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Enhancing Service Quality and Student Loyalty in Higher Education Using Blockchain Technology

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ABSTRACT

In the increasingly digital era demanding transparency, blockchain emerges as a technology with significant potential to support higher education services. This system offers security, efficiency, and decentralization in managing academic data and certifications. **This study aims to examine** the role of blockchain in improving service quality and student loyalty. **Data were collected** through interviews and FGDs with participants from students, faculty, and administrative staff relevant to the technology's implementation in their institutions. **The findings** show positive acceptance of blockchain, especially in terms of transparency and service speed. Participants also suggested digital incentives through a token system as a way to encourage active student engagement. However, **challenges such as** infrastructure, technological literacy, and regulations remain major obstacles. These results reinforce that blockchain can improve service quality and create loyalty based on a fair and measurable system. Additionally, the study highlights the potential for blockchain to be integrated with existing student information systems, as well as with other emerging technologies like AI and IoT. Such integration can enhance administrative efficiency and personalized learning services. The implications of this research suggest that blockchain has both operational and strategic value in higher education, especially when supported by regulatory frameworks, institutional readiness, and stakeholder training. This study contributes to the growing discourse on digital transformation in education and provides practical insights for policymakers and university leaders.

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1. INTRODUCTION

Service quality and student loyalty are two key factors that influence the higher education experience and the reputation of educational institutions [1]. High service quality can create a better academic experience for students, enhance their satisfaction, and ultimately strengthen their loyalty to the institution [2]. However, the challenge of maintaining consistent service quality and building student loyalty has become increasingly

complex with the demands of digitalization and the need for transparency in educational systems [3]. Therefore, technological innovation plays a crucial role in addressing these challenges [4]. One technology with significant potential to improve the quality of higher education services is blockchain technology [5].

Blockchain, initially recognized for its use in cryptocurrency, is now gaining attention as a solution to improve various operational aspects across many sectors, including education [6]. This technology offers a decentralized, secure, transparent, and immutable system that can improve how educational institutions manage student data, store academic records, and verify credentials [7]. By using blockchain, processes that were previously time-consuming and prone to human error such as enrollment, academic data management, and certification can be performed more efficiently and securely [8].

Furthermore, blockchain also has the potential to rebuild student loyalty [9]. A blockchain-based reward system, for example, can create transparency in student assessments and rewards, enhancing their trust in the educational institution [10]. By personalizing the student experience and offering clear incentives based on performance, blockchain can play a significant role in increasing student engagement and strengthening their relationship with the institution [11].

Through this research, the author aims to explore the potential applications of blockchain technology in enhancing the quality of higher education services and rebuilding student loyalty [12]. This study specifically investigates how blockchain can improve academic service quality, enhance student loyalty through practical reward systems, and be implemented effectively in diverse institutional contexts, while addressing real-world challenges and scalability [13]. The subsequent literature review explores key theoretical underpinnings related to service quality, blockchain technology, and student loyalty, which are then further linked to the findings and implications discussed in the final sections of this paper [14].

This research also aligns with the goals of the United Nations Sustainable Development Goals (SDGs), particularly SDGs 4 (Quality Education) and SDGs 9 (Industry, Innovation, and Infrastructure) [15]. By exploring the role of blockchain governance in empowering teachers and enhancing digital edupreneurship within the Merdeka Curriculum framework, the study supports equitable access to inclusive and quality education while promoting innovation in the education sector [16]. The implementation of transparent, secure, and efficient technologies like blockchain in academic processes can help reduce inequalities in learning opportunities, foster digital literacy among educators, and stimulate the growth of educational innovation ecosystems [17].

2. LITERATURE REVIEW

This literature review aims to provide a deeper understanding of the core concepts that form the foundation of this research, namely service quality in higher education, blockchain technology, and student loyalty [18]. In recent decades, service quality in the higher education sector has become a major concern for many institutions seeking to maintain their competitiveness and relevance [19]. Previous research on service quality, blockchain technology, and student loyalty will help identify gaps in the existing literature and provide direction for this study to fill these gaps [20]. Through this review, several key concepts closely related to the research topic will be discussed, along with how blockchain technology can be used to enhance service quality and build student loyalty in higher education [21].

2.1. Service Quality in Higher Education

2.1.1. Definition and Dimensions of Service Quality

Service quality in higher education is a critical aspect that determines the level of student satisfaction with the services they receive at university [22]. According to [23], service quality consists of five key dimensions is reliability, responsiveness, assurance, empathy, and tangibles [24]. Each of these dimensions directly impacts the student experience, from the quality of interactions with teaching staff to the physical facilities provided by the institution [25]. These dimensions also play an essential role in determining how students evaluate the quality of the services they receive during their academic journey [26].

2.1.2. The Impact of Service Quality on Student Satisfaction and Loyalty

Research by [27] shows that high service quality not only enhances student satisfaction but also contributes to the development of student loyalty [28]. In other words, the positive experience gained by students from good service quality will encourage them to continue choosing and staying loyal to the institution that provides such services [29]. Educational institutions that manage to maintain high service quality tend to have

higher student retention rates and are more capable of attracting new prospective students [30]. Therefore, improving service quality becomes a strategic step in retaining and building student loyalty [31].

2.2. Blockchain Technology

2.2.1. Definition and Basic Principles of Blockchain

Blockchain is a technology that uses a decentralized database system to store data securely and transparently [32]. This system allows every transaction or data entry to be recorded in blocks that are linked to each other, creating a chain that cannot be modified once data is recorded [33]. The basic principles of blockchain involve three main elements is decentralization, transparency, and security [34]. Each block in the blockchain is protected with cryptography to ensure data integrity, and the system does not require a third party to validate transactions, making it more efficient and secure compared to traditional systems [35]. This concept has revolutionized various industries, including finance, logistics, and healthcare, with increasing potential for applications in the education sector [36].

2.2.2. Blockchain Applications in Various Industries

Beyond the finance sector, blockchain is being used in a variety of other industries, such as logistics, government, and even healthcare [37]. In logistics, for example, blockchain is used to track supply chains in real-time, providing greater transparency in the distribution of goods [38]. In the education sector, this technology is being implemented to manage student data and the process of credential verification efficiently [39]. Blockchain provides a secure, efficient, and transparent solution for handling data that previously required third parties for verification and administrative processes [40].

2.3. Blockchain in Higher Education

2.3.1. Blockchain in Higher Education

One of the most relevant applications of blockchain in higher education is student data management [41]. Blockchain enables the digital, secure, and decentralized storage and management of academic data, student records, and credential information [42]. With this technology, students can have full control over their data and share it with others directly without requiring time-consuming verification processes [43]. Additionally, managing data using blockchain can reduce the risk of counterfeiting or loss of important information related to students education. Research by [44] shows that using blockchain for academic data storage allows for faster and more secure verification processes while reducing administrative costs associated with managing student data [45].

2.3.2. Blockchain in Recognition and Certification

Blockchain also offers a solution to the problem of academic certificate forgery, which is common in education [46]. By using this technology, educational institutions can issue certificates that are digitally recorded on the blockchain and can be easily verified by third parties, such as companies or other educational institutions [47]. This ensures that the credentials held by students cannot be altered or forged, providing both students and employers with a higher level of confidence in the validity of those credentials [48].

2.4. Student Loyalty

2.4.1. Definition and Factors Influencing Student Loyalty

Student loyalty refers to the extent to which students continue to enroll in and remain loyal to the same educational institution after they have enrolled [49]. Several factors influence this loyalty, including the quality of the academic experience, interactions with faculty and staff, and the quality of the facilities provided by the institution [50]. Strong student loyalty is typically correlated with high levels of satisfaction with the service quality received and a significant level of involvement in both academic and extracurricular activities [51]. Emphasizes that student loyalty is closely related to the quality of service they receive, which in turn affects student retention rates and the long-term success of the institution [52].

2.4.2. The Relationship Between Student Loyalty and Technology

The application of innovative technologies, such as blockchain, can strengthen student loyalty by creating more transparent and accountable systems. By using blockchain, educational institutions can provide a clear and structured reward system for students based on their academic performance and participation in various activities. This provides students with a tangible sense of achievement and motivates them to remain actively engaged in campus life.

2.5. Blockchain Technology and Student Loyalty

2.5.1. Blockchain as a Tool for Building Student Loyalty

The use of blockchain technology in higher education is not limited to improving administrative efficiency it can also play a significant role in building student loyalty. One way blockchain can be used is through a blockchain-based reward system that recognizes student achievements in a transparent and secure manner. This system not only provides rewards based on academic performance but can also include recognition for participation in extracurricular activities, community service, or personal development.

2.5.2. Implementation of Blockchain-Based Loyalty Systems in Higher Education

In a blockchain-based loyalty system, every reward received by a student can be recorded on the blockchain and tracked over time. Students who achieve certain milestones in their educational program or other activities can receive tokens or digital rewards that can be exchanged for various incentives, such as scholarships or internship opportunities. With this level of transparency and accountability, students feel more valued and motivated to continue performing well.

3. RESEARCH METHOD

This study employs a qualitative approach to explore a deeper understanding of how blockchain technology implementation can enhance service quality and build student loyalty in higher education. The qualitative approach was chosen because the aim of the research is to explore the perceptions, experiences, and viewpoints of students, faculty members, and administrative staff regarding the potential application of blockchain in their universities.

3.1. Research Design

The population in this study consists of students, faculty members, and administrative staff at higher education institutions that have either considered or are in the process of adopting blockchain technology. To obtain a more representative understanding, this study uses purposive sampling, which involves selecting participants based on specific criteria relevant to the research goals. The criteria for participant selection include students with basic knowledge of blockchain or who have been involved in discussions related to this technology, as well as faculty members and administrative staff involved in technology decision-making processes at their institutions. The research sample is estimated to include around 20-30 participants, who will be interviewed and involved in focus group discussions to gather relevant data for this study.

The estimated sample size of 20–30 participants was chosen based on the principle of data saturation, where the collection of new data no longer contributes additional insights to the themes being studied. This range is considered adequate in qualitative research to capture the diversity of perspectives while maintaining feasibility and depth in data analysis. Moreover, the purposive sampling technique ensures that participants have direct or indirect engagement with blockchain-related initiatives in their institutions, thus providing relevant experiential insights that align with the study's objectives.

3.2. Population and Sample

Data collection in this study will be conducted through two main techniques in-depth interviews and focus group discussions (FGD). In-depth interviews will be conducted to obtain more personal and detailed perspectives on participants experiences with the use of blockchain in higher education. These interviews will be conducted with students, faculty members, and administrative staff using semi-structured interview guidelines, allowing participants to freely express their opinions. Additionally, focus group discussions (FGD) will involve small groups of students and academic staff to discuss the implementation of blockchain in higher education. These discussions aim to gather collective insights from multiple stakeholders involved in the decision-making process. Both techniques are expected to provide comprehensive and in-depth data related to participants experiences and perspectives.

3.3. Data Collection Techniques

The data collected from interviews and FGDs were analyzed using a three-stage thematic analysis open, axial, and selective coding with each final theme systematically linked to specific research questions through a coding matrix, ensuring transparency and analytical consistency. In this analysis, the researcher will code the transcribed data to group statements or information that are relevant to specific themes, such as

perceptions of blockchain, service quality, and student loyalty. These themes will then be analyzed to identify patterns related to the implementation of blockchain in higher education. This process will also include data interpretation to formulate findings that can provide insights into how blockchain technology can contribute to improving service quality and student loyalty.

3.4. Data Analysis Techniques

The data collected from the interviews and FGDs will be analyzed using thematic analysis, which enables the researcher to identify the main patterns emerging from the qualitative data. In this analysis, the researcher will code the transcribed data to categorize statements or information relevant to specific themes, such as perceptions of blockchain, service quality, and student loyalty. These themes will then be analyzed to find patterns related to the implementation of blockchain in higher education. This process will also involve interpreting the data to develop findings that can offer insights into how blockchain technology can contribute to enhancing service quality and student loyalty.

The coding process was conducted using a multi-stage procedure. First, open coding was employed to identify key concepts in the transcripts, followed by axial coding to establish relationships between categories. Finally, selective coding was applied to refine the main themes that emerged. These themes were continuously cross-checked with the research questions to ensure alignment and relevance. A coding matrix was also developed to trace how each theme was grounded in specific participant narratives, thus reinforcing the analytical transparency and trustworthiness of the study.

3.5. Research Procedures

This research is conducted in four main stages. The first stage involves preparation, where data collection instruments, such as interview guidelines and FGD protocols, will be developed. The researcher will also identify relevant higher education institutions and select participants based on predetermined criteria. In the second stage, data collection will take place through interviews and FGDs involving selected students, faculty members, and administrative staff. Interviews will be conducted privately and in-depth, while FGDs will provide collective views from small groups. The third stage is data analysis, where the data obtained from the interviews and FGDs will be transcribed, coded, and analyzed to identify key themes. In the final stage, report preparation will be conducted based on the analyzed findings, which will include implications for the application of blockchain in higher education and recommendations for institutions seeking to adopt this technology.

3.6. Research Limitations

This study has several limitations that need to be considered. Because the approach used is qualitative, the results obtained may reflect the subjective views and experiences of the participants involved, and thus may not be generalizable to the entire population of students or higher education institutions. Additionally, the implementation of blockchain in higher education is still limited to a few institutions that have adopted this technology, meaning the research findings may be influenced by the relatively limited experiences available. Finally, limitations in time and access to participants with busy schedules for interviews and FGDs may affect the data collection process and the quality of the research outcomes.

4. RESULT AND DISCUSSION

4.1. Key Findings

The findings presented in this section are interpreted through the theoretical lens discussed earlier, particularly the role of blockchain in enhancing educational service dimensions and fostering student loyalty, as outlined in the literature review, and yielded five main points:

- Limited Knowledge but Significant Potential
  Few people are familiar with blockchain technology, but there is a great potential for its application. The majority of teachers and students only understand the basic concept of blockchain, usually limited to cryptocurrency usage. However, many participants showed great interest when it was explained how it could be applied in the education sector. They also recognized its potential to speed up and secure academic services.

- Positive Reception Towards Blockchain Implementation
  Many participants were open to the idea that blockchain-based administrative and certification systems could increase their trust in institutions, even though they have not experienced it firsthand. The two main reasons for this acceptance were transparency and data reliability.
- Blockchain Seen as Reducing Dependence on Manual Processes
  Most participants considered procedures like printing diplomas, requesting transcripts, or checking academic status to be inefficient, slow, and prone to human error. The idea that these processes could be carried out digitally and instantly via blockchain was well-received by students.
- Blockchain's Potential to Increase Student Engagement
  Participants suggested the implementation of a blockchain-based tokenization system to recognize student achievements in both academic and non-academic areas. Tokens could be used as rewards, similar to loyalty points that could be exchanged for internship opportunities or campus facilities.
- Concerns Regarding Implementation and infrastructure
  Faculty and administrative staff expressed doubts about the institution's readiness in terms of technical aspects, particularly IT infrastructure, human resource capabilities, data security, and regulations concerning digital data use. These issues, seen as initial challenges, need to be addressed strategically.

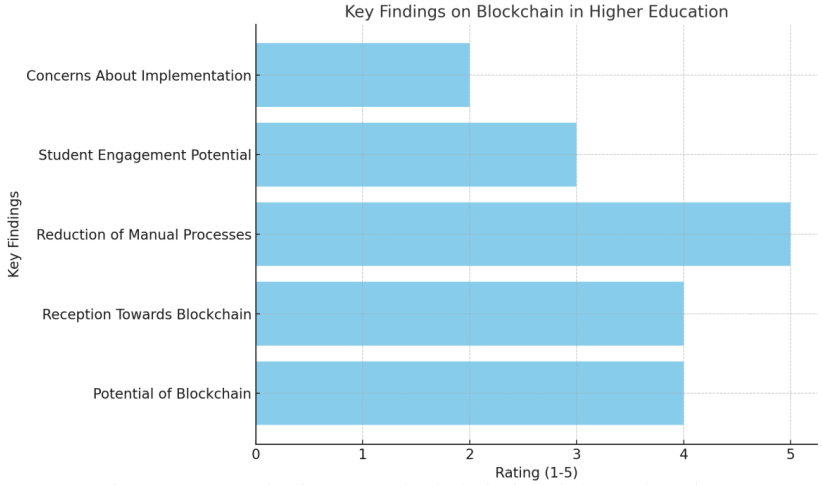

Figure 1. Key Findings on Blockchain in Higher Education

As illustrated in Figure 1, while blockchain technology holds significant potential to enhance the efficiency, transparency, and security of academic services, concerns remain regarding acceptance, infrastructure readiness, and limited understanding. These challenges, particularly in terms of technological and human resource preparedness, highlight the importance of strategic planning and capacity-building to ensure successful implementation in higher education institutions.

4.1.1. Blockchain's Role in Improving Educational Service Quality

Based on the data, blockchain has the potential to transform higher education services into a transparent and integrated digital system, as opposed to fragmented administrative systems. The blockchain system reduces administrative processing time and eliminates reliance on manual verification and third parties.To illustrate practical applications, a notable example is the initiative by the University of Nicosia in Cyprus, which has successfully implemented blockchain for issuing academic certificates that can be verified globally. Similarly, the MIT Media Lab developed a blockchain-based credentialing system called Blockcerts, allowing graduates to receive digital diplomas that are tamper-proof and instantly shareable. These case studies serve as models for Indonesian and global higher education institutions, including those in developing countries, to explore scalable blockchain applications that enhance transparency, automate processes, and ensure data authenticity while also aligning with broader interdisciplinary systems such as digital ID, credentialing platforms, and cross-border learning initiatives. For example:

- **Reliability** is enhanced because the system cannot be easily hacked or manipulated.
- **Responsiveness** is improved by automating processes such as data verification.
- **Assurance** is provided through a transparent system, preventing data fraud.
- **Empathy** and physical evidence are shown through personalized systems and students direct access to their data.

4.1.2. Blockchain as a Catalyst for Student Loyalty

Emotional and transactional loyalty of students towards institutions is enhanced through the implementation of blockchain-based incentive systems. Loyalty is no longer dependent on emotional bonds or subjective experiences is it can now be shaped through a verifiable reward system that is globally distributed. By using blockchain-based reward or incentive tokens, students have measurable and meaningful experiences.

Chen (2016) supports this idea, which aligns with the relationship marketing approach in higher education. This approach emphasizes the importance of building long-term relationships through value addition, participation, and two-way interaction between institutions and students. In this case, blockchain is not only a management tool but also an interpersonal platform that can create new value for users.

4.1.3. Implementation Challenges and Barriers

Despite the many opportunities, the focus group research results indicate that the adoption of blockchain in higher education institutions still faces the following challenges:

- **IT Infrastructure and Data Security:** Most institutions lack sufficient infrastructure to adopt blockchain-based systems. Additionally, there is concern about the potential for data leaks.
- **Uneven Technological Literacy:** Many teachers and administrative staff are unfamiliar with cryptographic-based digital systems, so they need thorough training.
- **Regulations and Government Policies:** There are no national regulations governing the use of blockchain in education, which discourages institutions from full adoption.
- **Initial Implementation Costs:** For state-run educational institutions with limited budgets, the initial investment in developing a blockchain platform is considered relatively high.

5. MANAGERIAL IMPLICATIONS

5.1. Blockchain Integration Strategies in Academic Service Delivery

The findings of this study have several managerial implications for educational institutions, policy-makers, and technology stakeholders aiming to enhance the quality of higher education through blockchain implementation. First, the adoption of blockchain-based systems can significantly improve the efficiency, transparency, and accountability of academic service delivery. Institutions should begin by conducting a needs assessment of their digital infrastructure and develop a phased implementation roadmap to integrate blockchain in academic records, certification processes, and reward systems. Moreover, educational leaders must prioritize teacher empowerment by investing in capacity-building programs that equip educators with blockchain literacy and digital entrepreneurship skills. This is particularly relevant within the Merdeka Curriculum framework, which encourages innovation, autonomy, and technological adaptation among educators.

5.2. Token-Based Incentives and Policy Support for Blockchain Adoption

In addition, the study suggests that token-based incentive mechanisms can boost student engagement and loyalty. Therefore, university administrators can collaborate with edtech providers to design blockchain-driven loyalty systems that recognize student achievements in academic, extracurricular, and entrepreneurial domains. These mechanisms can also serve as data sources to personalize learning pathways and improve student satisfaction. To support this transformation, national education authorities should consider formulating clear and standardized regulations for blockchain in education covering data ethics, privacy, and certification while also promoting collaborative research on blockchain's scalability and its synergy with AI, IoT, and other digital transformation initiatives in smart campus ecosystems. Policy support is essential to overcome institutional resistance, reduce legal uncertainty, and ensure equitable access across all types of higher education institutions.

6. CONCLUSION

This study demonstrates that blockchain technology can enhance higher education services by creating a more efficient, transparent, and secure system. The decentralized and immutable characteristics of blockchain can simplify the management of academic data, credential verification, and other administrative processes. This directly contributes to increased student satisfaction with educational institutions.

Moreover, blockchain has been proven to boost student loyalty through a blockchain-based reward system using digital tokens, which can objectively reflect academic and non-academic participation. This incentive system fosters trust and emotional engagement among students with their campus, as well as enhances their motivation. Loyalty that stems from a fair and transparent experience impacts long-term retention and institutional reputation.

However, blockchain implementation heavily relies on the institution's readiness in terms of infrastructure, technological knowledge, and political support. The adoption of this technology will face many challenges if not properly planned, with all stakeholders involved. Therefore, for blockchain-based digital transformation to truly add value to higher education, this approach should be gradual and collaborative, supported by future research that explores scalable infrastructure, regulatory models, and institutional readiness strategies.

7. DECLARATIONS

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7.2. Author Contributions

Conceptualization: AM, IG, and DC; Methodology: CG; Software: CT; Validation: AM and IG; Formal Analysis: DC and CG; Investigation: CT; Resources: AM; Data Curation: IG; Writing Original Draft Preparation: DC and CG; Writing Review and Editing: CT; Visualization: AM; All authors, AM, IG, DC, CG and CT, have read and agreed to the published version of the manuscript.

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The data presented in this study are available on request from the corresponding author.

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7.5. Declaration of Conflicting Interest

The authors declare that they have no conflicts of interest, known competing financial interests, or personal relationships that could have influenced the work reported in this paper.

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