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Abstract. The background of this research is how to find out the application of block chains in public transportation systems, using electronic money and digital wallets, the application of block chains in this study to determine the effectiveness of the electronic money storage system, which is used in public transportation payments, especially transportation in the city Jakarta. The research method used in this study is to use the literature review method, using the basis of journals and books, journals that have been read as many as 50 journals and books as many as 30 books, after the proposed system is made, a survey will be conducted which will be asked about the effectiveness of the system. It is proposed that a survey be conducted to 100 users of public transportation, with the basis of this research, it can be developed into a new research problem so that they can find novelties that can be used in the future. The problem raised in this research is the application of block chain technology which is applied to the public transportation system in the city of Jakarta, therefore it will be known the effectiveness of the block chain applied to the electronic payment system in public transportation modes. This study resulted in a proposed system whose effectiveness could be known based on a survey conducted to 100 users of public transportation. The results of the survey were 87% agreed with the application of the proposed system, and 13% disagreed.

Keywords: Block chain, Transportation, Payment, Jakarta, E Wallet.

INTRODUCTION

The application of block chain technology to the transportation system has begun to be implemented and has begun to show positive results, with block chain technology all payments will be made electronically, using the digital wallet method, with a digital money storage system, people do not need to carry cash In using public transportation, people

only bring smartphones that contain electronic money in the application so they can pay without having to come into direct contact with cash [1].

The system used today is still using a hybrid system by combining electronic money and cash because people still can't use electronic money 100% and are still dependent on cash circulation is still quite a lot because people still think cash is much better to use than cash electronic concepts like this must be changed because in the future there will be a lot of use of electronic money in every transaction, both personal transactions and public transactions [2].

The method used in this study is to use the literature review method by reading many journals and books related to this research. On this basis, the formulation of the problem will be found and will be developed based on previous research so that the latest problems can be found that can be raised in research, this time so that it can be used as a basis for future research [3].

The problem raised in this research is how to apply block chain technology to a smart transportation system that can connect all transportation into one application that will help the community so that they can help order transportation through the application and make payments through the application as well, therefore block chain technology is very helpful store all data and save all the money that is in the community, so that it can be channeled properly in the transportation sector [4].

The purpose of this research is to find out to what extent block chain technology can help in the transportation sector so that it can be developed in the future if transportation will develop with block chain technology, especially in the payment system. Therefore, block chain technology can be developed in the transportation system so that it can help develop with the concept of an electronic payment system and using a digital wallet [5].

Block chain technology is also here to provide solutions in synchronization, encryption, integration and other economic benefits. An example is the Slovakia-based company CargoX that specializes in "smart bills of landing" officially launching a block chain platform to the public in the shipping sector. According to the company CargoX, "In five to ten years, most maritime shipping documentation will be provided via block chain technology, just as people move from sending paper letters to sending emails for important and business-critical messages". End-to-end supply chains (e.g. from raw materials to finished products, or from importers/exporters to international sellers/buyers) require tracking and tracing that can be aided by technologies such as block chain, digital identifiers and electronic transactions. International trade is one example of a fragmented supply chain market where many parties interact with each other. In such a multi-agent system, transactions between organizations can take various formats, one of which is electronic data interchange (EDI). Enabling smart contracts can increase profits from contract trading, reduce company size, paper-based and manual work. This technology can solve existing problems in international trade and disputes by digitizing collaborative payments and tools on a peer-to-peer basis [6].

In this journal the author discusses a method called PoUW (Proof of Useful Work) where the purpose of using this method is to replace the POW (Proof of Work) technique which has many shortcomings where by using the PoUW method it is hoped that these shortcomings can be overcome. so as to improve block chain performance [7].

In this paper it is proven that PoUW can outperform POW in several ways such as loss of useless power consumption and is also more effective in validating block chain transactions used in financial applications. PoUW can also optimize distributed decision making relevant to the ecosystem that the block chain serves. For example, block chains used in finance with finance with optimization-based PoUW can optimize investment portfolios which can increase the usability of block chain beyond its function as a simple distributed ledger. It should be remembered that this PoUW is an imperfect system but has shortcomings. For example, the role of this PoUW cannot be fulfilled by other alternative validation mechanisms, such as Proof of Stake (POS). Not all block chains can be used for applications that require optimizing decisions [8].

Block chain technology is a decentralized, immutable and immutable database. Block chain technology can help manage logistics supply flows on the block chain, which is a technology based on the Internet of Things (IoT) so that it can guarantee the validity of data that cannot be guaranteed by traditional databases. In the field of transportation, block chain technology is currently in the process or development stage and there are still many barriers to adoption in the expensive transportation sector because if there is an irreversible error that increases transaction costs, a reputation system that aims to help reach consensus in a decentralized network of systems that unreliable, represented by drivers [9]. The scale of the lack of government policies and complex systems so that not everyone in the transport sector is well integrated. With this block chain technology, valid data can foster trust for its users. Block chain technology in the future aims to focus on sending data faster in the event of an important event such as an accident [10].

This journal describes the implementation of a private block chain-based halal supply chain in Indonesia. This research was conducted with the problem that Indonesia is a country with the largest Muslim population in the world, where the total population is 222 million Muslims and the percentage is 85%. Therefore, as Muslim customers grow,

awareness of halal products is increasing every year. However, the demand for halal products is not only certified as halal products by the MUI, there is even a movement of goods into the hands of consumers from upstream to downstream. Thus, the need for halal supply chains is getting higher. To prevent this, an Indonesian halal supply chain based on the Private Block chain has been implemented. Where the system is equipped with QR code access on smartphones for customers to achieve lean logistics and change the mindset of consumers to believe in using products based on the halal supply chain to avoid religious issues. This study uses a SWOT analysis research method and qualitative research to determine the impact and clearly describe the application of the system [11].

This paper was created with the aim of this research being to explore how to apply block chain technology for intelligent transportation, generate a hierarchical theoretical framework for transportation and explore intelligent transportation sustainable software systems under block chain. Combining block chain and smart traffic to form a block chain transport consortium joined by governments, enterprises and users, enabling the implementation of data upload, storage and conditional requests, will drive the improvement and further development of smart transport, from development systems to intelligent transport in under the block chain is very vague. In addition, the application of block chain in the smart transportation industry is difficult to explain from one level because it interacts with all subjects in intelligent transportation simultaneously in the software process, requiring multiple subjects to cooperate and interact with each other [12]. In addition, several existing studies have examined the combination of block chain and smart transportation from a sustainability perspective, which requires comprehensive consideration to address the needs and challenges for smart transportation brought about by block chain by considering three aspects: economy, society, and environment. Based on the above, in order to develop a sustainable block chain application system on the consortium block chain-based intelligent transportation, the following research is carried out in this paper. Logistics is a vital thing that is useful as one of the most important components of the scope of the business, dealing with various kinds of problems that occur [13]. Then the many causes of this problem stem from poor operation design because it takes the form of a very complex process which requires a system that must be coordinated to run operations more efficiently. The difficulty will increase if there are several models available that involve so many roles that have various features. There are basically four modes of transportation available, namely, road, rail, water and air [14].

Each of these models of course each has advantages and disadvantages depending on various factors such as the type of transportation, the size of the transportation, the distance to be traveled, the frequency of delivery, the value and size of the transportation. International transportation is preferred over local transportation for long-distance types of transportation because it is more flexible [15]. The European Commission (EC) defines this type of international transportation as the transportation of goods in units of the same load using at least two or more modes of transport without changing the goods themselves into different models. The involvement of various models and types of characteristics that are so complex can limit the growth of the international transportation system, and transparent information is one of the obstacles faced by international transportation [16].

The fragmented transport market creates several cost inefficients. As a result of delays, double expenses, disputes and cancellations. While in a competitive market, each player seeks his or her own advantage, optimization at the individual level becomes more difficult due to invisibility and disconnection [17]. While addressing some of these problems can be done with synchronization, encryption and integration, it seems that block chain not only combines all of these solutions in one package, but can also provide other economic benefits. Block chain is known as the main authentication and verification technology behind the first digital currency. Block chain is a centralized open-source platform that enables a more efficient, transparent and trustworthy flow of transactions between companies and individuals by removing middlemen and cutting costs, time lapses and lack of trust issues between parties, while also maintaining privacy, and also preserving business data [18]. Can help structure multi-party businesses that require trust in transparency, as well as efficiency in inter-party transactions, contracts and data processing. This technology not only overcomes barriers to international trade and disputes between agents. But it also expands commerce by providing access to services and infrastructure for all businesses. With traditional supply chain and international trade [19].

Concentrated on scientific studies that were directly related to the transportation industry in this review. The result, didn't include documents focusing on trust difficulties, the internet of things, trade, or general business. In the literature, there are just a handful true block chain systems. It should be mentioned that the bulk of scientific publications examined in the transportation industry are in the field of transportation are focused on possible applications [20].

Block chain technology is said to be useful in the logistics industry since it allows for traceability and security. Supply chain management that is more integrated. Block chain technology has the potential to improve data security and trust [21].

Actors in the supply chain are encouraged to share information. The use of block chain technologies is frequently linked to the proliferation of connected systems and gadgets via the Internet. Databases on the block chain must be related to the physical world, and many works assume that this connection will be made [22].

Internet of Thinks (IoT) gadgets will carry on the conversation. The "connected" automobile will become a part of the Internet of Things, and this is a good thing. The rationale for block chain's growing popularity in traffic management and smart city applications, Cooperative data sharing, transactions, and any other data exchanges that will be conducted in cities. The use of block chain could help bridge the gap between "autonomous" and "connected" vehicles. Technology that can provide specific qualities that standard databases cannot guarantee [23].

The use of block chain technology to the transportation sector is still in its early stages of development. While many authors support the usage of this technology, there are some reservations regarding its practicality [24].

Since some early block chain initiatives failed in their first years of deployment, new applications are being developed. The discussion will continue until a large number of apps have been deployed and used, and the specific applicative. The use of block chain could help bridge the gap between "autonomous" and "connected" vehicles. Technology that can provide specific qualities that standard databases cannot guarantee [25].

The use of block chain technology to the transportation sector is still in its early stages of development. While many authors support the usage of this technology, there are some reservations regarding its practicality [26]. Since some early block chain initiatives failed in their first years of deployment, new applications are being developed. The discussion will continue until a large number of apps have been deployed and used, and the specific applicative. The block chain technology sector has been adequately [27]. The optimistic and objective viewpoint that emerges. According to the findings, there is a growing interest in block chain applications in the scientific community in the field of transportation However, considerable work remains to be done, particularly in the transportation sector engineering researchers, in order for this promising technology to mature to its full potential.

RESEARCH METHOD

The research method used is a literature review by reading 50 journals and 30 books related to this research so as to add knowledge to this research and can find up-to-date research problems so that they can find novelty in this study.

The software used in this study is to use digital wallet applications that are already on the market such as Dana, OVO, Linkaja, GoPay so that researchers do not make an application anymore to create a digital wallet so that they only use existing digital wallets.

Based on Figure 1, there are 3 stages used in this study, the first stage in this research is to conduct a literature review by reading journals and books, the second stage in this research is to find the research problem that will be raised in this study and the latest research problem, Finally, this section proposes a system that will answer the research problem raised in this study as a novelty that will be raised in this study.

FIGURE 1. Research method

MODEL PROPOSED

In this section, we will discuss how the system that will be proposed in the block chain system is in intelligent transportation. Based on the Figure 2, it can be explained that this system starts from the start and then proceeds to the transportation sector after that making a payment. Then there are two choices, namely yes, when yes he will get the benefit then use the benefit is complete, but if the diet is chosen then the system will end immediately momentarily.
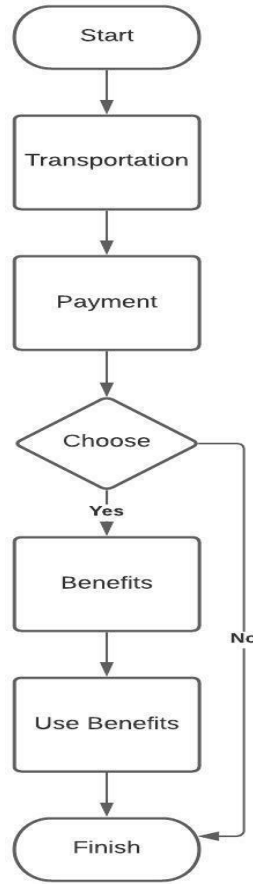
FIGURE 2. Flowchart

Based on the Figure 3, it will be explained that there are two actors in the use case system, the first use case contains transportation connected to the system, then the second use case is the user makes payments and is connected to the system, and the third use case is the user connected to cash benefits and connected to the system, with the three use cases, the block chain transportation system will be able to be used optimally.
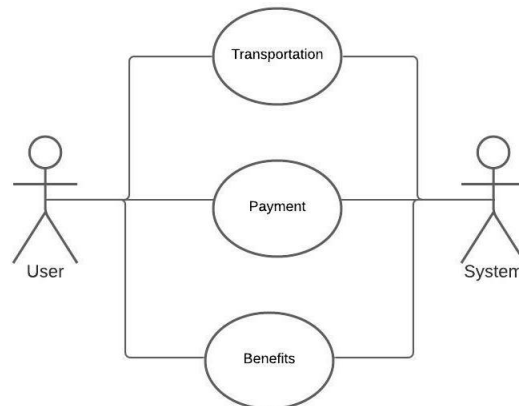

FIGURE 3. Use Case Diagram

Based on the Figure 4, it will be explained that the activity starts from the user determining the purpose of the transportation or the destination of the direction to be chosen then the system analyzes that goal after that it can choose

the transportation that will be used to achieve that goal from the system analyzes the transportation after that the user pays for the transportation. Then the payment validation system and the system provide benefits that the user can use in the future.
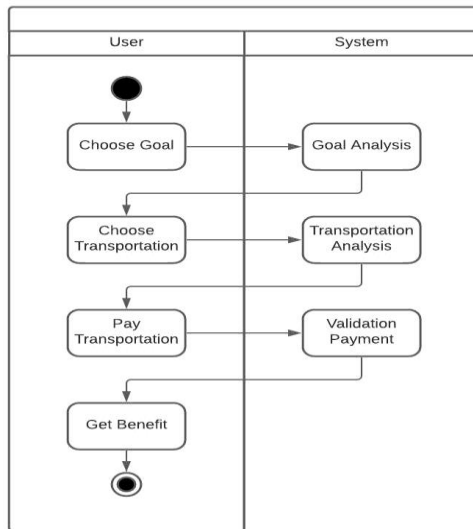

FIGURE 4. Activity Diagram

Based on the Figure 5 of the block chain life cycle in the transportation sector, it will be explained as follows, initially the user uses a transportation system both land, sea and air, using a payment system that is carried out electronically and using electronic money, using a digital wallet with various kinds of digital wallets used, so that users can get benefits such as discounts, cashback, or other promos, in the field of transportation this block chain cycle will continue to rotate until there will be a new use of electronic wallet media storage.
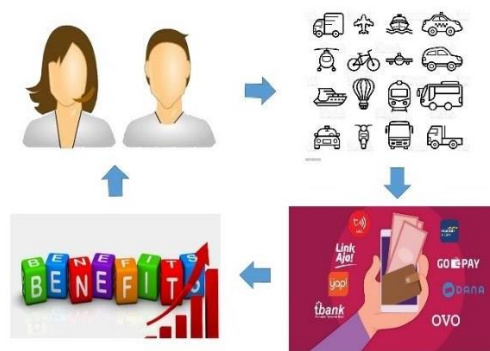

FIGURE 5. Block chain Cycle on Intelligent Transportation System

Based on the block chain diagram framework image in Figure 6, it will be explained as follows, users or transportation users use smartphones that have installed applications that are connected to several modes of public transportation, such as Go-jek, Grab, MRT, LRT, Transjakarta, and Jak Lingko, by connecting several applications, ordering transportation will be much easier and can be used anywhere, therefore with an electronic payment system using digital wallets such as Dana, LinkAja, OVO and Go-pay, the block chain system on the transportation system has going well, because using a digital wallet payment will be much easier, and the community will be much helped

by these payments, because they don't have to carry cash to pay for transportation, and other advantages are getting discounts, cashbacks and promos, which are available on transportation which can be used at a later date.

FIGURE 6. Model framework Intelligent Transportation System

RESULTS AND DISCUSSION

Based on the results of a survey conducted with 100 users of public transportation (See Figure 7), the proposed system and were widely approved by public transportation users. The results of the survey were 87% agreed with the implementation of the proposed system using electronic payments using digital wallets and 13% disagreed with proposed system that was made because they still want to use cash as a payment method.
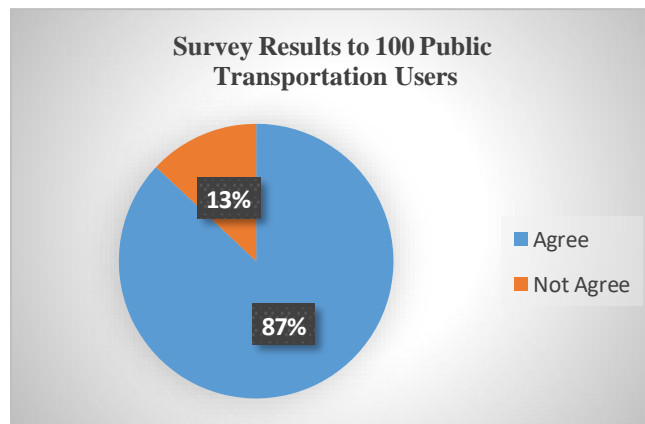

FIGURE 7. Survey Result to 100 Public Transportation Users

Based on the results of a survey conducted with 100 users of public transportation (See Figure 8), the proposed system and were widely approved by public transportation users. The results of the survey ask to men and women, were 68% is a men used public transportation users and 32% is a women used public transportation users.
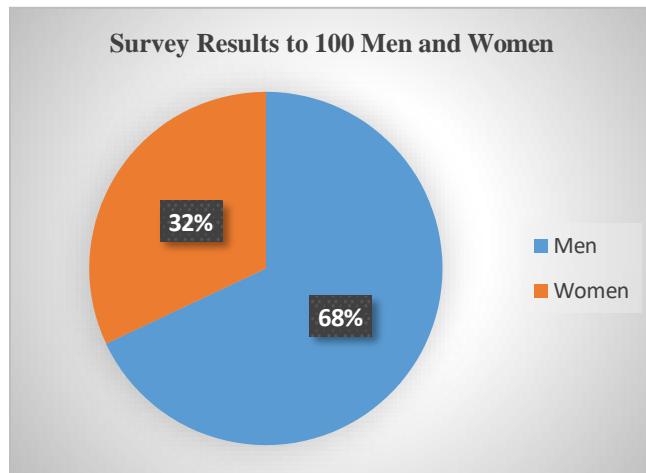

FIGURE 8. Survey Results to 100 Men and Women

Based on the results of a survey conducted with 100 users of public transportation (See Figure 9), the proposed system and were widely approved by public transportation users. The results of the survey ask based on age, were 58% is a people used public transportation users in age 17-50 and 42% is a people used public transportation users in age 31- 50.
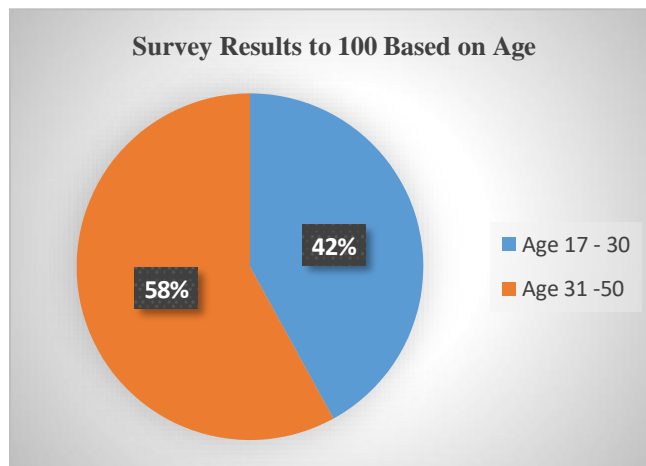

FIGURE 9. Survey Results to 100 Based on Age

Based on the results of a survey conducted with 100 users of public transportation (See Figure 10), the proposed system and were widely approved by public transportation users. The results of the survey ask based on education level, were 78% is a people used public transportation users is collage and 22% is a people used public transportation users is senior high school.
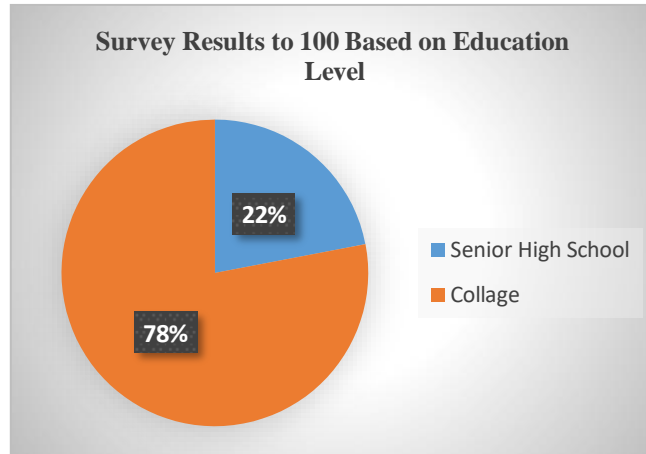
FIGURE 10. Survey Results to 100 Based on Education Level

CONCLUSION

Based on the results of the research above, it can be seen the effectiveness of using block chain technology in the field of public transportation in the city of Jakarta, with the use of block chain technology, the public transportation payment system will be much simpler and easier, so that it can help the people of Jakarta in making payments without having to use money. cash, every payment on the smart transportation system in Jakarta, therefore a survey was conducted on 100 users of public transportation in the city of Jakarta, and the results of the survey are as follows, 87% of Jakarta residents who use public transportation agree with the proposed system offered in the study this time, because it uses the concept of electronic money and digital wallets, and 13% do not agree because they still want to use cash in the transportation payment system in the city of Jakarta, The results of the survey ask to men and women, were 68% is a men used public transportation users and 32% is a women used public transportation users. The results of the survey ask based on age, were 58% is a people used public transportation users in age 17-50 and 42% is a people used public transportation users in age 31- 50. The results of the survey ask based on education level, were 78% is a people used public transportation users is collage and 22% is a people used public transportation users is senior high school. Because it is still considered better, based on the results of the analysis above, it can be concluded that block chain technology is very t can be applied to smart transportation in the city of Jakarta, and can help even better for the transportation sector, future research is how to combine block chain technology, especially in the payment system with a marketplace that can be used for promos or discounts obtained by digital wallet users so that money electronics can be used in many places.

REFERENCES

1. M. Humayun, N. Z. Jhanjhi, B. Hamid, G. Ahmed. Emerging smart logistics and transportation using IoT and blockchain". *IEEE Internet of Things Magazine*, **3**(2), 58-62(2020).
2. M. H. Alkinani, W. Z. Khan, Q. Arshad. "Detecting human driver inattentive and aggressive driving behavior using deep learning: recent advances, requirements and open challenges". *IEEE ACCESS*, **8**, 105008-105030 (2020).
3. A. Bayat, P. Kawalek. "The Planning of Smart City Initiatives." *Academy of Managment Global Proceedings*, **4**, 1-26 (2018).
4. E. Irannezhad. "Is blockchain a solution for logistics and freight transportation problems?". *Transportation Research Procedia*, **48**(20), 290–306 (2020).
5. Y. Arif, H. Nurhayati, F. Kurniawan, S. Nugroho, M. hariadi. "Blockchain-Based Data Sharing for Decentralized Tourism Destinations Recommendation System". *International Journal of Intelligent Engineering and Systems*, **13**(6), 472–486 (2020).

6. M. T. Çaldağ, E. Gökalp. "Exploring Critical success factors for blockchain-based intelligent transportation systems" (2020).

7. M. Mitra, A. Chowdhury. "A modernized voting system using fuzzy logic and blockchain technology". *International Journal of Modern Education and Computer Science*, **12**(3), 17–25 (2020).

8. A. Bekrar, A. A. El Cadi, R. Todosijevic, J. Sarkis. "Digitalizing the closing-of-the-loop for supply chains: A transportation and Blockchain perspective". *Sustainability*, **13**(5), 2895 (2021).

9. H. Liu, Y. Zhou, Y. Zhang, Y. Su. "A rough set fuzzy logic algorithm for visual tracking of blockchain logistics transportation labels". *Journal of Intelligent & Fuzzy Systems*, **41**(4), 4965-4972 (2021).

10. S. Bao, Y. Cao, A. Lei, P. Asuquo, H. Cruickshank, Z. Sun, M. Huth. "Pseudonym management through blockchain: Cost-efficient privacy preservation on intelligent transportation systems". *IEEE Access*, 7, 80390-80403 (2019).

11. A. Imeri, C. Feltus, D. Khadraoui, N. Agoulmine, D. Nicolas. "Solving the trust issues in the process of transportation of dangerous goods by using blockchain technology". In *Proceedings of the 11th International Conference on Security of Information and Networks,* 1-2 (2018).

12. Z. Xiaocong, Y. Yang, W. Zhilei. "Optimization of biomass collection, transportation and storage processes empowered by blockchain technology". *IOP Conference Series: Earth and Environmental Science,* **766**(1) 012103 (2021).

13. L. Koh, A. Dolgui, J. Sarkis. "Blockchain in transport and logistics–paradigms and transitions". *International Journal of Production Research*, **58**(7), 2054–2062 (2020).

14. Z. Merkaš, D. Perkov, V. Bonin. "The significance of blockchain technology in digital transformation of logistics and transportation". *International Journal of E-Services and Mobile Applications*, **12**(1), 1–20 (2020).

15. X. Du, Y. Gao, C. H. Wu, R. Wang, D. Bi. "Blockchain-Based intelligent transportation: a sustainable GCU application system". *Journal of Advanced Transportation*, **2020**, 5036792 (2020).

16. L A. Hîrțan, C. Dobre, H. González-Vélez. "Blockchain-based reputation for intelligent transportation systems". *Sensors*, **20**(3), 791 (2020).

17. B. O. KÖSE. "Towards Adoption of Blockchain Technology for Enhancing Communication in Smart Transportation". *Avrupa Bilim ve Teknoloji Dergisi*, **21**, 473-485 (2021).

18. X. Wang, H. Shi. "Research on Container Transportation Application Based on Blockchain Technology." *Proceedings of the Asia-Pacific Conference on Intelligent Medical 2018 & International Conference on Transportation and Traffic Engineering* 2018, 277-281 (2018).

19. D. C. Karlson'Charlie'Hargroves, B. Stantic. "The Potential for Blockchain and Artificial Intelligence to Enhance the Transport Sector". *Journal of Civil Engineering and Architecture*, **15**, 146-155 (2021).

20. M. Haouari, M. Mhiri, M. El-Masri, K. Al-Yafi. "A novel proof of useful work for a blockchain storing transportation transactions". *Information Processing and Management*, **59**(1), 102749 (2022).

21. M. H. Miraz, A. M. Hye, K. A. M. Alkurtehe, M. Habib, M. S. Ahmed, M. S. Molla, M. T. Hasan. "The effect of blockchain in transportation Malaysia". *International Supply Chain Technology Journal*, **6**(1), 1-10 (2020).

22. G. T. Nugraha, R. D. R. Hidayat, T. Budiman, A. Setiawan. "The implementation of halal supply chain with private blockchain in Indonesia". *Advances in Transportation and Logistics Research*, **1**, 174-186 (2018).

23. A. H. Kuncoro, M. Mellyanawaty, A. Sambas, D. S. Maulana, M. Mamat. "Air Quality Monitoring System in the City of Tasikmalaya based on the Internet of Things (IoT)." *Jour of Adv Research in Dynamical & Control Systems*, **12**(2), 2473-2479.

24. S. Listyarini, L. Warlina, A Sambas. "The Air Quality Monitoring Tool Based on Internet of Things to Monitor Pollution Emissions Continuously". *Environment and Ecology Research*, **10**(6), 824-829.

25. R. Gupta, A. Kumari, S. Tanwar. "A taxonomy of blockchain envisioned edge-as-a-connected autonomous vehicles". *Transactions on Emerging Telecommunications Technologies*, **32**(6), e4009 (2021).

26. P. Dutta, T. M. Choi, S. Somani, R. Butala. "Blockchain technology in supply chain operations: Applications, challenges and research opportunities". *Transportation research part e: Logistics and transportation review*, **142**, 102067 (2020).

27. A. S. Putra, H. L. H. S. Warnars. "Intelligent Traffic Monitoring System (ITMS) for Smart City Based on IoT Monitoring". *Indonesian Association for Pattern Recognition International Conference (INAPR)*, 161- 165 (2018).