tracking of cargo, sharing documents, and collaborating with other participants in the logistics chains. Currently, over 100 companies from various countries, including customs authorities, have joined the platform [2].

2. Research on the Use of Blockchain Technology in Customs Control on Railway Transport

To provide a comprehensive statistical review of the use of blockchain technologies in customs control on railway transport from 2017 to 2023, we will analyse trends, the level of implementation, and the impact of blockchain integration on efficiency and security. This review includes several key indicators presented in Table 1-3 [3-5].

Table 1

Implementation of blockchain in customs control (2017-2023)

Year	Number of initiated projects	Countries implementing blockchain	Main platforms used	Efficiency improvement, %
2017	5	Estonia, Georgia, Ukraine, Lithuania, Latvia	Trade Lens, IBM Blockchain	10
2018	8	Estonia, Georgia, Ukraine, Lithuania, Latvia, Finland, Poland, Kazakhstan	Trade Lens, IBM Blockchain, Maersk	15
2019	12	Estonia, Georgia, Ukraine, Lithuania, Latvia, Finland, Poland, Kazakhstan, Germany, China	Trade Lens, IBM Blockchain, Maersk, Hyperledger	20
2020	15	Estonia, Georgia, Ukraine, Lithuania, Latvia, Finland, Poland, Kazakhstan, Germany, China, USA, United Kingdom	Trade Lens, IBM Blockchain, Maersk, Hyperledger, Corda	25
2021	20	Estonia, Georgia, Ukraine, Lithuania, Latvia, Finland, Poland, Kazakhstan, Germany, China, USA, United Kingdom, France, Italy, Japan	Trade Lens, IBM Blockchain, Maersk, Hyperledger, Corda, Ethereum	30
2022	25	Estonia, Georgia, Ukraine, Lithuania, Latvia, Finland, Poland, Kazakhstan, Germany, China, USA, United Kingdom, France, Italy, Japan, India, Singapore, Australia	Trade Lens, IBM Blockchain, Maersk, Hyperledger, Corda, Ethereum, VeChain	35
2023	30	Estonia, Georgia, Ukraine, Lithuania, Latvia, Finland, Poland, Kazakhstan, Germany, China, USA, United Kingdom, France, Italy, Japan, India, Singapore, Australia	Trade Lens, IBM Blockchain, Maersk, Hyperledger, Corda, Ethereum, VeChain	40

Based on the conducted research, we can draw the following conclusions:

- Growing implementation: There is a significant increase in the number of projects utilizing blockchain in customs control, from 5 in 2017 to 30 in 2023;
- Geographical expansion: The number of countries implementing blockchain technologies in customs control has grown from 3 in 2017 to 18 in 2023;
- Diversity of platforms: Various blockchain platforms, including Trade Lens, IBM Blockchain, and Maersk, are widely used, each offering unique capabilities tailored to specific needs in customs control and logistics;
- Efficiency improvement: The implementation of blockchain technologies has led to a significant increase in efficiency, rising from 10% in 2017 to 40% in 2023.

Table 2

Major platforms used in customs control

Platform	Number of projects	Key characteristics
Trade Lens	50	Real-time cargo tracking, data exchange
IBM Blockchain	40	Secure transactions, scalability
Maersk	35	Full logistics chain, fraud prevention
Hyperledger	30	Permissioned networks, smart contracts
Corda	25	Interoperability, privacy
Ethereum	20	Decentralized applications, tokenization
VeChain	15	Supply chain logistics, traceability
Others	10	Various specialized use cases

Table 3

Comprehensive analysis of blockchain integration and financial trends in the transportation sector (2017-2023)

Year	Market value, USD billion	Adoption rate, %	Funding, USD billion	Number of deals, total	Transaction volume, USD million	Key use cases and implementations
2017	0,34	5	1,00	875	94,900	Supply chain tracking (Walmart's food safety blockchain)
2018	0,74	8	2,50	1,083	146,000	Freight and Logistics (Maersk's Trade Lens blockchain platform)
2019	1,43	15	4,00	1,351	237,000	Smart contracts for shipping (IBM's blockchain for shipping)
2020	3,00	25	6,50	1,781	365,000	Secure payments (Blockchain payment solutions for transportation)
2021	5,00	35	10,00	1,000	558,000	Real-time shipment tracking (Blockchain-enabled shipment tracking by UPS)
2022	7,12	45	15,00	1,258	808,000	Passenger identity verification (Blockchain for secure passenger identification)
2023	10,00	55	20,00	1,500	1712,00	Decentralized ride-sharing (Blockchain-based ride-sharing applications)

These statistics highlight the growing relevance and impact of blockchain technologies in customs control, demonstrating their potential to revolutionize the industry by enhancing transparency, reducing costs, and improving overall efficiency.

Ukraine has also shown interest in using blockchain in customs control and logistics. For example, a pilot project for data exchange between customs and a brokerage company created an electronic registry of permits for importing cars into Ukraine. This registry ensures data preservation and exchange between customs and the brokerage company using blockchain technology, improving data exchange efficiency and transparency, reducing time and costs for document processing, and providing greater security and accuracy in customs control [6, 7].

The use of blockchain in the customs sector opens the way for process improvements, cost and risk reduction, and increased trust between participants in customs control and international trade. Blockchain application promotes greater automation, reliable data storage, improved security, and fraud prevention, making it a powerful tool for customs in the future. An important indicator characterizing potential changes in customs protection efficiency is the level of customs protection. To calculate the effective level of customs protection, we will use the following formula

$$E = \frac{t_f - At_i}{1 - A}, \quad (1)$$

where E – effective level of customs protection; t_f – nominal tariff rate on the final product; t_i – nominal tariff rate on imported parts and components; A – share of the value of imported components in the value of the final product [8].

Let's assume we have the following data for Ukraine:

- Nominal tariff rate on the final product (t_f) = 20% (0.20);
- Nominal tariff rate on imported parts and components (t_i) = 10% (0.10);
- Share of the value of imported components in the value of the final product (A) = 30% (0.30).

Then, we substitute these values into the formula:

$$E = \frac{0.20 - 0.30 \cdot 0.10}{1 - 0.30} = 0.243$$

Therefore, the effective level of customs protection E is approximately 24.3%. This calculation shows that the effective level of customs protection for the final product in Ukraine, given the provided data, is about 24.3%.

3. Conclusions

The implementation of blockchain technologies in customs control on railway transport has significant potential to enhance efficiency, transparency, and security of the processes. The experience of countries like Estonia, as well as platforms such as Trade Lens, demonstrates the possibilities that blockchain provides for logistics and customs control. Ukraine is also actively integrating these technologies, which underscores their relevance and necessity in the modern world. The development of blockchain technologies in this sector will help reduce costs, improve coordination among logistics process participants, and ensure greater trust between them, which is crucial for the successful development of international trade and transport.

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