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Strategy for Implementing Blockchain Technology in Higher Education Administrative Management

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ABSTRACT

Background. Higher education institutions are faced with demands to increase efficiency and security in administrative management, including management of student data, certification, transcripts, and others. With the many changes in student administration data and the importance of security and transparency in the administration process, blockchain technology has become a concern in providing innovative solutions in this regard.

Purpose. This research aims to analyze the potential and benefits of implementing blockchain technology in higher education administrative management with a focus on security, efficiency and transparency.

Method. Research Method: The research method used includes a literature study regarding information technology and higher education management, as well as a comprehensive analysis of blockchain implementation in managing student administrative data.

Results. The research results show that the implementation of blockchain technology in higher education administrative management can increase data security and transparency, reduce administrative costs, speed up the certification verification process, and enable the development of a more efficient administrative management system. **Conclusion**. In conclusion, this research confirms that blockchain technology has great potential to change the management paradigm of higher education administration by providing better data security, increasing process efficiency, and creating a more transparent and decentralized administrative environment. Thus, the implementation of blockchain technology in higher education administrative management can provide significant benefits in facing the complex challenges faced by these educational institutions.

KEYWORDS

Administrative Management, Blockchain Technology, Implementation Strategy

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INTRODUCTION

The development of technology has brought major transformations in various aspects of life, including in the world of education (Alammary et al., 2014). Higher education as an institution of higher learning is not immune from the positive impact and development of technology that continues to grow ("The Internet Information and Technology Research Directions Based on the Fourth Industrial Revolution," 2016). In recent years, technological breakthroughs have penetrated into higher education management, presenting new opportunities and

challenges that administrators and academic staff must face (Ahmad et al., 2022). Technological developments in higher education management cover various aspects, ranging from academic administration, finance, to student services. One of the most striking changes is in terms of data management (Baharun, 2019). In the past, administrative processes in higher education often involved the use of physical files that took up time and space. However, with the advancement of technology, the use of computerized data management systems has become increasingly common (Camilleri & Camilleri, 2022), allowing for faster and more efficient access to academic and administrative information.

Technology has also changed the way universities interact with students and other stakeholders. Colleges are increasingly using digital platforms and applications to communicate, provide information, and deliver services to students (Aluko et al., 2016). This helps to increase student engagement and facilitate easier access to academic and administrative resources. However, technological developments in higher education management also bring new challenges (Saadati et al., 2023). One of the main challenges is related to data security. With more and more information being stored digitally, the risk of data leakage and cyber-attacks is increasing. Colleges need to take appropriate measures to protect sensitive student data and financial information from possible threats (Awaji et al., 2020). In addition, universities are also faced with the challenge of integrating new technologies into existing systems. The implementation of new systems often requires large investments in human resources, infrastructure and training (Buinytska et al., 2021). In addition, universities also need to ensure that the use of new technologies not only increases efficiency, but also improves the quality of service and student experience.

The history of the development of blockchain technology began with the birth of Bitcoin in 2009 by a person or group of people using the pseudonym Satoshi Nakamoto (Raimundo & Rosário, 2021). Bitcoin is the first digital currency based on blockchain technology (Ralston, 2020). The basic concept of blockchain was introduced in a whitepaper published by Satoshi Nakamoto in October 2008, which explained how a decentralized peer-to-peer system works to transfer value without the need for intermediaries (Iswahyudi et al., 2023). Blockchain technology was first applied in the context of Bitcoin to enable open and secure tracking of Bitcoin transactions (Abreu et al., 2020). Basically, blockchain is a distributed database that stores records of validated transactions in cryptographically linked blocks. Each block stores a number of transactions and has links to previous blocks, forming a chain of blocks that cannot be altered or manipulated. Since its birth, blockchain technology has undergone rapid development and been adopted in a variety of contexts beyond digital currencies (Chen et al., 2018). In the early years, the use of blockchain was still primarily related to cryptocurrencies , but over time, an understanding of the potential applications of blockchain beyond digital currencies began to develop (Alnafrah & Mouselli, 2021). In 2013, Vitalik Buterin proposed Ethereum, a blockchain platform that enables the execution of smart contracts. Ethereum expanded the possible uses of blockchain by allowing developers to create decentralized applications (DApps) and smart contracts that execute automatically based on pre-set conditions.

The process of developing blockchain technology in higher education administrative management has become one of the main concerns in this digital era (Haugsbakken & Langseth, 2020). Blockchain technology, which first emerged as the supporting infrastructure for the Bitcoin digital currency, is now increasingly recognized as an innovative solution to address various problems in college administrative management (Hindarto, 2023). This process did not just happen, but rather went through a series of steps and stages involving an in-depth understanding

of the technology's potential, identification of college administration needs, development of appropriate infrastructure, and implementation and testing of blockchain applications in the context of college administration (Mulyati et al., 2021). The first step in this process was an in-depth understanding of blockchain technology and its potential applications in college administrative management (Partel et al., 2019). This involves comprehensive research and understanding of the basic concepts of blockchain technology, its working principles, and its advantages and limitations (Woodside et al., 2017). This understanding is important to help decision-makers in higher education understand the potential applications of blockchain in improving efficiency, transparency, security, and accountability in administrative management.

After understanding the potential of blockchain technology, the next step is to identify the administrative needs of the college that can be addressed or improved through blockchain implementation (Alamri et al., 2020). This involves a thorough evaluation of various administrative processes, from tuition payment, student data management, certificate verification, to financial management (Hernández-López et al., 2016). By understanding the needs and challenges faced by colleges in administrative management, it will be easier to determine the areas where blockchain technology can have a positive impact. The next step is the development of a suitable technological infrastructure to support the implementation of blockchain in college administrative management (Sharples & Domingue, 2016). This involves selecting the right blockchain platform, developing blockchain-based applications or systems that suit administrative needs, as well as integration with existing systems (Kant & Anjali, 2020). In this regard, it is important to consider various factors, including scalability, security, interoperability, and implementation costs (Alsubaie, 2022). Once the technological infrastructure is built, the next step is the implementation of blockchain technology in the college's administrative management. This process involves testing and validating the blockchain application in a real environment (Palma et al., 2019), as well as training for the administrative staff who will be using the new system . During the implementation stage, it is also necessary to continuously monitor and evaluate the performance of the system to ensure that the blockchain application functions as expected and provides the desired benefits (Lutfiani et al., 2021).

There are several previous research opinions. The first research according to Indraprakoso & Haripin, (2023), with the research title Exploring the Potential of Using Blockchain in Optimizing Port Management in Indonesia: Literature Review (Banihashem et al., 2018). The results of his research stated that can provide in-depth insight into the trend of using Blockchain in optimizing port management in Indonesia. This research can also be a basis for further research and help stakeholders in Indonesia in making decisions regarding the application of Blockchain technology in the context of port management. The second research according to Priambodo & Suroso, (2022), with the research title Strategic Planning for Information Systems and Information Technology at STIE Pertiba Pangkalpinang. The results of his research stated that Ramework Ward and Peppard can see various company points of view in terms of internal and external strengths and weaknesses on the business or IS/IT side, so that they can identify future IS/IT portfolio needs required by the company through the IS/IT business strategy process, IS management /IT and IT strategy. The third research according to Purba, (2021), with the research title Identifying the Need for a Krs Academic Information System (Study Plan Card) Using Blockchain Technology at Bina Darma University Palembang. The results of his research stated that Blockchain is one of the various technical systems that have arisen in recent years. Blockchain is a technology system for recording digital transaction data that is connected by cryptography and managed by a collection of computers.

The research conducted by previous researchers is different from the research conducted by researchers. Meanwhile, the research that the researchers conducted was entitled Strategy for Implementing Blockchain Technology in Higher Education Administrative Management. The research results show that the implementation of blockchain technology in higher education administrative management can increase data security and transparency, reduce administrative costs, speed up the certification verification process, and enable the development of a more efficient administrative management system.

RESEARCH METHOD

The research method used in research on the implementation of blockchain technology in higher education administrative management is a qualitative research method in the form of a literature study regarding information technology and higher education management, as well as a comprehensive analysis of blockchain implementation in managing student administrative data (Rachmawati, 2007). A literature study was conducted to understand the concepts, principles and applications of blockchain technology in the context of higher education administration management study(Apriliawati, 2020). The literature sources used include scientific journals, research articles, books, and related publications that discuss the benefits, challenges, and implementation of blockchain technology in various industries, including higher education. In the literature study, researchers also looked for data collections and previous research results to support understanding of the impact of implementing blockchain technology in higher education administrative management.

The qualitative research method with literature study is an approach used to understand a phenomenon or research through in-depth analysis of various literary sources such as books, journals, articles and other document s. The first step in this method is to identify the research topic you want to research and collect various literature sources that are relevant to that topic (Asim & Kumar, 2018). Then, researchers conducted in-depth data analysis, identifying themes, patterns and relationships between various concepts that emerged from the literature. After that, the data is interpreted and interpreted to understand various aspects of the research topic. The results of the analysis are then compiled in a research report which explains the findings from the literature study, the analysis carried out, as well as the conclusions and implications of the research. The advantage of qualitative research methods with literature studies is efficiency, because it does not require primary data collection which takes quite a lot of time and money. Apart from that, this method also provides broad access to various literary sources without being limited by geographic or time constraints.

A comprehensive analysis of blockchain implementation in managing student administrative data is carried out through the following steps: 1. Identification of Administrative Needs: The first step is to identify existing administrative needs, including student data management, certification, transcripts, and other administrative processes. This will ensure that blockchain implementation can be directed to meet specific and relevant needs in the higher education context. 2. Evaluation of Implementation Potential: Through comprehensive analysis, researchers will evaluate the implementation potential of blockchain technology in meeting identified administrative needs. This includes the potential for increased security, efficiency, transparency and reduced administrative costs. 3. System Design: After the implementation potential is evaluated, the researcher will design a blockchain-based administrative management system that is adapted specifically for the higher education context. This involves data structure modeling, integration with existing systems, as well as implementation process planning. 4.

Simulation and Testing: The final step in a comprehensive analysis is to simulate and test the system that has been designed to ensure its functionality, security and scalability before the actual implementation takes place. It is hoped that this research method can provide an in-depth understanding of the potential, benefits and challenges of implementing blockchain technology in higher education administrative management. With a comprehensive approach, it is hoped that the results of this research can provide a valuable contribution in developing a clearer view regarding the direction and impact of implementing blockchain technology in the context of higher education.

RESULTS AND DISCUSSION

Blockchain technology is a system designed to record transactions and information in a decentralized, transparent and secure manner. Basically, a blockchain is a series of blocks connected to each other chronologically, where each block contains a number of transactions or information. One of the main features of this technology is that the data stored in the blockchain cannot be changed or manipulated carelessly, because each block is interlinked and locked with cryptography. Blockchain was first introduced in 2008 by a person or group of people using the pseudonym Satoshi Nakamoto, as part of the design of Bitcoin, a cryptocurrency that was first introduced in 2009. Since then, the blockchain concept has developed and is used in various applications beyond cryptocurrency, including in the financial industry, logistics, health, and also in education.

Each block in a blockchain contains a number of transactions that have been verified by a connected computer network, and each block is connected to the previous block, forming a block chain that cannot be changed or manipulated. One of the main characteristics of blockchain technology is that no single entity controls or has authority over the data stored in the blockchain, making it decentralized and trusted. More technically, blockchain uses cryptographic techniques to ensure the security and authenticity of transactions occurring within it. Each transaction recorded in a blockchain block is accompanied by a unique digital signature, which allows verification of the identity and integrity of the transaction by all members of the network. In addition, the data in blockchain blocks is stored encrypted and spread across the network, thereby minimizing the risk of data manipulation or leakage. Thus, blockchain offers a high level of security for storing and transferring data, especially sensitive or high-value data such as financial transactions or identity information.

One of the main advantages of blockchain technology is its ability to provide authentic and transparent proof of a transaction or information. Because every transaction or information entered into the blockchain must be approved by the majority of participants in the network, the integrity and authenticity of the data in the blockchain is guaranteed cryptographically. This makes blockchain a very effective solution to the problem of data security and information falsification, especially in the context of higher education administration where sensitive data such as student and financial information must be guarded very closely. Apart from that, blockchain also offers advantages in terms of decentralization and openness. As a decentralized system, blockchain does not depend on a single authority or specific third party, thereby eliminating the need for intermediaries in the transaction process. This can reduce the costs and time required to carry out transactions, as well as reduce the risk of errors or manipulation that may occur if a third party is involved. In addition, because blockchain is an open system, anyone can access and verify the data

stored in it, thereby increasing transparency and accountability in higher education administration.

Another advantage of blockchain technology is its security. Because the data stored in the blockchain is encrypted and distributed across the network, the risk of data leakage or manipulation can be minimized. Even if a small part of the blockchain network experiences a disruption or attack, the data will remain safe because copies of the same data are stored on various other nodes. This makes blockchain a very effective solution for protecting sensitive data such as student information, academic history. This potential makes blockchain technology an attractive solution for a variety of applications and industries, including in the fields of finance, logistics, health, and education. By exploiting the full potential of blockchain technology, various organizations and institutions can improve their operational performance, increase trust from various parties, and create significant added value in their business.

Table 1: Strategy for Implementing Blockchain Technology in Higher Education Administrative Management

NO	Implementation Strategy	Explain
1	Payment of Tuition Fees	The use of blockchain technology in paying tuition fees can speed up the transaction process and minimize the risk of data loss or payment manipulation.
2	Student Data Management	Blockchain can be used to store and manage student data, including personal information, academic history, and extracurricular activity records.
3	Certificate Verification	By utilizing blockchain, student certificates and diplomas can be verified directly and automatically by parties who need them, such as prospective employers.
4	Financial Transparency	Blockchain technology can increase transparency in higher education financial management by providing an immutable record of transactions.
5	Fund Usage Tracking	Colleges can use blockchain to track the use of funds transparently and ensure that funds are allocated according to specified goals.

Higher education institutions can utilize blockchain technology in various aspects of their administrative management. One implementation strategy that can be implemented is in terms of paying tuition fees. By implementing blockchain in the payment process, universities can speed up transactions and reduce the risk of data loss or payment manipulation. Apart from that, blockchain can also be used for student data management. Personal information, academic history, and extracurricular activity records can be stored and managed securely using this technology. This data will be encrypted and stored in a distributed manner, thereby minimizing the risk of information leakage or data manipulation. Verification of student certificates and diplomas can also be improved by utilizing blockchain. Parties who require verification, such as prospective employers, can easily check the authenticity of the certificate directly and automatically via blockchain, without the need to go through a time-consuming manual process. In terms of financial transparency, blockchain can be a solution to increase accountability and transparency in higher education financial management. Financial transaction records will be stored securely and cannot be changed, allowing related parties to track and verify each transaction easily. Lastly, blockchain can also be used to track the use of

funds transparently. Universities can use this technology to ensure that the funds received are allocated according to the specified goals and are not misused. Thus, the implementation of blockchain technology in higher education administrative management can bring various benefits, ranging from process efficiency to increased transparency and accountability.

However, apart from the many positive strategies, the implementation of blockchain technology in higher education administrative management also has several negative impacts that need to be considered carefully. One of the negative impacts that may arise is related to the cost and complexity of implementation. Implementing blockchain technology requires a substantial initial investment in the necessary infrastructure and system development. Apart from that, managing and maintaining blockchain systems also requires human resources who have special expertise in this field, which can increase long-term operational costs for universities. Furthermore, security aspects also need to be considered carefully. Although blockchain is considered a secure technology, no system is completely immune to attacks or tampering. Security threats such as 51% attacks or double attacks can threaten the integrity of data in a blockchain if not addressed properly. Therefore, continuous efforts are needed to improve the security and reliability of blockchain systems in order to overcome various potential security threats.

Finally, another negative impact is related to scalability. Although blockchain offers high security and transparency, this technology still faces limitations in terms of scalability, especially if the number of transactions or users increases significantly. This can result in delays or delays in the transaction verification and validation process, which can disrupt the university's overall operational performance. Thus, while the implementation of blockchain technology in higher education administrative management brings a number of significant positive impacts in terms of efficiency and transparency, it also needs to be carefully considered regarding costs, complexity, security and scalability. It is important for universities to conduct a thorough evaluation and plan implementation carefully, as well as considering the challenges and risks that may arise, in order to maximize the potential of blockchain technology and achieve the desired administrative goals.

The aim of implementing blockchain technology in higher education administrative management is to increase efficiency, transparency, security and accountability in managing various administrative aspects. One of the main goals is to increase the efficiency of administrative processes, such as tuition fee payments, student data management, and certificate verification, by utilizing the automation and decentralization features offered by blockchain technology. By using blockchain, administrative processes can be automated and simplified, reducing the time and costs involved in the process, as well as increasing the productivity of administrative staff. Apart from that, another goal of implementing blockchain technology is to increase transparency in higher education administration. With every transaction or data change recorded in the blockchain, all interested parties can easily access and verify the information, increasing trust and accountability in administrative processes. This transparency also allows external parties, such as accreditation bodies or supervisory institutions, to better monitor and evaluate higher education performance.

Security is also the main goal in implementing blockchain technology in higher education administration management. With its strong cryptography and decentralized design, blockchain offers a high level of security against data manipulation or leakage. Information stored in blockchain blocks is encrypted and cannot be changed or manipulated by unauthorized parties, thereby providing better protection for sensitive data, such as student personal information or college financial information. Furthermore, another aim of implementing blockchain technology is to increase accountability in the management of higher education administration. With every transaction or data change recorded in the blockchain, universities can track accurately and transparently all activities that occur in the system, including use of funds, payment of tuition fees, or changes to student data. This allows universities to

verify the validity and integrity of each transaction or record, as well as ensure that all administrative activities are carried out in accordance with applicable procedures and regulations. Apart from these goals, the implementation of blockchain technology in higher education administrative management also aims to reduce operational costs, improve services to students, and increase the competitiveness of higher education in this digital era. By leveraging blockchain features, such as automation, transparency, and security, universities can reduce administrative costs associated with manual processes or intermediaries, and provide faster, more accurate, and efficient services to students and other stakeholders.

CONCLUSIONS

Based on the results and discussion above, it can be concluded that the implementation of blockchain technology in higher education administrative management marks a major step forward in responding to modern administrative challenges with innovative solutions. By introducing the blockchain concept, universities can bring greater efficiency, transparency, security and accountability in the management of various aspects of their administration. The main advantage of blockchain technology is its ability to provide a secure and transparent decentralized system for storing and processing data. With transactions recorded in encrypted and connected blocks, the risk of data manipulation or leakage can be minimized, resulting in a more secure and trusted administrative environment. Apart from that, blockchain implementation also brings the potential to increase the efficiency of administrative processes in higher education. Blockchain also introduces a higher level of transparency in college administration. With every transaction or data change recorded in the blockchain, all interested parties can easily access and verify the information, increasing trust and accountability in administrative processes. This not only provides benefits for staff and students, but also allows external parties, such as accreditation bodies or regulatory bodies, to better monitor and evaluate college performance. With the right approach, universities can maximize the potential of blockchain technology to achieve their administrative goals and provide better services to students and other stakeholders.

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