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Blockchain Adoption in E-Voting in Malaysian Higher Education: Concept paper

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Abstract

Many industries use blockchain. Its potential to change eVoting systems has received global interest. This concept paper addresses the pros and downsides of integrating blockchain technology into Malaysian higher education's eVoting system. To contribute to the scientific debate on secure, transparent, and efficient voting techniques. This topic's difficulties and prospects are examined. We analyse the benefits of blockchain technology for Malaysian electronic voting. Blockchain technology in eVoting is challenging to implement despite its benefits. This section covers important issues such as technology readiness, scalability, and regulation. These challenges must be overcome to enable blockchain-based eVoting.

Keywords: blockchain technology, electronic voting, higher education

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1.0 Introduction

Electronic voting, sometimes referred to as eVoting, has experienced a growing prevalence in contemporary society, particularly in the era of digital advancements (Jafar, 2021). This method presents a streamlined and easily accessible approach to conducting elections and facilitating decision-making procedures among the Malaysian higher education landscape, the utilisation of eVoting holds significant importance as it serves as a crucial mechanism in upholding democratic principles and enabling the facilitation of consequential decisions among academic communities (Guzman, 2023). Nevertheless, the conventional electronic voting (eVoting) systems utilised in numerous Malaysian educational institutions have faced enduring obstacles to identification, transparency, and data integrity. The increasing need for voting systems that ensure security and prevent tampering has led to the emergence of blockchain technology as a potentially viable solution. The concept of blockchain, widely recognised for its intrinsic characteristics of decentralization (Howell, 2023), transparency (Hellani, 2021), immutability (Palitou, 2019), and cryptographic security (Fernandes C., 2020), has attracted significant interest in diverse industries because to its capacity to potentially transform operations, such as electronic voting (Islam, 2020). There are significant factors that must be taken into account when considering the implementation of blockchain technology in electronic voting systems. The factors above, including technological preparedness (Khalili,2021), scalability (Yang, D.,2021), and regulatory frameworks (Ellul,2020), are crucial in comprehending the potential advantages and obstacles that are anticipated in the future. This will provide a

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concise overview of these fundamental characteristics, establishing the foundation for a more comprehensive understanding of how Bitcoin plays an important role in voting.

The readiness of the technological infrastructure present in Malaysian higher education institutions is a crucial factor in determining whether or not blockchain technology will be successfully adopted for use in electronic voting. This readiness includes characteristics such as the capacities of networks (Denis G.,2022), the processing power (Jafar, 2021) that is available, and the availability of qualified employees (Matthew, 2023) who are able to design, operate, and secure blockchain-based systems. The implementation of blockchain technology in electronic voting in a seamless manner is still a patronizing ambition, especially in the absence of a solid technological foundation. As a result, Clouhesi (2019) have mentioned that determining the level of technological preparedness possessed by educational institutions and taking steps to improve it has become of the utmost importance.

The ability of blockchain technology to manage an increasing volume of transactions and participants while preserving performance and efficiency is referred to as scalability. Scalability is critical in the context of eVoting in higher education because it assures that the system can accommodate an increasing number of voters, candidates, and elections without compromising security or speed (Huber, 2022). The ability of blockchain to scale successfully is a critical component in establishing its sustainability as an eVoting solution in Malaysian academia. The consideration and adaptation of regulatory frameworks pertaining to eVoting and blockchain technology are crucial in order to fit them effectively with the distinct requirements of higher education institutions (Malhotra, 2022). The establishment of well-defined and inclusive rules can serve as a legal structure for the secure and ethical implementation of blockchain technology in electronic voting systems, thereby guaranteeing adherence to both domestic and international norms and guidelines (Poskriakov,2020). Achieving a harmonious equilibrium between regulatory supervision and technical advancement is crucial in effectively managing the intricate challenges associated with implementing blockchain technology within the academic electoral system. This article explores the utilisation of blockchain technology in electronic voting systems within the higher education sector in Malaysia.

1.1 Problem statement

In the context of higher education technology in Malaysia, the utilisation of blockchain technology remains uncertain despite its development in the 2010s. In the previous ten years, Malaysia has experienced rapid transformation and has readily absorbed new technology. However, knowledge and adoption of blockchain technology remain low. Blockchain technology provides a more extensive and comprehensive data storage method (Katebi, 2022). Due to the fact that blockchain technology offers a broader and more thorough way of data storage, it will take some time for this nation to properly understand and successfully adapt to the technology.

This paper attempts to solve a research question:

RQ1: What are the factors contributing to blockchain technology usage in higher education in Malaysia?

1.2 Research Objective

Based on the previously established facts, the objective of this study is to ascertain the key considerations of blockchain usage for higher education in Malaysia. Next is to align the keys to the factors of blockchain usage in higher education for Malaysia by adapting the TOE framework.

RO1: To determine the factors contributing to blockchain technology usage inhigher education in Malaysia

2.0 Methodology

This article discusses the approach for gathering information to construct a literature review. The process of selecting keywords is driven by these fundamental ideas (refer to Table 1). Ullah (2023) has mentioned exploring the Google Trends analysis, country-by-country trends analysis, year-by-year publication trends, and classification of key factors and themes into computer aspects, transaction aspects, relational aspects, technological aspects, legal aspects, hierarchical aspects, compliance aspects, organizational aspects, storage aspects, and information aspects were among the data items. All these elements are proposed for the literature review process. Retrieved articles are cross-checked and narrowed down to a more specific topic in order to retrieve more precise information.

Table 1: Methodology used to identify the concept of the study

Subject	Description
Criteria Definition	Established criteria emphasizing technological infrastructure, skill expertise, interoperability in blockchain technology
Geographic Relevance	Prioritized Malaysian to ensure cultural and contextual alignment
Database Review	Analyzed current literature on blockchain technology use for e-voting

The study's limitations encompass the context-specific findings for the Malaysian scenario in utilizing blockchain technology in the e-voting system, the impact of external factors, issues regarding the representativeness of the sample, potential oversights in the selection of moderators, the concentration on specific social media metrics, the bias resulting from self-selection among participating libraries, and the challenge of capturing long-term changes in sustainability practices.

2.1 Overview of Blockchain development in Malaysia for higher education

According to Sedaghatparast (2019), the distributed ledger technology known as blockchain was initially used in Malaysia in the early 2010s. This coincided with a surge in interest in this game-changing breakthrough all over the world. The real uses of blockchain technology, on the other hand, did not appear until a considerable amount of time later, in the middle of the 2010s, when Malaysian institutions and corporations began examining the possibilities afforded by the revolutionary technology. Since then, technological advancements have been made in a variety of fields.

The Malaysian financial sector's use of blockchain technology was a turning point. Fintech and financial institutions have led the way in using blockchain technology for secure and efficient transactions, demonstrating its potential to improve transparency and security (Tan, 2017).

When it was new in Malaysia, blockchain technology was largely researched by tech boosters, startup enterprises, and forward-thinking businesses. Early blockchain users recognised its disruptive potential and sought methods to use it in various contexts. Malaysia was among the first to examine using blockchain to protect financial transactions (Ku Mahamud, 2019). Financial technology companies led these explorations. They believed blockchain might transform financial organisations by improving transaction transparency, security, and efficiency.

Financial, supply chain, and government sectors in Malaysia are intensively exploring blockchain technology (Ku Mahamud, 2019). Malaysia's dedication to blockchain innovation and firms' and startups' rising interest bode well for the technology's future despite the challenges. Blockchain technology could transform many industries and boost Malaysia's economy.

The first blockchain application in the financial industry showed its potential to transform banking and payment systems. Blockchain technology can streamline cross-border payments, reduce transaction costs, and improve security, according to financial firms. This led to the Malaysian financial sector's proof-of-concept and pilot projects. Bank Negara Malaysia, the Central Bank of Malaysia, has shaped Malaysia's blockchain and cryptocurrency regulations. The central bank announced thorough digital currency money laundering and terrorism financing prevention instructions in 2019 (Hersi, 2023). Authorities have provided guidance that has increased regulatory clarity and legalised bitcoin businesses in the country. This study concentrates on blockchain technology in higher education.

2.2 Blockchain application in higher education

The promise of blockchain technology to revolutionise higher education is well recognised due to its notable attributes of transparency (Ameyaw, 2020), security, and immutability. This article examines the diverse range of uses of blockchain technology within the higher education sector. It delves into how blockchain can be utilised for the safe verification of credentials (Rama Reddy,2021), efficient management of educational information, and the potential to enhance the entire learning experience. Through the utilisation of blockchain technology, educational institutions have the potential to optimise administrative procedures, guarantee the authenticity and reliability of academic records, and empower both students and instructors (Liang,2023). The field of higher education is currently on the verge of a significant technological shift, with blockchain technology emerging as a leading force in this transformative process. In addition to its affiliation with cryptocurrencies, blockchain technology presents a wide range of potential applications that have the capacity to profoundly influence the operational landscape of higher education institutions (Rahardja,2021). Blockchain technology has the potential to significantly transform the educational sector by facilitating safe credential verification, efficient content administration, and the cultivation of a transparent and innovative culture.

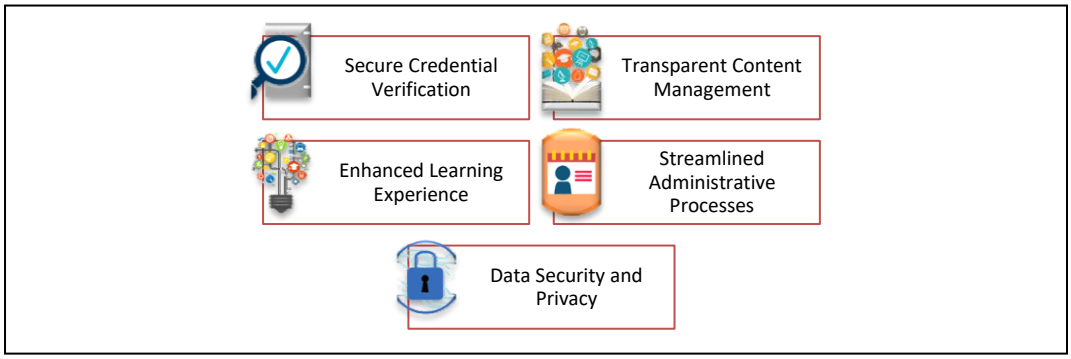

Fig. 1: The rationale behind the introduction of blockchain technology within the higher education sector.

As seen in Fig. 1, credential verification is considered to have a high potential application of blockchain technology within the realm of higher education. Historically, the process of validating academic degrees, certificates, and transcripts has been arduous and frequently lacking in efficiency (Kim,2022). The implementation of blockchain technology has the potential to revolutionise the management of academic records by offering a highly secure and unalterable storage system. The utilisation of blockchain technology enables the storage of students' credentials, facilitating prompt and dependable verification (Ezike, 2019). This implementation streamlines employment procedures and academic admissions. The utilisation of blockchain technology is of utmost significance in the realm of content management in higher education (Wei,2023). Through the utilisation of decentralised platforms, educational institutions may effectively guarantee the integrity and openness of educational resources guarantee the integrity and openness of educational resources (Alam, 2022). Academic instructors possess the ability to effectively and securely disseminate educational materials to their

students, safeguard copyrighted content, and monitor the dissemination of digital textbooks and research papers. The utilisation of blockchain technology guarantees the monitoring of content usage while upholding the integrity of intellectual property rights. The utilisation of blockchain technology holds promise in enhancing the educational experience for both students and educators. By utilising blockchain technology, students have the ability to exhibit their accomplishments and proficiencies that extend beyond the confines of conventional degrees through the utilisation of digital badges and certificates adorned by Shelton, P. (2020). In addition, blockchain technology has the potential to facilitate competency-based education, a pedagogical approach that allows learners to advance at individualised rates and earn micro-credentials upon achieving mastery in specific abilities. According to Awaji (2020), administrative duties constitute a substantial component of higher education operations, and the implementation of blockchain technology has the potential to optimise and expedite these processes. This is also supported by Ayub (2020) on automating tasks such as student enrollment, distribution of financial aid, and management of academic records through the utilisation of smart contracts, which can provide several benefits in an academic setting. These advantages, explained by Søgaard (2021), include the reduction of administrative burdens, elimination of human fallibility, and improvement of overall operational efficiency. Ensuring the protection of data has the utmost importance in the realm of higher education, and the decentralised characteristics of blockchain technology serve to bolster both security and privacy measures. The storage of student and faculty information, research data, and financial records can be facilitated through the utilisation of a blockchain network that incorporates effective encryption mechanisms (Kosasi, 2022). Not only does this practice serve to secure sensitive data from cyber dangers, but it also ensures adherence to data protection rules.

2.3 Key Considerations on Blockchain usage for higher education in Malaysia

The revolutionary potential of blockchain technology in higher education in Malaysia has attracted significant interest. The properties of security, transparency, and immutability present novel answers to the issues encountered by educational institutions (Bidry, 2020). Nevertheless, the effective incorporation of blockchain technology within the realm of higher education relies heavily on the resolution of crucial factors, specifically the level of technological preparedness, the ability to scale the technology, and adherence to legal requirements. The ability of an organisation to accept and successfully deploy sophisticated technologies, such as blockchain, inside its operations is heavily influenced by its technological readiness. This concept pertains to the readiness of an organization's technology framework, workforce, and operational procedures to effectively leverage the advantages offered by novel solutions (Chavalala, 2022).

In the realm of blockchain implementation within higher education, the concept of technological readiness pertains to the ability of a higher education institution to effectively incorporate blockchain technology into its current processes without disruption (Manupati, 2022). This preparedness entails reviewing the existing technological infrastructure of the institution (Gacs,2020), determining the presence of competent staff (Martin, 2019), and verifying that the organisation's systems are capable (Jöhnk, 2021) of adequately supporting blockchain networks. The successful application of blockchain solutions necessitates a fundamental evaluation of technological preparedness. The implementation of blockchain technology in higher education is crucial not only for ensuring stability and efficiency but also for minimising disruptions and maximising potential benefits within the educational landscape.

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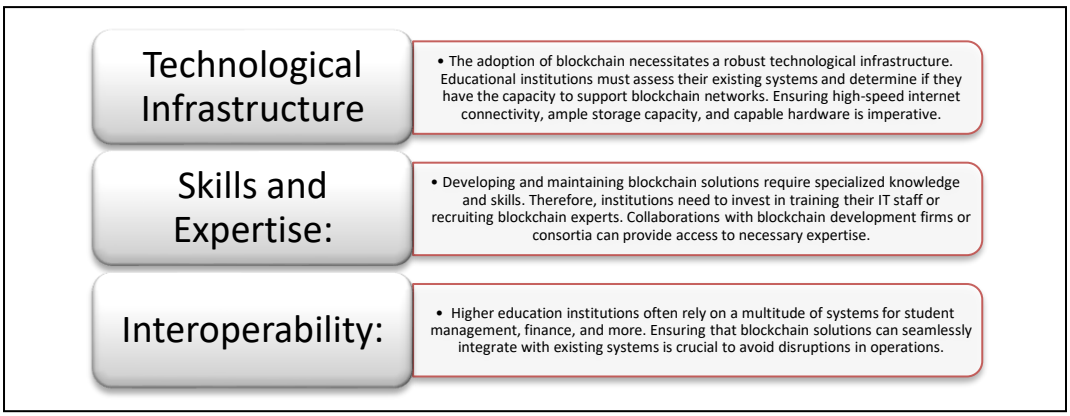

Fig. 2: Key considerations on blockchain usage for higher education in Malaysia.

The effective deployment of blockchain technology in higher education requires a strong and dependable technological infrastructure as depicted in Fig. 2. The infrastructure in question comprises a variety of hardware, software, and network components that have been specifically designed to meet the distinct needs of blockchain systems. By strategically addressing the essential factors related to the competencies and knowledge required within institutions of higher education, stakeholders can facilitate a more seamless integration of blockchain technology, optimize its advantages, and equip students with the necessary proficiencies to thrive in an ever-changing labor market that exhibits a growing demand for blockchain expertise.

3.0 Factors for Blockchain Adoption in Malaysian Higher Education E-Voting

Blockchain technology has been embraced by a variety of industries, which has resulted in a fundamental shift in the ways in which data is stored, transmitted, and protected (Johnson, 2023). In the context of electronic voting systems in Malaysian higher education, the

incorporation of blockchain presents a compelling method to improve transparency, security, and efficiency in the election process (Jafar, 2021). However, the implementation of electronic voting systems that are based on blockchain technology is contingent on the fulfilment of a number of essential requirements, including technological readiness, scalability, and legislative frameworks. This article takes into consideration a variety of vital concerns as it investigates the potential benefits and drawbacks of utilising blockchain technology for electronic voting in Malaysian higher education institutions.

3.1 Technological Preparedness

The technological readiness of Malaysian higher education institutions must be evaluated prior to introducing blockchain-based electronic voting systems. This entails assessing the stakeholders' readiness as well as the IT capabilities and current infrastructure. For the complicated cryptographic processes and data storage requirements of blockchain technology, a reliable network and powerful computer capacity are essential. To make sure that administrators, students, and faculty members are knowledgeable about blockchain technology, institutions should engage in training and skill development programs. Universities also need to assess the usability of blockchain-based electronic voting systems. They must take into account all eligible voters' access to devices and internet connectivity in order to achieve inclusion. All members of the academic community can participate in the electronic voting process without prejudice, although special attention should be paid to potential concerns connected to digital literacy and accessibility.

3.2 Scalability

When using blockchain for electronic voting, scalability is of utmost importance, particularly in the context of higher education, where there may be a sizable number of participants (Katebi, 2022). Blockchain networks must manage a potentially enormous number of simultaneous transactions and users while yet delivering top-notch security and performance. Malaysian institutions must take scalability alternatives into account to prepare for future expansion in engagement and enrollment. Adopting a permissioned blockchain network, which offers more control over scalability, is one solution. This lowers the possibility of congestion by ensuring that only trusted nodes are present in the network. Universities should also investigate consensus technologies like Proof of Stake (PoS) and Delegated Proof of Stake (DPoS), which can handle large volumes of transactions without sacrificing security.

3.3 Regulatory Frameworks

The adoption of blockchain-based electronic voting systems in Malaysian higher education must abide by the legal and regulatory standards of the nation. To guarantee that the e-voting process is open, safe, and reliable, regulatory compliance is necessary (Ku Mahamud, 2021). To gain the required permissions and guarantee that their systems abide by data protection and privacy regulations, institutions must engage closely with the relevant governmental organizations and regulatory bodies. Universities should also take into account problems with voter authentication and identity verification (Jafar, 2021). To avoid fraud and guarantee that only eligible voters participate, it is imperative to implement a strong and trustworthy digital identity system. In this context, adherence to Know Your Customer (KYC) and Anti-Money Laundering (AML) legislation is crucial.

4.0 **Conclusions & Recommendation**

A conceptual framework is being designed based on the elements that have been identified as contributing to the usage of blockchain technology in the Malaysian e-voting system. (refer to fig. 3). Factors contributing to the adoption of blockchain technology in the e-voting system for Malaysia higher education.

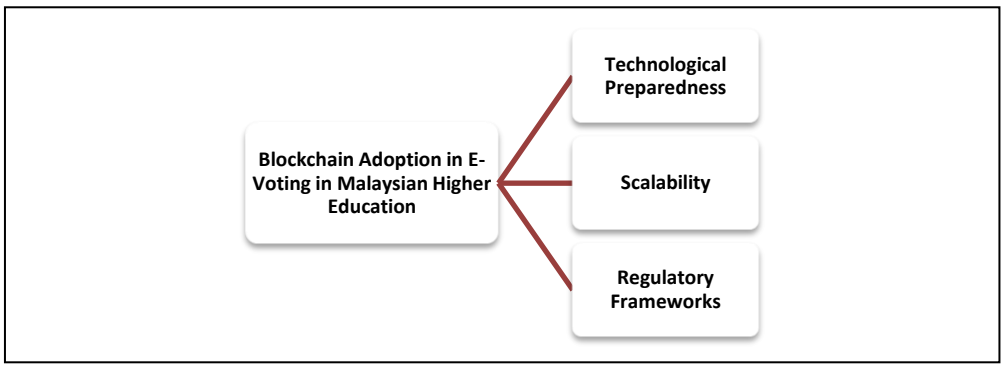

Fig. 3: Conceptual framework of the study

Blockchain technology in Malaysian higher education e-voting systems has significant promise in terms of increased security, transparency, and efficiency. However, before deploying such systems, institutions must carefully assess their technological readiness, scaling requirements, and conformity to regulatory frameworks. Technological preparation entails reviewing infrastructure and guaranteeing digital inclusion, whereas scalability concerns the ability to accommodate expanding numbers of participants. Furthermore, compliance with legislative frameworks is required to ensure the integrity and legitimacy of the e-voting process. Malaysian higher education institutions can successfully leverage blockchain technology to transform their e-voting systems by addressing these factors

holistically and comprehensively, providing students and faculty with a secure, transparent, and efficient means of participating in democratic processes within the academic community.

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