Blockchain Use in Disbursing Financial Aid at Higher Education Institutions

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Abstract: Financial aid plays a crucial role in ensuring access to education, particularly for individuals from disadvantaged financial backgrounds. Education is a powerful driver of cultural and national development. By facilitating education, financial aid cultivates young professionals capable of driving progress across various fields. Notably, approximately 84 percent of students benefit from financial aid scholarships. In South Africa, bursaries and scholarships play a crucial role in providing essential financial support to students. However, the existing disbursement process is fraught with significant challenges. The manual nature of these processes leads to time-consuming operations, a high risk of errors, delays in fund distribution, and vulnerability to fraud. These inefficiencies hinder the timely delivery of financial aid, posing severe risks to students' academic success. To address these pressing challenges, it is imperative to transition to automated systems that streamline operations, minimise errors and delays, and enhance security against fraud. This transformation will ensure that financial aid reaches deserving students efficiently and securely. Therefore, this study conducts a systematic literature review to thoroughly investigate the challenges faced by financial aid institutions and students in fund disbursement at higher education institutions. Additionally, it examines the potential of Blockchain technology in improving fund disbursement processes. Findings indicate that the current scholarship disbursement procedures in South African institutions are manual, inefficient, and prone to errors, resulting in delays and opportunities for fraud. The urgency of this issue cannot be overstated, as students suffer from both hunger and frustration, while some lose their funds altogether. Importantly, the research highlights that a Blockchain ledger is inherently challenging to tamper with, thereby providing enhanced security. In a Smart Contract Blockchain-based system, every transaction is meticulously recorded on a distributed, publicly visible ledger, ensuring traceability and transparency of all disbursements and significantly reducing the risk of fraud.

Keywords: Blockchain, Smart contracts, Financial aid disbursements, Transparency, Education

1. Introduction

Financial aid plays a crucial role in ensuring access to education, particularly for individuals from disadvantaged financial backgrounds (Hutchinson, 2025). “Education remains a fundamental drive of social, cultural, and national development” (Alshamaila, 2024). Bouchrika (2024) states that education helps in equipping individuals with skills and knowledge that fuel innovation, productivity, and economic growth. By facilitating education through financial support, financial aid programs help cultivate skilled professionals who can make meaningful contributions to various industries and sectors, thereby fostering innovation and development. As reported by Bouchrika (2024), the average published tuition and fees for full-time students in the academic year 2023-24 have increased by 2.5 percent to 4 percent from the previous year. The study also revealed that approximately 84 percent of students receive financial aid through need-based grants. Bursaries and scholarships are critical, as they not only provide support that empowers individuals but also foster inclusivity and equal opportunity within the education system. This provision also contributes to the reduction of inequality and the enhancement of long-term socio-economic outcomes (Bouchrika, 2024). However, the current manual financial aid disbursement process faces major challenges, including administrative delays, human errors, lack of transparency and vulnerability to fraud, which hinder the timely and fair distribution of funds (Tressa & Priya, 2024). These inefficiencies negatively affect students’ academic progress and trust in the system. To address this, a shift toward automated, secure, and transparent solutions is essential (Bedi et al, 2020). This study aims to investigate the challenges faced by financial aid institutions and students in fund disbursement at higher education institutions.

By examining these challenges in depth, the study highlights the barriers that limit the effectiveness of financial aid systems and their ability to meet the needs of students equitably and efficiently. The study also aims to examine the potential of Blockchain technology in improving fund disbursement processes. The study explores how Blockchain features, such as decentralisation, immutability, and automation through Smart Contracts, could address current inefficiencies and enhance transparency, security, and accountability in financial aid management. This study is essential as it contributes to both academic knowledge and methods for integrating Blockchain into financial aid processes. The study is timely given the increasing demand for transparency, accountability, and speed in financial transactions across educational sectors (Shahrukh, 2023). This analysis

could provide insights for global institutions, highlighting potential approaches and considerations for creating a more inclusive higher education.

This paper is organized as follows: Section 2 outlines the study background and identifies a research gap in the disbursement of financial aid at higher education institutions, highlighting the potential for Blockchain solutions. Section 3 details the research methodology, including the strategies employed to investigate challenges in financial aid disbursement and develop a suitable solution. Section 4 presents the results from the literature review and analysis. Section 5 discusses the findings, focusing on their significance, practical implications, and the trade-offs between centralized efficiency and decentralized trust, as well as technical and economic limitations like asset volatility and Smart Contract rigidity. Section 6 offers recommendations for implementing Blockchain solutions and suggests strategies to address scalability and regulatory challenges. Finally, Section 7 concludes the study by summarizing key insights and contributions.

2. Study Background

2.1 Traditional Fund Disbursement Systems

Bedi et al. (2020) identified key issues in India's Central Sector Scheme of Scholarship (CSS), such as poor traceability of applications, lost forms during postal transit, limited transparency, and bank account verification challenges. Similarly, Tekguc, Adalier, and Yurtkan (2020) highlighted problems in Turkey's traditional scholarship management at the Credit and Hostels Institution (CHI), including manual verifications, inefficiencies, and high maintenance costs, alongside potential vulnerabilities in Smart Contracts. Bálint et al. (2019) noted issues in traditional bursary systems, such as a lack of transparency and reliance on intermediaries. Jadhav and Pise (2023) also found problems like poor communication and tracking difficulties in scholarship management. Honesti et al. (2022) discussed time-consuming manual processes and delays in the Gamification Scholarship Scheme. Despite multiple studies addressing specific challenges, no research has compiled a comprehensive list of issues faced by financial aid institutions and students in fund disbursement in higher education. This study aims to fill that gap.

Delays, fraud, and lack of transparency in financial aid significantly impact student performance and well-being. At Kenyatta University, 17% of students faced HELB loan disbursement delays, leading to disrupted attendance and poorer academic outcomes; students without delays had GPAs 0.647 points higher (Borner et al., 2022). In South Africa, cyber fraud has caused severe financial losses for 100% of affected financial aid recipients, with many losing over R5,000 and none recovering their funds. This resulted in academic disruptions, with 27% experiencing grade deterioration and 35% dropping out, alongside psychological distress for 93% and loss of trust in institutions for 90% (Hutchinson, 2025). Additionally, a lack of transparency leaves 61% of first-generation and 40% of low-income students confused and at risk of increased debt, leading to lower enrollment and higher dropout rates. Blockchain-based systems are proposed as a solution to enhance transparency and accountability in financial aid disbursement (Rane, Choudhary, & Rane, 2023).

2.2 Technology-advanced Fund Disbursement Systems

Bedi et al. (2020) implemented a Smart Contract-based system on Ethereum for automating scholarship authentication, enhancing transparency, and preventing application loss, though it remained vulnerable to Denial-of-Service and Man-in-the-Middle attacks, while overlooking data privacy and regulatory compliance. Tekguc, Adalier & Yurtkan (2020) introduced the ScholarChain platform in Turkey, which used Blockchain and Smart Contracts for document verification and scholarship processes. Despite its integration of Oracle services for data accuracy, challenges include reliance on external sources, high costs, and technical complexity. Jadhav & Pise (2023) presented CryptoScholarChain, a Blockchain framework improving scholarship management with Ethereum Smart Contracts and a ReactJS front end yet faced issues with Smart Contract complexity and scalability. Honesti et al. (2022) proposed a Blockchain-based solution for a Gamification Scholarship Scheme, automating application processes and fund disbursement; however, it still confronts accessibility challenges, including the need for mobile applications and system scalability.

The studies discussed above indicate that while Blockchain technology offers certain advantages, it also presents notable disadvantages. To date, no research has comprehensively explored and delineated the benefits and potential challenges of implementing Blockchain in fund disbursement processes. Therefore, this study seeks to investigate the challenges faced by financial aid institutions and students in the distribution of funds at higher education institutions, and to examine how Blockchain technology could improve these processes.

2.3 Contribution of This Study

Based on this investigation, the authors' contribution lies in demonstrating the potential of Blockchain technology to improve the financial aid disbursement process. The analysis also assesses whether it constitutes an appropriate and effective solution to the challenges inherent in existing financial aid systems. This study examines existing scholarship management solutions and frameworks that leverage Smart Contracts to automate verification and fund transfers, thereby reducing delays and human error. The study also highlights practical considerations for implementing Blockchain in higher education, including system security, scalability, and integration with existing institutional processes.

3. Research Methodology

This paper seeks to investigate the challenges faced by financial aid institutions and students in fund disbursement at higher education institutions. The study also aims to examine the potential of Blockchain technology in improving fund disbursement processes. Therefore, this study conducts a systematic literature review to thoroughly investigate these challenges faced by financial aid institutions and students in fund disbursement. Systematic literature reviews (SRs) are a way of synthesising scientific evidence to answer a particular research question in a way that is transparent and reproducible, while seeking to include all published evidence on the topic and appraising the quality of this evidence (Lame, 2019). The use of a SR in this study will assist in facilitating a rigorous investigation of the challenges associated with fund disbursement in a transparent and unbiased manner. There are different systematic literature reviews; this study has utilised the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 statement. PRISMA was first established in 2009 and later updated in 2020 to ensure transparent and accurate reporting of systematic reviews (Matthew et al, 2021).

Table 1: Systematic Literature Review Approach

Database	Timespan	Keywords	First Round Results	Titles, abstracts, and conclusions	Research Aim
Google Scholar	2019-2025	Blockchain, Smart Contracts, financial aid disbursements, and education.	2056	125	23
EEE Xplore			19	5	3
ScienceDirect			23	8	4
			988	44	15

The main keywords used during the search were restricted to “Blockchain, Smart Contracts, financial aid disbursements, and education”. To capture as many relevant studies as possible, the study conducted electronic searches using Google Scholar, IEEE Xplore, and ScienceDirect databases, dating back to 2019 (Table 1). Articles and studies most relevant to the research theme were considered for this study. The searches on Google Scholar, ScienceDirect and IEEE Xplore in the first round yielded 2056 and 19 studies, 1011 respectively. For the ScienceDirect database, the author conducted two separate keyword searches. The first search, using the primary keyword, returned 23 records. A second search was conducted using the keywords Blockchain and Smart Contracts to broadly review the functionality of Blockchain technology yielding 988 articles. Articles not focusing on Blockchain-based financial aid disbursements, not written in English, published before 2019, or not peer-reviewed were excluded.

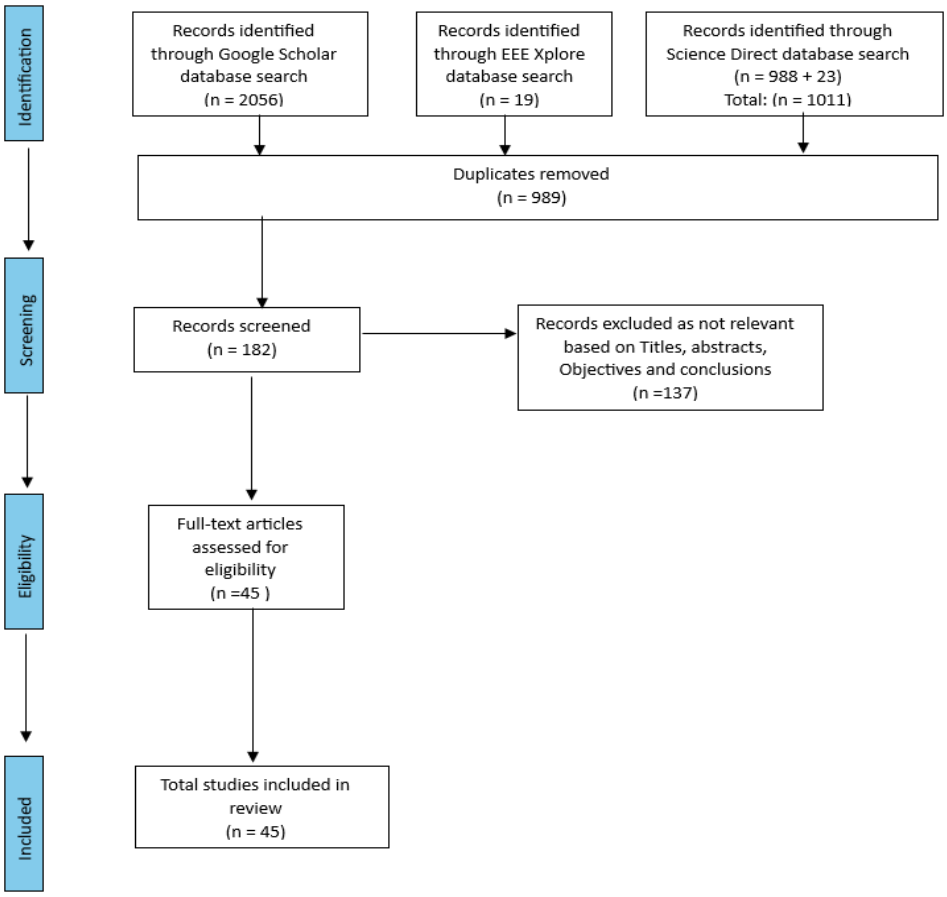

Figure 1: Literature search and filtering process

A total of 3086 journal articles and conference papers published between 2019 and 2025 were retrieved for this study. 989 duplicate records were removed and an initial screening of titles, abstracts, and conclusions resulted in 182 studies being shortlisted for further review. A subsequent full-text assessment was conducted to determine eligibility, and the studies that did not correspond with the research objectives were excluded. The primary objectives of this study are to investigate the challenges faced by financial aid institutions and students in the disbursement of funds at higher education institutions, and to examine the potential of Blockchain technology to enhance these processes. Following this evaluation, 45 studies were retained for qualitative analysis, as presented in Table 1 and Figure 1. The subsequent section provides a comprehensive discussion of the findings derived from this analysis.

4. Findings

The study by Davis (2022) highlights persistent shortcomings in the existing financial aid system, including overwhelming demand, administrative inefficiencies, and recurring delays in funds disbursement. To gain a deeper understanding of these issues, this review examined 40 scholarly articles. The analysis revealed recurring concerns regarding the transparency, efficiency, and timeliness of financial aid distribution, while also emphasising the potential of Blockchain technology as a viable solution to mitigate these challenges.

4.1 Challenges Faced in the Current Fund Disbursement

Bedi et al (2020) reported challenges faced by the Indian government in scholarship disbursement, including a lack of transparency, limited traceability, insecure verification, form loss, manual processing, and difficulties with bank account validation. Similar studies in financial aid and education have highlighted inefficiencies such as security risks and a lack of transparency in fund disbursement (Bedi et al, 2020; Honesti et al, 2022; Claudia, 2023), as presented in Table 2 below.

Table 2: Challenges in current financial aid disbursement

Authors	Challenges	
	Faced by universities	**Faced by students**
Bedi et al (2020)	Manual authentication, delays.	Lost forms, no transparency, no bank check, manual process.
Bálint et al (2019)	Error-prone systems, admin burden, weak security.	Manual paperwork causing delays.
Honesti et al (2022)	Manual checks, time-consuming.	Poor tracking and transparency.
Muneeb et al (2021)	Low security, Paper contracts.	Lack of trust.
Jadhav & Pise (2023)	Tamper-prone.	Tracking issues, lost documents, poor communication, and delayed process.
Asamoah et al (2023)	A long administrative process leading to a delay.	Long processing times or bureaucracy before funds are released.
Samu et al (2024)	Manual system processes leading to errors	Unfair and complex processes that lead to delays in releasing funds.
Tressa & Priya (2024)	Fraud, manual tasks, scalability.	Debt burden, no financial transparency.
Kibet (2025)	Data privacy risks, reliance on self-reports, poor cross-verification and delays.	Errors in self-reported data, fraud risk, and weak data security.
Solomon Christopher (2023)	Corruption, fraud, weak accountability.	Aid not reaching recipients, corruption, and outdated systems.
Emmanuel Goodluck (2025)	Loss of funds before they reach the intended beneficiaries	No transparency in fund use, fraud.
Jielong Yan et al (2025)	Privacy breaches, unreliable data, poor transparency.	Risk of unauthorised access to student data.
Nguyen-Hoang et al (2025)	Staff mismanagement of resources, excessive evaluation time and administrative resources	Privacy risks, data breaches, misconceptions, and false information.
Claudia (2023)	Inefficiency, fraud/corruption, weak accountability.	No transparency in fund use, low trust.

The study by Bedi et al (2020) also confirmed that students and financial aid institutions face multiple challenges in fund disbursement at higher education institutions. The study highlighted difficulties such as a lack of traceability of application forms, loss of forms during postal transit, limited transparency between students and education boards, and inadequate verification of bank accounts, which can lead to scholarship funds being returned if accounts are inactive. According to Jadhav & Pise (2023), traditional scholarship management systems are often centralised, lack transparency, rely on inefficient communication, are vulnerable to tampering, and face challenges in tracking and verifying applications. Similarly, Samu et al (2024) reported that the National Scholarship Portal (NSP) in India experiences challenges such as manual and complex application processes, physical verification requirements, delays in disbursement, excessive paperwork, and limited support services, reinforcing the notion that existing systems struggle with efficiency and reliability. Blockchain and Smart Contract technologies have been explored as potential solutions, with emphasis on enhancing trust, automating processes, and strengthening the financial aid disbursement system's resilience.

Blockchain technology has been identified as a potential solution to selected challenges in student financial aid systems, particularly fraud, lack of transparency, manual verification, and processing delays. Studies by Rane, Choudhary, and Rane (2023) indicate that the decentralised, cryptographic nature of Blockchain can reduce the risk of fraud by ensuring that transactions are securely recorded in an immutable, transparent ledger. Omar et al. (2020) highlighted that Blockchain enhances transparency and data integrity by improving data management and protocol compliance across participating entities. The use of smart contracts can automate eligibility

verification and fund disbursement processes, thereby reducing reliance on manual verification and minimising administrative delays. However, while Blockchain demonstrates strong potential in addressing security and trust-related issues, many of the other identified challenges can be effectively resolved through alternative centralised digital systems that offer automation, transparency, and reduced processing times without the complexity and overhead associated with Blockchain implementation.

4.2 Potential of Blockchain Technology

According to Sarmah (2018), Blockchain is a distributed ledger technology that records validated transactions across a global network of computers. Taherdoost (2023) defined Smart Contracts as automated programs within the Blockchain framework that enforce agreed-upon terms between parties. This review analysed scholarly works that apply Blockchain within educational and funding contexts, revealing both their strengths and vulnerabilities, and offering valuable insights for the development of a secure and efficient financial aid framework. Most studies incorporate Smart Contracts as a core component, and the review focuses on three key aspects (Table 3 below): the strengths, weaknesses, and applications of Blockchain in financial aid distribution.

Table 3: Strengths and Weaknesses of using Blockchain

Blockchain studies	Strengths in financial aid disbursement	Weaknesses in financial aid disbursement	Application / Focus
Bedi et al (2020)	Automation, transparency, verification, and error reduction.	Vulnerability to some cyberattacks, complexity, and limited testing.	Smart contract for scholarship disbursements
Bálint et al (2019)	Payment automation, transparency, security, low cost.	Security risks from connected systems.	Smart Contract for university bursary payments.
Honesti et al (2022)	Minimises human error, transparent transactions.	Cybersecurity vulnerabilities, legal and regulatory gaps.	Smart Contract-based gamification scheme for student selection, verification, multi-entity confirmation, and fund disbursement.
Muneeb et al (2021)	Robust security reduces costs and provides transparent implementation details.	Depending on external data sources.	Business transactions, many-to-many Smart Contracts.
Swati, J. & Nitin, P (2023)	Traceable transactions and efficient fund transfers.	High implementation costs, technical complexity, potential security risks from external components, and scalability limitations.	Ethereum-based Smart Contracts for the scholarship process in higher education, connecting donors, students, and NGOs.
Asamoah et al (2023)	Encryption, trust, privacy, and data integrity.	High transaction costs, latency, reliance on guarantors.	Blockchain-based student loans Smart Contracts.
Samu et al (2024)	Improve security, transparency, efficiency, inclusion, and simplify the scholarship application process.	Concerns over off-chain data security, lack of performance benchmarking.	Smart Contract to automate the scholarship portal to manage the entire scholarship lifecycle.
Zheng X.R. & Lu Y (2022)	Security enhancement, transparency, efficiency, and credential verification.	Cost, legal, adoption, and security challenges.	Secure financial operations, academic credentialing, and administrative automation.

Blockchain studies	Strengths in financial aid disbursement	Weaknesses in financial aid disbursement	Application / Focus
(Kibet 2025)	Improves transparency, security, and efficiency.	Relies on self-reported data and infrastructure challenges.	Need-based aid allocation.
Friday et al (2023)	Decentralised, tamper-proof records and real-time auditing.	Limited infrastructure, unclear regulations, scalability issues, and stakeholder resistance.	Automates fund release for public and international financial aid.
Goodluck (2025)	Lack of transparency, auditability, and accountability.	Resistance to change, policy and privacy uncertainties.	University funding.
Jielong Yan et al (2025)	Strong encryption, hierarchical access control, secure.	Prone to breaches and lack of adaptability.	Financial management Smart Contract-based system for educational institutions.
Tu-Anh Nguyen-Hoang et al (2025)	Lack of transparency preserves student privacy.	Low adoption.	Scholarship management platform.
Ngoc Cu Hoang et al (2024)	Ensures data integrity and immutability, reduces administrative overhead.	Scalability limits and latency.	Scalable Scholarship Management.

The analysis of the findings reveals noteworthy insights. Blockchain applications in financial aid consistently demonstrate strengths such as automation, transparency, decentralisation, enhanced security, trust, efficiency, and error reduction. These technologies have been applied to scholarship disbursements, bursary payments, student loan management, credential verification, university funding, and broader scholarship lifecycle management. However, recurring weaknesses include high implementation and transaction costs, scalability limitations, technical complexity, dependence on external data sources, cybersecurity vulnerabilities, and regulatory or policy gaps. The overall analysis highlights Blockchain's potential to transform financial aid systems by ensuring secure, transparent, and efficient fund management, while also emphasising the need to address challenges related to adoption, governance, and scalability for sustainable implementation.

5. Discussion

This section discusses the findings from the analysis, considering the core research objectives. This study was envisaged to investigate the challenges faced by financial aid institutions and students in the disbursement of funds at higher education institutions. This study also examined the potential of Blockchain technology in improving fund disbursement processes. The discussion also highlights the strengths and weaknesses of both traditional and Blockchain-based systems and interprets the lessons learned.

5.1 Challenges of Traditional Financial Aid Systems

The findings demonstrate that traditional financial aid systems face significant systemic and operational barriers that affect both institutions and students. Bedi et al (2020) identified critical inefficiencies in India's Central Sector Scheme of Scholarship (CSS), including manual verification of forms, delays in processing, and loss of documents during postal transmission. Honesti et al (2022) further highlighted that centralised platforms such as the National Scholarship Portal (NSP) often lack inclusivity, restricting access primarily to government-based scholarships and leaving private schemes unintegrated. Similarly, Kibet (2025) emphasised data integrity risks and privacy concerns in Kenya's New Funding Model (NFM), where opaque categorisation of students undermines fairness and creates mistrust. These studies collectively indicate that centralisation and reliance on manual processes are the root causes of inefficiency, opacity, and vulnerability to error or fraud. Administrative bottlenecks, inadequate bank account verification, and fragmented communication between agencies hinder the timely distribution of funds, undermining the primary purpose of student support schemes. Furthermore, the analysis by Samu et al (2024) reveals that existing scholarship systems, while attempting to centralise access, fail to deliver efficiency or equity due to structural issues. Authors, including Bedi et al (2020) and Kibet (2025),

highlight that the weaknesses stem from over-reliance on manual authentication, a lack of secure data sharing, and fragmented oversight. The analysis revealed that any future solution must directly address these inefficiencies by introducing automation, transparency, and secure stakeholder collaboration.

5.2 Potential of Blockchain Technology in Fund Disbursement

The analysis demonstrates that Blockchain technology, particularly through Smart Contracts, presents a viable and innovative solution to the challenges of traditional systems. Bedi et al (2020) proposed a Blockchain model that automates verification against educational databases, eliminating manual processes and reducing risks of form loss. Honesti et al (2022) emphasised that a Blockchain-based system could integrate private scholarships into a single ecosystem, enhancing inclusivity. Kibet (2025) demonstrated that Blockchain-based Smart Contracts can enhance data integrity and fairness in means testing by ensuring secure data exchange among multiple agencies. Similarly, Samu et al (2024) advocated for the adoption of permissioned frameworks such as Hyperledger Fabric, which protect privacy while maintaining trust across stakeholders. Analysis of prior studies indicates that Blockchain addresses the shortcomings of traditional systems by ensuring transparency through immutable records, fostering accountability through real-time fund tracking, and enhancing security against tampering or fraud (Claudia, 2023). Smart Contracts are a crucial mechanism here, as they enable automated disbursement once eligibility conditions are met, thereby reducing human error and delays. By removing the need for intermediaries, Blockchain-based Smart Contracts streamline processes, reduce administrative overhead, accelerate timelines, and lower transaction costs (Claudia, 2023). The capacity to integrate multiple scholarship sources within a decentralised system further supports fairness and accessibility.

Strengths: Blockchain introduces transparency, security, and efficiency into the fund disbursement process. Its tamper-proof nature enhances trust, while automation reduces administrative burden and accelerates fund release (Bedi et al, 2020; Samu et al, 2024). Private frameworks such as Hyperledger Fabric balance decentralisation with controlled access, making them suitable for sensitive financial and academic data (Samu et al, 2024). It was observed that Blockchain provides transparency, security, and efficiency in fund disbursement (Bedi et al, 2020). Smart Contracts were utilised by Bedi et al (2020) to automate processes, reducing administrative burdens and delays while eliminating intermediary costs. According to Claudia (2020), Kibet (2025) and Tressa & Priya (2024), decentralisation and immutability ensure tamper-proof records, improving trust and accountability. Additionally, cryptographic techniques safeguard sensitive student data, and the distributed ledger architecture enhances system resilience by eliminating single points of failure (Kibet, 2025). Permissioned frameworks, such as Hyperledger Fabric, preserve privacy and integrity (Challissery et al, 2024). Studies such as Tressa & Priya (2024) and Jadhav & Pise (2023) indicate that Blockchain enhances real-time transparency in tuition payments and funds. The study by Hoang et al (2025) utilised zk-rollups, which demonstrated significant scalability improvements by reducing transaction costs and confirmation times.

Blockchain technologies offer solutions for challenges in scholarship and financial aid systems, such as fraud, delays, and lack of transparency. Features like decentralized ledgers, smart contracts, and cryptographic methods can enhance transparency, automate fund disbursement, and improve data integrity. However, these advantages are limited by issues like dependence on accurate off-chain data, complex integration, privacy concerns, and ongoing security risks.

Weaknesses: Several limitations persist. Honesti et al. (2022) highlight the difficulty of accurately translating real-world processes into smart contract logic. Similarly, Claudia (2023) and Kibet (2025) identify high implementation costs, regulatory uncertainty, and the immutability of smart contracts as significant barriers, particularly when policy conditions change. Capacity building among stakeholders and the development of comprehensive legal frameworks for Blockchain technologies remain underdeveloped.

Beyond these general concerns, existing commercial Blockchain platforms that rely on smart contracts exhibit critical weaknesses, particularly in value-sensitive applications. A major issue is the extreme price volatility of crypto assets, which lack fundamental value and are largely driven by speculative market behaviour (Baur, Hong, & Lee). In student financial aid or scholarship disbursement, this volatility may result in beneficiaries receiving significantly more or less value than intended, thereby undermining budgeting accuracy, equity, and policy objectives (Yermack, 2024). Such instability raises serious concerns regarding the reliability, predictability, and accountability of Blockchain-based financial systems. The other factor is the technical complexity of smart contract development, which marginalises non-technical stakeholders, weakening claims of transparency and inclusivity. Smart contracts are susceptible to subtle programming vulnerabilities arising from discrepancies between developer intent and distributed execution semantics (Atzei et al, 2017). These risks are exacerbated by Blockchain immutability, as deployed contracts cannot be easily amended, often resulting in irreversible

financial losses (Atzei et al, 2017). Taken together, these economic and technical constraints underscore the limitations of Blockchain in socially and policy-critical applications.

Overall, this analysis indicates that the Blockchain solution must be adopted with caution. Its decentralised, secure, and automated characteristics may target the outlined challenges. Empirical prototypes and conceptual models proposed by Bedi et al. (2020) and Samu et al. (2024) further demonstrate the practical feasibility of Blockchain-based solutions. However, successful implementation depends on overcoming regulatory hurdles, managing technical complexity, and ensuring adequate stakeholder training. As several authors argue, Blockchain adoption represents not merely a technological upgrade but a systemic transformation requiring coordinated policy, institutional, and technological alignment.

Comparative analysis of Decentralised and Centralised solutions

This section evaluates decentralised Blockchain solutions compared to traditional centralised systems, addressing trade-offs in complexity, security, and practicality. The study by Islam et al. (2024) identifies strengths and weaknesses of each approach. Decentralised systems excel in security and transparency, as their distributed nature minimizes data tampering and enhances trust. However, they face scalability challenges. In contrast, centralised systems are efficient and scalable due to unified control but are prone to security vulnerabilities and reduced transparency, impacting trust (Islam et al. 2024). Blockchain can address security issues in multi-stakeholder environments like financial aid disbursement, where transparency is crucial. While centralised systems may streamline processes, Blockchain offers greater security and accountability despite increased complexity (Islam et al. 2024).

6. Recommendations and Future Work

This study reveals inefficiencies in traditional financial aid systems, including delays and a lack of transparency. It suggests that Blockchain technology can enhance these systems through decentralisation, immutability, automated Smart Contracts, and improved security. By incorporating Blockchain, scholarship and aid disbursements can become faster, more transparent, and secure, while also unifying government and private funding sources for greater inclusivity. Future research should address challenges such as scalability, regulatory issues, and the rigidity of Smart Contracts. Exploring stablecoin integration, hybrid models with legacy systems, and implementing machine learning-based fraud detection will be essential for a robust financial aid infrastructure. Leveraging these technologies can create a more equitable and efficient system.

7. Conclusion

This study investigated the challenges of financial aid disbursement and the potential of Blockchain to mitigate them. Findings reveal that traditional systems suffer from security vulnerabilities and administrative bottlenecks that hinder student success. Blockchain provides a viable alternative by enhancing transparency, accountability, and data integrity. However, practical implementation requires addressing system security, scalability, and the necessity of stakeholder training to bridge the technical gap. By integrating Blockchain with complementary technologies like machine learning, institutions can modernise financial aid into a secure, equitable system that ensures funds reach students efficiently.

Ethics declaration: This research did not require ethical clearance, as it did not involve human participants, animals, or sensitive personal data.

AI declaration: An AI tool (Grammarly) was utilised to improve grammar, spelling, and language clarity. The tool was not used for idea generation and analysis

References

Alshamaila, Y., Alsawalqah, H., Habib, M., Al-Madi, N., Faris, H., Alshraideh, M., Aljarah, I. and Masadeh, R. (2024) 'An intelligent rule-oriented framework for extracting key factors for grants scholarships in higher education', International Journal of Data and Network Science, 8(2), pp. 1325–1340.

Asamoah, K.O., Darko, A.P., Antwi, C.O., Kodjiku, S.L., Aggrey, E.S.E., Wang, Q. and Zhu, J. (2023) 'A Blockchain-based crowdsourcing loan platform for funding higher education in developing countries', IEEE Access, 11, pp. 24162–24174.

Atzei, N., Bartoletti, M. and Cimoli, T. (2017) 'A survey of attacks on Ethereum smart contracts', International Conference on Principles of Security and Trust, pp. 164–186.

Bálint, K., Cvetković, D., Takács, M., Holik, I. and Tóth, A. (2019) 'Connecting bitcoin Blockchain with digital learning chain structure in education', Acta Polytechnica Hungarica, 16(1), pp. 77–96.

Baur, D.G., Hong, K. and Lee, A.D. (2018) 'Bitcoin: Medium of exchange or speculative assets?', Journal of International Financial Markets, Institutions and Money, 54, pp. 177–189.

Bomer, A., Liu, X., Irungu, W.R. and Wanjiru, W.A. (2021) 'How is academic performance affected by delay in student loan disbursement in Kenyan universities? A case study of Kenyatta University', Higher Education Studies, 11(1), pp. 121–136.

Bouchrika, I. (2024) 'Financial aid and scholarships for online students in 2024', Education.

Claudia, M. (2023) 'Transforming Education Fund Management: Leveraging Blockchain for Transparency, Fraud Reduction, and Efficiency', Indonesia Auditing Research Journal, 12(4), pp. 179–186.

Friday, S.C., Lawal, C.I., Ayodeji, D.C. and Sobowale, A. (2023) 'Systematic review of Blockchain applications in public financial management and international aid accountability', International Journal of Multidisciplinary Research and Growth Evaluation, 4(1), pp. 1165–1180.

Goodluck, E. (n.d.) 'Higher education funding transparency through Blockchain: A secure data governance model for public universities'.

Hang'andu, N.B. (2022) 'Modes and challenges of accountability and transparency in the financial management systems in grant aided schools: A case of Kasisi girls and Kafue boys secondary schools' (Doctoral dissertation, The University of Zambia).

Hasan Shahrukh, M.R., Rahman, M.T. and Mansoor, N. (2023) 'A new paradigm in Blockchain-based financial aid distribution', in World Conference on Information Systems for Business Management, Cham: Springer, pp. 137–146.

Honesti, L., Aini, Q., Setiawan, M.I., Santoso, N.P.L. and Prihastiwi, W.Y. (2022) 'Smart contract-based gamification scheme for college in higher education', APTISI Transactions on Management (ATM), 6(2), pp. 102–111.

Hutchinson, G. (2025) 'The effects of cyber fraud on higher education financial aid students in South Africa'.

Islam, S. and Apu, K.U. (2024) 'Decentralized vs. centralized database solutions in Blockchain: Advantages, challenges, and use cases', Global Mainstream Journal of Innovation, Engineering & Emerging Technology, 3(4), pp. 58–68.

Khan, Y., Goyal, S.B. and Bedi, P. (2020) 'Security challenges of Blockchain', in International Conference on Innovations in Bio-Inspired Computing and Applications, Cham: Springer, pp. 248–257.

Kibet, A. (2025) 'Enhancing transparency and security in means testing for education financing: A Blockchain-based approach', in 2025 IST-Africa Conference (IST-Africa), IEEE, pp. 1–14.

Kshetri, N. (2017) 'Blockchain's roles in strengthening cybersecurity and protecting privacy', Telecommunications Policy, 41(10), pp. 1027–1038.

Luu, L., Chu, D.H., Olickel, H., Saxena, P. and Hobor, A. (2016) 'Making smart contracts smarter', Proceedings of the 2016 ACM SIGSAC Conference on Computer and Communications Security, pp. 254–269.

Muneeb, M., Raza, Z., Haq, I.U. and Shafiq, O. (2021) 'Smartcon: A Blockchain-based framework for smart contracts and transaction management', IEEE Access, 10, pp. 23687–23699.

Nguyen-Hoang, T.A., Hoang, N.C., Hua, P.T., Thi, M.T.N., Ta, T.T., Nguyen, T., Tan-Vo, K., Dinh, N.T. and Nguyen, H.T. (2024) 'Advancing scholarship management: A Blockchain-enhanced platform with privacy-secure identities and AI-driven recommendations', IEEE Access.

Omar, I.A., Jayaraman, R., Salah, K., Simsekler, M.C.E., Yaqoob, I. and Ellahham, S. (2020) 'Ensuring protocol compliance and data transparency in clinical trials using Blockchain smart contracts', BMC Medical Research Methodology, 20(1), 224.

Rane, N., Choudhary, S. and Rane, J. (2023) 'Blockchain and artificial intelligence (AI) integration for revolutionising security and transparency in finance', SSRN 4644253.

Samu, L.C., Khithani, N., Alve, K., Gambhire, V., Hande, A. and Choubey, S. (2024) 'Blockchain based intelligent disbursement in National Scholarship Portal', IET Blockchain, 4(4), pp. 407–422.

Sarmah, S.S. (2018) 'Understanding Blockchain technology', Computer Science and Engineering, 8(2), pp. 23–29.

Swati, J. and Pise, N. (2023) 'CryptoScholarChain: Revolutionizing scholarship management framework with Blockchain technology', International Journal of Advanced Computer Science and Applications, 14(8).

Taherdoost, H. (2023) 'Smart contracts in Blockchain technology: A critical review', Information, 14(2), p. 117.

Xu, X., Weber, I. and Staples, M. (2019) Architecture for Blockchain applications.

Yan, J., Wang, K., Huang, Z., Zhang, R., Chen, N., Wei, L. and Zhou, Y. (2025) 'Educational institution financial management system based on enhanced smart contracts', in 2025 6th International Conference on Computer Engineering and Application (ICCEA), IEEE, pp. 1051–1055.

Yermack, D. (2024) 'Is Bitcoin a real currency? An economic appraisal', in Handbook of Digital Currency, pp. 29–40. Academic Press.

Zheng, X.R. and Lu, Y. (2022) 'Blockchain technology–recent research and future trend', Enterprise Information Systems, 16(12), p. 1939895.

Zheng, Z., Xie, S., Dai, H., Chen, X. and Wang, H. (2017, June) 'An overview of Blockchain technology: Architecture, consensus, and future trends', in 2017 IEEE International Congress on Big Data (BigData Congress), pp. 557–564. IEEE.