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PROCEEDINGS OF JOHOR INTERNATIONAL INNOVATION INVENTION COMPETITION AND SYMPOSIUM 2024 (JIIICaS 2024)



*"Flourish and Nurturing Sustainable
Innovation for a Prosperous Nation"*

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Preface

In the name of Allah, the Almighty who gives us the enlightenment, the truth, the knowledge and with regards to Prophet Muhammad (peace be upon him) for guiding us to the straight path. We thank to Allah for giving us guidance and strength to write this e-book.

This e-book compiles the extended abstracts that submitted to Johor International Innovation Invention Competition and Symposium 2024 (JIIICaS2024), where JIIICaS2024 is a virtual platform for all creative minds to share and present their invention and innovation. Each abstract gives a brief background on the innovation or project.

We hope that this e-book will help the readers to get to know the innovation done by the students and get some ideas to develop future innovation products.

Foreword Rector



Assalamualaikum warahmatullahi Wabarakatuh,
Salam Sejahtera, Salam Malaysia MADANI and
Salam UiTM Dihatiku.

In the name of Allah, the Most Gracious, the Most
Merciful.

It is a great honor to welcome you to the Johor
International Innovation, Invention, Competition, and
Symposium 2024 (JIIICaS 2024). This event

connects various disciplines, focusing on education and engaging educators,
students, researchers, and innovators from all walks of life.

Innovation is not just about ideas; it demands perseverance, creativity, and
determination to turn those ideas into reality. The remarkable projects
showcased today highlight the dedication and spirit of all participants.
Initiatives like this not only explore new technologies but also cultivate skills
and leadership among our youth. At Universiti Teknologi MARA (UiTM) Johor
Branch, we are fully committed to fostering a dynamic culture of innovation,
promoting the commercialization of new products, and encouraging
meaningful collaborations with industry and society.

As we celebrate this event, I would like to extend my heartfelt gratitude to all
sponsors, judges, the College of Computing, Informatics and Mathematics,
UiTM Pasir Gudang Campus as the event organizer, as well as to the
researchers and participants for their hard work in making this event a
success. Let us continue striving for innovation and excellence. May the
ideas presented today inspire us and lay the groundwork for future
achievements.

Thank you.

Associate Professor Dr. Saunah Zainon
Rector
Universiti Teknologi MARA (UiTM)
Johor Branch

(A-SS047) IMPLEMENTING BLOCKCHAIN TECHNOLOGY FOR FINANCIAL SUSTAINABILITY IN URBAN RAILWAYS: A HOLISTIC MULTIDIMENSIONAL FRAMEWORK FOR MALAYSIA'S FUTURE TRANSPORTATION

Mohamed Faiz Ramli¹, Hanini Ilyana Che Hashim ¹, Mohd Khairul Afzan Mohd Lazi ¹,
Zafara Farhana Zakaria¹

¹ Universiti Teknologi Malaysia, Johor Bahru, Malaysia

Corresponding author: mohamedfaiz@graduate.utm.my

ABSTRACT

The urban railway system plays a critical role in modern transportation, demanding constant operational efficiency and cost-effectiveness improvement. Blockchain technology holds promise for revolutionizing financial transactions and maintenance strategies in urban railway systems. Existing payment systems and maintenance operations often suffer from inefficiencies and lack transparency. Blockchain offers a decentralized and secure platform to address these challenges. This study proposes a model framework leveraging blockchain technology to enhance sustainability practices in Malaysian urban railways. Urban railways face issues with international payment systems, transparency, and operational efficiency. Conventional financial systems lead to high transaction costs and delays for tourists, while maintenance operations suffer from manual processes and lack of collaboration among stakeholders. This study adopts a multidimensional approach to develop a model framework for sustainable urban railways in Malaysia and also to approach to assess different types of blockchain networks. The framework incorporates key dimensions such as environmental impact, social equity, economic viability, and governance effectiveness. Indicators within each dimension are identified to measure performance and guide decision-making. Public permissionless blockchains enable global accessibility and instant settlements for tourists, while public permissioned, private permissioned, and private permissionless blockchains offer transparency, streamlined workflow management, predictive maintenance analytics, and supply chain optimization for maintenance operations in urban railways. Blockchain technology presents opportunities for innovation in urban railways by enhancing financial transactions, governance, and maintenance operations. Implementing the proposed model framework, Malaysian urban railways can achieve greater sustainability by leveraging blockchain technology. The framework provides a comprehensive roadmap for assessing, monitoring, and improving sustainability practices across key dimensions. Through strategic adoption and continuous refinement, stakeholders can work together to build resilient, environmentally friendly, and socially inclusive urban railway systems in Malaysia.

Keywords: operation and maintenance costs, rolling stock, urban railway development and blockchain technology

1.0 INTRODUCTION

The fast process of urbanization and the increase in population in Malaysia have created significant strain on its urban transportation systems, requiring inventive measures to guarantee sustainability, effectiveness, and dependability. The urban railway industry in Malaysia, which is an essential part of the public transportation network, has several difficulties such as operational inefficiencies, safety issues, and an increasing need for openness and accountability. These problems highlight the need of adopting a revolutionary strategy that utilizes new technology to improve the sector's capacity to withstand and maintain its sustainability. Malaysia may use blockchain technology to investigate potential uses in managing goods, optimizing scheduling, enhancing communication networks, and implementing automated ticketing systems for its urban train infrastructure.

Blockchain technology, which is distinguished by its decentralized, transparent, and unalterable attributes, offers promising solutions to these challenges. Blockchain technology was initially created to guarantee secure financial transactions; however, its potential extends far beyond the confines of cryptocurrencies. By guaranteeing the accuracy and reliability of data, enhancing security measures, optimizing supply chain management, and facilitating real-time monitoring and maintenance, the integration of blockchain technology into urban railway systems has the potential to completely transform operations. This technology integration is consistent with the global trend of digitization and supports Malaysia's goal of establishing a transportation system that is sustainable, efficient, and future-proof.

Ultimately, this study presents a comprehensive and multifaceted plan for incorporating blockchain technology into Malaysia's urban railroads. The primary objectives are to improve sustainability, operational efficiency, and trust by stakeholders. The framework encompasses several aspects, such as governance, technology infrastructure, regulatory compliance, and social implications offering a thorough strategy to implementing blockchain in this industry. Integrating blockchain technology into Malaysia's urban train system may enhance transparency, streamline operational operations, and cultivate public confidence. This, in turn, will contribute to the nation's overall sustainable development goals.

2.0 OBJECTIVE

The purpose of this project is to provide a detailed and diverse framework for integrating blockchain technology into Malaysia's urban railway networks. The framework will focus on essential elements such as governance, deep learning, financial technology, and regulatory compliance to support long-lasting and effective railway operations. The research aims to improve operating and maintenance efficiency, increase data accuracy, simplify supply chain management, enable real-time monitoring and maintenance, and facilitate smart contract implementation by concentrating on these specific areas.

Furthermore, the project will investigate the potential of blockchain technology to enhance transparency and accountability in urban trains, hence promoting increased trust and confidence among stakeholders and the general public. The assessment will evaluate the technology's influence on sustainability, including its

capacity to diminish operating expenses, enhance resource administration, and decrease carbon emissions. The purpose also seeks to tackle the legislative and societal obstacles linked to the implementation of blockchain technology, offering valuable insights and suggestions to steer future progress in Malaysia's transportation infrastructure.

Lastly, the study examines how blockchain technology might be used to significantly change Malaysia's urban train systems, making them a prime example of sustainability and creativity. The suggested framework serves as both a strategic plan for upgrading urban railroads and a crucial step towards achieving Malaysia's future transportation goals. This research seeks to provide a meaningful contribution to the current discussion on sustainable urban transportation by adopting a multidisciplinary approach. The insights gained from this study might be beneficial for policymakers, industry stakeholders, and academics.

3.0 METHODOLOGY

In order to successfully incorporate blockchain technology into Malaysia's urban trains, as illustrated in Figure 1. The research will use the SCRUM framework, with specific emphasis on the responsibilities of the Product Owner. This stage is accountable for establishing the project's overall direction and ensuring that the system is in line with the requirements of all parties involved, such as government agencies, stakeholder's, and the wider community. The responsibilities of the Product Owner include the creation and management of the Product Backlog, which is a prioritized inventory of crucial features and requirements necessary for the implementation of blockchain solutions in railway operations and maintenance. This position necessitates a profound comprehension of stakeholder expectations and strategic decision-making in order to guarantee that the blockchain system provides significant value and tackles crucial requirements such as operational efficiency, transparency, and security.

However, the SCRUM process entails a method of iterative development known as Sprints, whereby each cycle concludes with a Sprint Review, as shown in Figure 1, during which the team showcases the finished work to stakeholders. This evaluation is essential for assessing the advancement of the blockchain system and collecting practical input. The Product Owner utilizes the knowledge acquired from these reviews to modify and refine the Product Backlog, guaranteeing that the project adapts to stakeholder input and technical improvements. This iterative method promotes ongoing improvement, enabling the project to adjust to emerging difficulties and possibilities. The SCRUM framework's focus on frequent communication, transparency, and adaptability is especially advantageous for overseeing innovative projects such as blockchain integration. This approach guarantees that the system stays in line with the requirements of stakeholders and the objectives of the project throughout its development.

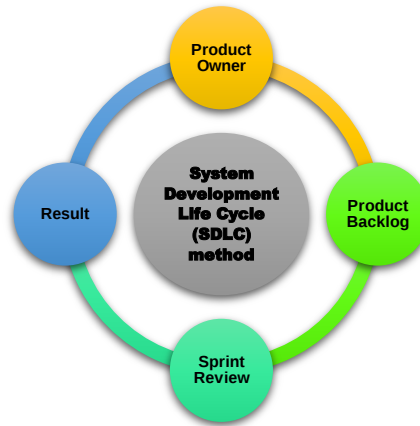


Figure 1: Scrum Method (Agile Framework)

4.0 RESULTS

This study employs a comparative analysis to evaluate traditional and blockchain-based financial systems, focusing on payment processes, transparency, and operational efficiency, as illustrated in Figure 2. The methodology is structured around four main areas. First, payment systems are examined by comparing transaction flows in traditional financial systems with blockchain-based systems. Traditional systems are analyzed for currency exchange procedures, including international and domestic payments, and the use of counter and machine tickets. In contrast, blockchain systems are investigated for their ability to facilitate direct cryptocurrency payments, which bypass conventional exchange rates and potentially streamline transactions.

Next, the second focus area is public transparency. Figure 2 highlights the difference in transparency between traditional financial systems and blockchain-based systems. Traditional systems provide a certain level of transparency, but blockchain technology inherently offers a higher degree of openness. Transactions and actions are recorded on a distributed ledger, creating an immutable and transparent transaction log. This feature enhances accountability and fosters greater community engagement by making financial information more accessible and verifiable to all stakeholders.

Finally, the flow chart addresses operation and maintenance transparency, including the analysis of maintenance activity records. This encompasses comprehensive records of inspections, repairs, and enhancements to the system. Within a system that operates on blockchain technology, these data are included into an unchangeable ledger, guaranteeing the integrity and capacity to track the history of maintenance. The last segment delves into the capacity of blockchain technology in enhancing asset management and optimizing supply chains. The system presents the ideas of department-specific data-driven storage and a node-based system architecture. The flow chart proposes the incorporation of smart contracts with parameters to compute expenses, provide data exchange methods, and immutable records, as depicted in Figure 2.

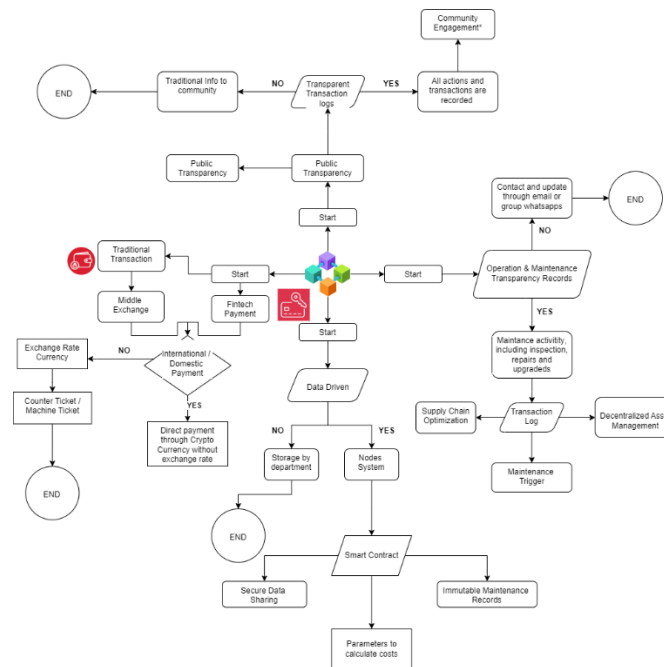


Figure 2: 4'P Tech Research Flow

5.0 CONCLUSION

Integrating blockchain technology into Malaysia's urban train networks signifies a revolutionary transition towards enhanced safety, efficiency, and sustainability. The fundamental characteristics of blockchain technology, including decentralization, transparency, and immutability, play a crucial role in resolving the existing operational inefficiencies and safety issues in the urban transportation industry. Malaysia may improve operational efficiency and promote transparency and stakeholder confidence by implementing a complete framework that utilizes blockchain technology for materials management, scheduling, communication, and ticketing. This strategy is in line with current worldwide trends in smart city development, guaranteeing a transportation network that is more resistant and prepared for the future.

Last but not least, under the specific circumstances of emerging nations such as Malaysia, blockchain technology has significant potential to completely transform intelligent transportation networks. The main aspects of this technology are strong data security and privacy, achieved via decentralization and resilience to attacks. These properties are essential for the modernization of transportation infrastructure. Blockchain technologies enhance the potential to scale and integrate different urban infrastructure components, effectively tackling issues in smart city services. Malaysia may achieve a sustainable urban train system by customizing blockchain frameworks to meet unique requirements. This would enable efficient operations, promote cooperation among stakeholders, and align with the nation's objectives of sustainable urban living and innovation.