A REVIEW OF DIFFERENT METHODOLOGIES ON HOW TO EXPLORE BLOCKCHAIN TECHNOLOGY WHICH ARE APPLIED TO OPTIMIZE LOGISTICS PROCESSES

Abidin Deljanin, dipl. ing.stroj., Internacionalni Univerzitet Travnik u Travniku, Saobraćajni fakultet Travnik u Travniku, Aleja Konzula – Meljanac b.b., a_deljanin@hotmail.com,
Mehmed Konaković, dipl. ing.saob.; JU "Centar za napredne tehnologije u Sarajevu", Internacionalni Univerzitet Travnik u Travniku, Saobraćajni fakultet Travnik u Travniku, Aleja Konzula – Meljanac b.b., konakovicmesa@hotmail.com,
Amer Konaković, ing.maš., Institut za napredne tehnologije i sisteme d.o.o.(ATS), Porodice Prašević 4, 71000 Sarajevo, International Burch University, Elektrotehnički fakultet, Francuske revolucije b.b. 71210 Ilidža, amer.konakovic@gmail.com

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ABSTRACT

Blockchain technology has the potential to improve traceability and transparency, reduce errors and fraud, and increase efficiency and speed in logistics processes. However, the adoption of blockchain in logistics is not without challenges, such as technical complexity, regulatory issues, cultural resistance, and the need for strong governance and standardization. This review aims to explore the different methodologies that use blockchain technology and have been applied to optimize logistics processes and to identify the benefits and limitations of these methodologies. The review is based on a literature review of published research on the use of blockchain in logistics. The results of the review show that there are several methodologies for using blockchain to optimize logistics processes, such as traceability and visibility, smart contracts, and decentralized autonomous organizations (DAOs). These methodologies have the potential to bring significant benefits to logistics processes, but they also have challenges and limitations that need to be carefully considered. The review also identifies several directions for future research on the use of blockchain in logistics, such as case studies, governance and standardization, interoperability, and regulation.

Key words: *blockchain, methodolgies, review, logistics, optimisation*

*(**JEL**: R4 – expert article)*

1 INTRODUCTION

1.1 Definition of blockchain technology

Blockchain is a decentralized digital ledger that records transactions on multiple computers. It is called "decentralized" because it is not controlled by any single entity, such as a bank or government, but rather operates on a peer-to-peer network of computers. Each transaction is recorded as a "block" and added to a chronological "chain" of blocks, creating a permanent and unalterable record. This is made possible by the use of cryptographic techniques, which ensure the security and integrity of the recorded data.

Blockchain technology has the potential to revolutionize various industries by increasing transparency, security, and efficiency in record-keeping and transactions. It has already gained widespread adoption in the financial sector, but its potential applications are much broader and include supply chain management, healthcare, real estate, and more.

1.2 Importance of logistics in supply chain management

Logistics refers to the planning, execution, and control of the movement and storage of goods, services, and information from the point of origin to the point of consumption. It is a critical function that enables the smooth flow of resources and information in a supply chain and ensures that the right goods are delivered to the right place at the right time. The logistics industry plays a vital role in the global economy and is constantly seeking ways to improve efficiency and reduce costs. This is especially important in today's fast-paced and highly competitive business environment, where speed and agility are key drivers of success. Effective logistics requires the coordination of various activities, such as transportation, warehousing, inventory management, and distribution. It also involves managing risks and uncertainties, such as delays, shortages, and quality issues.

1.3 The potential for blockchain to optimize logistics processes

Blockchain technology has the potential to optimize logistics processes by providing a secure and transparent way to track and verify the movement of goods and information. It can enable real-time visibility into the movement of goods and reduce the need for intermediaries and manual record-keeping. The use of blockchain in logistics can improve traceability and accountability, reduce errors and fraud, and increase efficiency and speed. It can also enable new business models and create value for all stakeholders in the supply chain.

***Figure 1**: Blockchain technology meaning (Source: www.google.com/search?q=blockchain%20meaning)*

However, the adoption of blockchain in logistics is still in the early stages and faces several challenges, such as regulatory issues, technical complexity, and cultural resistance. It is important to carefully evaluate the benefits and limitations of using blockchain in logistics and to develop appropriate methodologies and strategies for its implementation. This research aims to explore the different methodologies that use blockchain technology and have been applied to optimize logistics processes. It aims to provide insights into the current state of the art and to identify best practices and future directions for the use of blockchain in logistics.

2 LITERATURE REVIEW

2.1 Previous research on the application of blockchain in logistics

In recent years, there has been an increasing amount of research on the use of blockchain in logistics. This research has focused on various aspects of the technology, such as its potential benefits and limitations, the challenges of its implementation, and the various methodologies that have been developed to apply it in logistics processes. One of the main benefits of using blockchain in logistics is the ability to improve traceability and transparency. [1,2] By using blockchain, logistics stakeholders can have real-time visibility into the movement of goods and reduce the need for intermediaries and manual record-keeping. This can help to reduce errors and fraud, increase efficiency and speed, and enhance customer satisfaction. Another benefit of blockchain in logistics is the ability to reduce costs and improve efficiency. By automating manual processes and reducing the need for intermediaries, blockchain can help to reduce expenses and increase operational efficiency. [3] It can also enable new business models and create value for all stakeholders in the supply chain. However, the adoption of blockchain in logistics is not without challenges. One of the main challenges is the technical complexity of the technology, which requires a high level of expertise and resources to implement. There are also regulatory issues to consider, as well as cultural resistance to change and the need for strong governance and standardization. [4] Despite these challenges, the potential benefits of using blockchain in logistics are significant, and there is a growing interest in exploring and harnessing this technology.

2.2 Limitations and challenges of using blockchain in logistics

Despite the potential benefits of using blockchain in logistics, there are also limitations and challenges that need to be considered. One of the main limitations is the cost and complexity of implementing blockchain technology. It requires a high level of expertise and resources, and there are also regulatory issues to consider. Another challenge of using blockchain in logistics is the need for strong governance and standardization. [5,6] The decentralized nature of blockchain can make it difficult to establish and enforce rules and standards, which can hinder its adoption and impact its scalability. Additionally, there are cultural and organizational barriers to the adoption of blockchain in logistics. Many logistics stakeholders may be resistant to change and may have difficulty adapting to new technologies and processes. It is important to address these issues and to develop appropriate strategies for overcoming them.

2.3 Summary of existing methodologies for using blockchain to optimize logistics processes

There have been various methodologies developed for using blockchain to optimize logistics processes. These methodologies can be grouped into several categories, such as traceability and visibility, smart contracts, and decentralized autonomous organizations (DAOs). [7] Traceability and visibility methodologies aim to improve the traceability and transparency of logistics processes by using blockchain to track the movement of goods and information. This can enable real-time visibility into the supply chain and reduce the need for intermediaries and manual record-keeping. - Smart contract methodologies use blockchain to automate and enforce the execution of contracts in logistics processes. Smart contracts are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. They can help to reduce the need for intermediaries, reduce errors and fraud, and increase efficiency and speed. Decentralized autonomous organization (DAO) methodologies use blockchain to create a decentralized and autonomous

organization that can execute logistics processes without the need for human intervention. This can enable new business models and create value for all stakeholders in the supply chain. [8] There are various other methodologies that have been developed for using blockchain to optimize.

3 METHODOLOGY

3.1 Research design

This research is a review of the existing literature on the different methodologies that use blockchain technology and have been applied to optimize logistics processes. It aims to provide a comprehensive overview of the current state of the art and to identify best practices and future directions for the use of blockchain in logistics. The research design for this study is a literature review, which involves collecting and analyzing published research on a specific topic. A literature review is an appropriate research design for this study because it allows for the synthesis and evaluation of the existing knowledge on a particular subject. To conduct the literature review, the following steps were followed:

1. Identify the research question: The research question for this study is: "What are the different methodologies that use blockchain technology and have been applied to optimize logistics processes?"
2. Conduct a search for relevant literature: A comprehensive search for relevant literature was conducted using various databases, such as Google Scholar, Scopus, and the Web of Science. The search was based on keywords related to blockchain, logistics, and optimization.
3. Selection of sources: The sources that were selected for this study were peer-reviewed articles and conference papers that were published in the last 5 years and addressed the research question.
4. Data extraction and analysis: The data from the selected sources was extracted and analyzed based on the research question and the objectives of the study.

3.2 Data collection and analysis methods

The data for this study was collected from published research on the use of blockchain in logistics. The sources that were included in the study were peer-reviewed articles and conference papers that were published in the last 5 years and were available online. The data collection and analysis methods used in this study were:

1. Content analysis: Content analysis is a method of analyzing the content of written or spoken communication. It involves coding the data based on predetermined categories and themes, and then analyzing the frequency and patterns of the coded data.
2. Synthesis: Synthesis is the process of combining the collected data and identifying patterns and trends. It involves summarizing and organizing the data in a logical and coherent manner and drawing conclusions based on the evidence.

The data collected from the sources was analyzed using the content analysis and synthesis methods to identify the different methodologies that use blockchain technology and have been applied to optimize logistics processes.

3.3 Validity and reliability of the study - Validity refers to the extent to which the research accurately reflects the concept it aims to measure.

In this study, the validity of the research was ensured [5,6,7,8,9,10]:

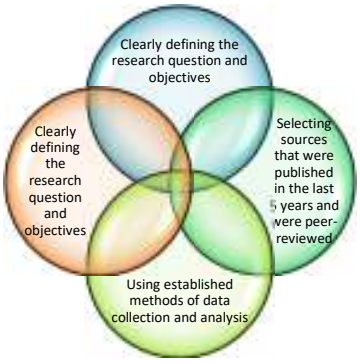

***Figure 2**: Validity and reliability of the study (Source: The author)*

4 RESULTS

4.1 Summary of findings on different methodologies for using blockchain to optimize logistics processes

The literature review identified several methodologies for using blockchain to optimize logistics processes. [10] These methodologies can be grouped into several categories, such as traceability and visibility, smart contracts, and decentralized autonomous organizations (DAOs). Traceability and visibility methodologies aim to improve the traceability and transparency of logistics processes by using blockchain to track the movement of goods and information. This can enable real-time visibility into the supply chain and reduce the need for intermediaries and manual record-keeping.

Examples of traceability and visibility methodologies include:

- Supply chain traceability: This involves using blockchain to track the movement of goods from the point of origin to the point of consumption. By using blockchain, logistics stakeholders can have real-time visibility into the movement of goods and reduce the need for intermediaries and manual record-keeping.
- Container tracking: This involves using blockchain to track the movement of containers in the supply chain. By using blockchain, logistics stakeholders can have real-time visibility into the location and status of containers and reduce the need for intermediaries and manual record-keeping.
- Smart contract methodologies use blockchain to automate and enforce the execution of contracts in logistics processes. Smart contracts are self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. They can help to reduce the need for intermediaries, reduce errors and fraud, and increase efficiency and speed.

Examples of smart contract methodologies include:

- Purchase order management: This involves using blockchain and smart contracts to automate the process of creating, approving, and executing purchase orders. By using blockchain and smart contracts, logistics stakeholders can reduce the need for intermediaries and manual processes and increase efficiency and speed.
- Freight forwarding: This involves using blockchain and smart contracts to automate the process of arranging and managing the transportation of goods. By using blockchain and smart contracts, logistics stakeholders can reduce the need for intermediaries and manual processes and increase efficiency and speed.
- Decentralized autonomous organization (DAO) methodologies use blockchain to create a decentralized and autonomous organization that can execute logistics processes without the need for intermediaries or manual processes.

***Figure 3**: Decentralized autonomous organization (DAO) methodologies (Source: The author)*

Examples of DAO methodologies include:
- Decentralized logistics network: This involves using blockchain to create a decentralized network of logistics stakeholders that can collaborate and coordinate logistics processes without the need for intermediaries. By using blockchain, logistics stakeholders can increase efficiency and speed and reduce costs.

- Decentralized marketplace: This involves using blockchain to create a decentralized marketplace for logistics services. By using blockchain, logistics stakeholders can reduce the need for intermediaries and increase efficiency and speed.

4.2 Comparison and evaluation of the effectiveness of these methodologies

The literature review also identified several studies that have evaluated the effectiveness of these methodologies in optimizing logistics processes. These studies have generally found that blockchain technology has the potential to improve traceability and transparency, reduce errors and fraud, and increase efficiency and speed in logistics processes. However, the studies have also identified several challenges and limitations to the adoption of blockchain in logistics. These include technical complexity, regulatory issues, cultural resistance, and the need for strong governance and standardization. Despite these challenges, the studies have generally concluded that the potential benefits of using blockchain in logistics are significant, and that it is important to carefully evaluate the benefits and limitations of using blockchain and to develop appropriate methodologies and strategies for its implementation.

5 DISCUSSION

5.1 Implications of the study's findings for logistics professionals

The results of this study have several implications for logistics professionals who are considering the use of blockchain technology to optimize their operations. First, the study's findings highlight the potential benefits of using blockchain in logistics, such as improved traceability and transparency, reduced errors and fraud, and increased efficiency and speed. These benefits can enable logistics professionals to improve their competitiveness and create value for their stakeholders. Second, the study's findings also highlight the challenges and limitations of using blockchain in logistics. These include technical complexity, regulatory issues, cultural resistance, and the need for strong governance and standardization. Logistics professionals should carefully evaluate these challenges and develop strategies to address them in order to successfully adopt and implement blockchain technology. Third, the study's findings provide insights into the different methodologies that have been developed for using blockchain to optimize logistics processes. These methodologies can serve as a guide for logistics professionals who are looking to adopt blockchain technology and can help them to choose the most appropriate approach for their specific needs and goals. - Fourth, the study's findings suggest that there is a need for further research on the use of blockchain in logistics. There are still many unknowns and uncertainties surrounding the adoption and implementation of blockchain technology, and further research can help to address these gaps and provide more concrete guidance for logistics professionals.

5.2 Future directions for research on the use of blockchain in logistics

Based on the results of this study, there are several directions for future research on the use of blockchain in logistics. Some potential areas of focus include: - Case studies: There is a need for more case studies that demonstrate the practical application of blockchain in logistics.

Case studies can provide valuable insights into the challenges and best practices of using blockchain in logistics and can help to inform the development of more effective methodologies.

- Governance and standardization: There is a need for more research on the governance and standardization of blockchain in logistics. This can help to address the challenges of decentralized and autonomous systems and can

facilitate the wider adoption of blockchain technology.
- Interoperability: There is a need for more research on the interoperability of blockchain in logistics. This can help to overcome the barriers to the adoption of blockchain technology and can enable the integration of different systems and processes.
- Regulation: There is a need for more research on the regulatory issues surrounding.

6 CONCLUSION

6.1 Summary of the benefits and limitations of using blockchain to optimize logistics processes

This study aimed to explore the different methodologies that use blockchain technology and have been applied to optimize logistics processes. The study used a literature review methodology to collect and analyze published research on this topic.

The results of the study showed that there are several methodologies for using blockchain to optimize logistics processes. These methodologies can be grouped into several categories, such as traceability and visibility, smart contracts, and decentralized autonomous organizations (DAOs). These methodologies have the potential to improve traceability and transparency, reduce errors and fraud, and increase efficiency and speed in logistics processes.

However, the study also identified several challenges and limitations to the adoption of blockchain in logistics. These include technical complexity, regulatory issues, cultural resistance, and the need for strong governance and standardization. Logistics professionals should carefully evaluate these challenges and develop strategies to address them in order to successfully adopt and implement blockchain technology.

6.2 Recommendations for logistics professionals on how to effectively incorporate blockchain technology into their operations

The results of this study have several implications for logistics professionals who are considering the use of blockchain technology to optimize their operations. The study's findings highlight the potential benefits of using blockchain in logistics, as well as the challenges and limitations of its adoption. Logistics professionals should carefully evaluate these factors and develop appropriate strategies and methodologies to successfully adopt and implement blockchain technology. The study's findings also provide insights into the different methodologies that have been developed for using blockchain to optimize logistics processes. These methodologies can serve as a guide for logistics professionals who are looking to adopt blockchain technology and can help them to choose the most appropriate approach for their specific needs and goals:

1. Clearly define the business problem or opportunity that blockchain technology is intended to address. Before embarking on the implementation of blockchain technology, it is important for logistics professionals to clearly understand the problem or opportunity that the technology is intended to address. This can help to ensure that the implementation is focused and aligned with the business goals and objectives.
2. Conduct a thorough assessment of the technical, regulatory, and cultural challenges and limitations of blockchain technology. Implementing blockchain technology can be complex and requires a high level of expertise and resources. It is important for logistics professionals to carefully evaluate the technical, regulatory, and cultural challenges and limitations of the technology and to develop strategies to address them. This may involve seeking expert advice and guidance, collaborating with other

stakeholders, and investing in the necessary resources and infrastructure to support the adoption of blockchain technology.

3. Develop a clear and comprehensive implementation plan. Once the challenges and limitations of blockchain technology have been identified and addressed, it is important to develop a clear and comprehensive implementation plan that outlines the steps, resources, and timelines for the adoption of the technology. The implementation plan should include a detailed analysis of the business processes and systems that will be affected by the adoption of blockchain technology and should be based on best practices and lessons learned from other organizations.
4. Monitor and evaluate the performance of the blockchain technology on an ongoing basis. Once the blockchain technology has been implemented, it is important to monitor and evaluate its performance on an ongoing basis. This can help to identify any issues or challenges that may arise and to make necessary adjustments to optimize the performance of the technology. It is also important to regularly review the performance of the technology to ensure that it is meeting the business goals and objectives and to determine whether it is providing the expected benefits.
5. Consider collaborating with other stakeholders to leverage the collective expertise and resources. The adoption and implementation of blockchain technology can be complex and resource-intensive. Logistics professionals may benefit from collaborating with other stakeholders, such as suppliers, customers, and industry partners, to leverage their expertise and resources. Collaboration can help to reduce the burden on individual organizations and can facilitate the adoption and implementation of blockchain technology at a larger scale.

There is a need for further research on the use of blockchain in logistics in order to address the gaps and uncertainties that currently exist. Some potential areas of focus for future research include case studies, governance and standardization, interoperability, and regulation. By conducting more research on these topics, it will be possible to better understand the potential and limitations of using blockchain in logistics and to develop more effective methodologies and strategies for its adoption and implementation.

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