Systematic Literature Review on Blockchain-Based Knowledge Integration Models for Higher Learning Institutions

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Article Info

Abstract

This paper presents a systematic literature review (SLR) on the knowledge integration (KI) of blockchain technology within higher learning education institutions (HLI), focusing on the development of a comprehensive model. With the growing importance of blockchain in various sectors, its potential applications in higher education, particularly in areas like data management, credentialing, and academic integrity, warrant an in-depth exploration. This SLR examines existing literature from academic databases, analyzing studies that discuss blockchain's role and potential in educational contexts. The review synthesises findings across various dimensions, including blockchain's advantages, challenges, and the requirements for effective integration within institutional frameworks. Thirty-three studies from 2020–2024 that were found in Scopus, Science Direct, and Google Scholar satisfied the study's requirements. Using the PRISMA paradigm, this study looked at a number of literature review components, such as subject area, research approach, and research type. This article's conclusion offers guidance for next research. By addressing both opportunities and challenges, this research contributes a framework to guide educational institutions in leveraging blockchain technology for enhanced knowledge management, data security, and operational efficiency. The paper concludes with recommendations for future research and practical guidelines for

administrators and policymakers considering blockchain integration within educational environments.

1. Introduction

The rapid technological advancements in the digital era have profoundly transformed the landscape of higher education institutions (HEIs), driving a shift toward more decentralized, transparent, and data-driven ecosystems. Among these innovations, blockchain technology has emerged as a particularly disruptive force, offering novel solutions to long-standing challenges in higher education such as credential verification, academic record security, intellectual property protection, and cross-border collaboration (Tahora et al., 2023). Blockchain, characterized by its decentralized, immutable, and transparent nature, holds immense potential to enhance operational efficiency, trust, and knowledge management practices within Higher Learning Institutions (HLIs). As the global market for blockchain in education is projected to experience substantial growth by 2023, its integration into academic and administrative processes is increasingly becoming a strategic priority for institutions seeking to remain competitive in the digital knowledge economy. Despite the growing interest, the adoption of blockchain in HLIs remains uneven, often hindered by regulatory uncertainties, infrastructural limitations, and a lack of standardized implementation frameworks. In particular, knowledge integration (KI)—the process of collecting, combining, and applying diverse sources of information and expertise within an organisation—is a critical function in higher education that stands to benefit significantly from blockchain technologies. However, the practical and theoretical underpinnings of how blockchain can support or transform KI processes in HLIs remain underexplored.

Moreover, while existing studies have touched on the potential of blockchain to support educational activities, there is limited synthesis of how current models address the unique challenges faced by HLIs, such as interoperability with legacy systems, cost of implementation, and alignment with institutional governance structures. This gap highlights the pressing need to investigate context-specific adoption models that consider both technological and organisational variables influencing blockchain integration in educational settings. Furthermore, regulatory frameworks play a pivotal role in shaping the trajectory of blockchain adoption. Without a clear understanding of regional policy landscapes and institutional readiness, attempts to implement blockchain-based systems may face significant resistance or fail to deliver expected outcomes. Thus, a systematic review of existing models—both theoretical and practical—is essential to uncover the gaps, validate the benefits, and propose directions for future adoption strategies tailored to HLIs. This Systematic Literature Review (SLR) aims to explore the current state of blockchain-based knowledge integration models for higher learning institutions. By synthesizing the existing body of research, the review will identify the benefits, challenges, and practical use cases of blockchain in academic environments. In doing so, it seeks to provide a comprehensive foundation for future research and development of blockchain frameworks that are technically sound, theoretically informed, and contextually appropriate for HLIs.

2. Literature Review

Blockchain technology has garnered significant attention in the education sector due to its unique features, such as decentralization, security, reliability, and data integrity (Alammary et al., 2019). Current research has explored the application of blockchain technology in various areas of higher education, including student records management, digital credentialing, online payment systems, and academic research collaboration (Tahora et al., 2023). A recent study conducted by (Tahora et al., 2023) highlights the potential of blockchain technology to enhance the efficiency, security, and transparency of higher education management systems. The researchers found that blockchain can streamline processes like student enrolment, grade records, and transcript management, while also enabling secure data sharing and tamper-resistant record-keeping. In addition, one of the primary areas where blockchain technology can make a substantial impact is in academic certification and record-keeping. Blockchain's immutable and tamjtper-resistant nature can provide a secure and transparent way to store and verify student achievements, transcripts, and credentials. This can help eliminate the issue of fraudulent certificates and reduce administrative burdens associated with the verification process (Jaramillo & Piedra, 2020). Another research by Awaji & Solaiman (2022) shows how students' blockchain-based trustworthy accomplishment record system was designed, implemented, and evaluated. Being more efficient and user-friendly than previous systems, the researchers show that this one is a notable development over older systems. Furthermore, blockchain technology has been explored as a means to address the growing issue of academic degree fraud. By using a decentralized, immutable ledger, blockchain can provide a secure and verifiable platform for storing and sharing academic credentials, reducing the risk of forgery or tampering. Other than that, blockchain technology can facilitate the creation of decentralized applications involving multiple stakeholders, such as students, faculty, and administrative staff, without the need for a central controlling authority. This can lead to

more efficient and collaborative workflows, improved data management, and enhanced transparency in the higher education ecosystem.

However, implementing blockchain technology in higher education faces several significant challenges. One of the primary issues is the low acceptance rate of blockchain due to various technological, organisational, and environmental barriers (Muhammad & Vargas, 2022). Technological challenges include data protection laws such as the General Data Protection Regulation (GDPR) and the California Consumer Protection Act (CCPA), which complicate compliance for application developers, as well as scalability issues due to slow transaction speeds and the Scaling Trilemma (Steiu, 2020). Organisational challenges stem from the traditional slow adoption of new technologies by higher education institutions, which are often cautious or dismissive of blockchain's potential (Haugsbakken & Langseth, 2019). Additionally, the complexity of integrating blockchain with existing heterogeneous information systems and the diverse demands of decentralized stakeholders, such as students, lecturers, and alumni, further complicates its implementation (Hu et al., 2023). Despite these challenges, blockchain's potential to enhance transparency, security, and efficiency in managing educational credentials and processes remains a compelling reason for continued exploration and research in this area (Fedorova & Skobleva, 2020; Iyer et al. 2021). Furthermore, the higher education sector of Malaysia is yet to explore the potential of Blockchain technology (Kundasivam, 2018). There is limitation regarding knowledge Integration adoption of Blockchains technology model for Higher Learning Institutes. Based on previous research, the Malaysian government is in the early phase of regulating Blockchain, due to its changing environment (Karim, 2018). This can be one of the major reasons that respondents do not consider regulatory policy as the determinant of Blockchain technology in the higher education sector of Malaysia. Also, as the Blockchain technology is currently in its infancy phase of being implemented across various industries (Zhao & Shaokun, 2016; Berg, 2017) this might be a reason that Malaysian higher education institutes do not want to take a risk of adopting a technology that is currently new, due to the perceived risks. Overall, while blockchain technology holds promise for improving data management in education, the challenges associated with managing data and knowledge integration using blockchain need to be carefully considered and addressed. This requires a collaborative approach involving all stakeholders, including educators, students, administrators, policymakers, and the financial services industry.

3. Methodology

The protocols adopted by this study are aligned with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement and previous studies. This study conducted a systematic review adapted from Okoli et al. (2015), Iskandar Ishak et al. (2019), and Haifaa et al. (2024). The review process contains four stages, namely planning, selection, extraction, and execution.

3.1 Planning

The planning stage activities include identifying specific research context, defining review protocols, and constructing research questions. In this review, the issues related to the knowledge integration (KI) of blockchain technology model for higher learning institutions (HLI) are the main context of the research. A review protocol is also defined in this stage based on the input from the research team, which includes researchers specialising in Fig. 1.
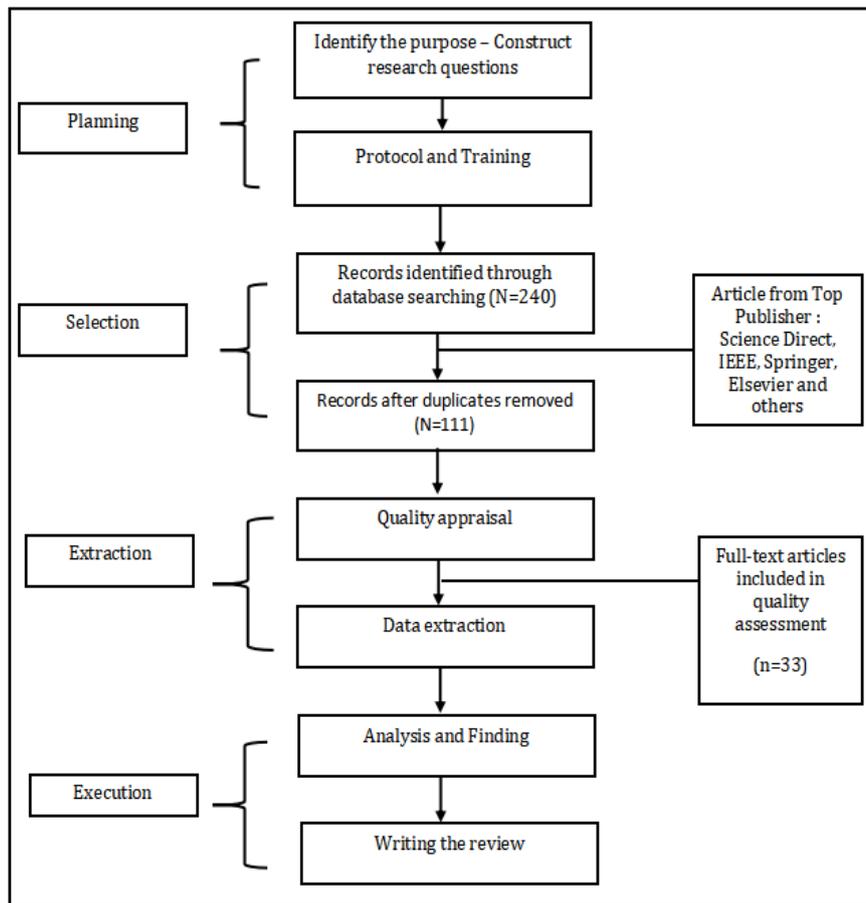
Fig. 1 *SLR processes*

3.2   Selection

Searches are performed in six prominent electronic journal databases: Scopus, IEEE, WoS, Google Scholar, Elsevier, and others throughout the selection phase. A set of criteria for literature filtration was devised. This study utilised literature exclusively from high-quality sources, as indicated in Table 1, based on established criteria. This research selected journals and conference papers from English-language peer-reviewed sources, while excluding dissertations, book reviews, conference papers, and books. The search was confined to items published between 2020 and 2024. The subsequent delineates the principal contributions of the planned research: i) To examine the current published literature on knowledge integration (KI) of blockchain technology models for higher learning institutions (HLI) and ii) to evaluate the research about knowledge integration (KI) of blockchain technology models in higher learning institutions (HLI).

Table 1 *Criteria of article*

No	Criteria	Inclusion	Exclusion
1	Focus on the article	Knowledge Integration, Block-chains Technology, Education	Articles that did not focus on Knowledge Integration, Block-chains Technology, Education
2	Journal published	Top publisher/source: Scopus, IEEE, WoS, Google Scholar	Journal and conference paper outside of the top publisher/source
3	Publication date	2020 onwards	Before 2020
4	Publication type	Journal, conference paper	Book chapters, technical reports, dissertations
5	Language	Journal article, conference paper was written in English	Other languages were not included

3.3 Extraction and Execution

The authors examined the publications that fulfilled the criteria listed in Table 2 for supplementary studies to satisfy the inclusion requirements for the review. At this point, the redundant articles were eliminated. Furthermore, papers were assessed for relevancy, mostly through their titles and abstracts. Table 2, titled "Quality Assessment Criteria," outlines four questions (Q1 to Q4) intended to evaluate the quality of a paper. Each question focuses on a specific aspect: Q1 assesses the clarity of the aims and objectives, Q2 examines whether the method of analysis is adequately explained, Q3 checks for the presence of primary data, and Q4 evaluates whether the model structure is detailed. For each question, the answers can be "Yes," "No," or "Partially," providing a structured way to assess the comprehensiveness and quality of the paper. The thoroughness and benefits of data extraction were assessed for quality evaluation. The four questions (Q1-Q4) are detailed in Table 2. Each question presents three response options: yes=1; partially=0.5; and no=0. The report phase delineates the characteristics of the literature and the outcomes of the evaluation, which are subsequently provided in the next section.

Table 2 *Quality assessment criteria*

No.	Item	Answer
Q1	Does the study have a clear list of its goals and aims?	Yes/No/ Partially
Q2	Does the publication adequately convey the pertinent method of analysis?	Yes/No/Partially
Q3	Is the paper substantiated by primary data?	Yes/No/ Partially
Q4	Does the paper provide a comprehensive explanation of the model structure?	Yes/No/ Partially

4. Results and Discussion

4.1 Study Characteristics

Using the information in this part, the current published resources were examined. This was done to show how relevant the present research is to the suggested one. Various forms of investigation were carried out to provide a thorough understanding of the current state. The abstract and succinct material of the chosen paper was then assessed on the next level. After that, the quality assessment criteria helped to filter thirty-three pertinent papers. There are 240 references in all deemed pertinent to this subject. After running the exclusion criteria, only 33 papers out of 111 (29.72%) were approved for the data synthesis of evidence. Considered for this review, Table 3 shows the general summary of the last batch of articles chosen for the quality evaluation of the 33 publications (P1-PD33).

Table 3 *Final set of articles selected for this study*

Paper ID	Year	Author's Name	Publisher/ Database	Type of Article	Type of Study
P1	2024	Sumardi et al. (2024)	Adisam Publisher	Journal	Conceptual
P2	2024	Madhavi et al. (2024)	Atlantis Press	Proceeding	Conceptual
P3	2024	Alzahrani (2024)	Google Scholar	Journal	Conceptual
P4	2024	Manohar et al. (2024)	Elsevier	Journal	Conceptual
P5	2024	Hamood Al-Hattami (2024)	Springer	Journal	Empirical
P6	2023	Caramihai & Severin (2023)	MDPI	Journal	Conceptual
P7	2023	Bhatia & Bhasin (2023)	ScienceDirect	Journal	Conceptual
P8	2023	Rustemi et al. (2023)	IEEE	Journal	Review
P9	2023	Bhabad & Wawale (2023)	CrossRef	Journal	Conceptual
P10	2023	Mcgreal (2023)	Google Scholar	Journal	Review
P11	2023	Wang et al. (2023)	Hindawi	Journal	Conceptual

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P12	2023	Zhao et al. (2023)	MDPI	Journal	Review
P13	2023	Saja & Stecyk (2023)	Google Scholar	Journal	Conceptual
P14	2023	Sun et al. (2023)	Google Scholar	Journal	Review
P15	2023	Awerika et al. (2023)	CrossRef	Journal	Conceptual
P16	2023	Rasheed Mimirinis (2023)	MDPI	Journal	Conceptual
P17	2023	El Koshiry Et Al. (2023)	Elsevier	Journal	Review
P18	2022	Tran & Hoang (2023)	Springer	Journal	Empirical
P19	2022	Froza et al. (2022)	ABEPRO	Journal	Conceptual
P20	2022	Li et al. (2022)	Clausius Scientific Pres	Journal	Conceptual
P21	2022	Min & Bin (2022)	Springer	Journal	Empirical
P22	2022	Chandrasekaram (2022)	PublishOA	Journal	Conceptual
P23	2022	Komath, M. A. C., & Sayilir, Ö. (2022)	Google Scholar	Journal	Conceptual
P24	2021	Duwadi (2021)	Google Scholar	Journal	Review
P25	2021	Delgado-Von-Eitzen Et Al. (2021)	MDPI	Journal	Review
P26	2021	Raimundo & Rosário (2021)	MDPI	Journal	Review
P27	2021	Iftikhar et al. (2021)	Atlantis Press	Proceeding	Empirical
P28	2021	Guustaaf et al. (2021)	Google Scholar	Journal	Conceptual
P29	2021	Ghonim & Corpuz (2021)	Google Scholar	Journal	Conceptual
P30	2021	Chukowry et al. (2021)	Elsevier	Journal	Conceptual
P31	2020	Saleh et al. (2020)	Sciedu	Journal	Review
P32	2020	Bhaskar et al. 2020)	Springer	Journal	Review
P33	2020	Awaji et al. (2020)	ACM	Proceeding	Review

The pie chart, as shown in Figure 2, illustrates the distribution of publication types, categorizing them into journal articles and conference proceedings. The majority, comprising 91%, are journal articles, while a smaller portion, 9%, consists of proceedings. This distribution indicates a strong preference or focuses on publishing in journals over conference proceedings, suggesting that the research is predominantly disseminated through peer-reviewed journal platforms, which may emphasize depth and rigor in scholarly communication compared to the generally quicker turnaround and broad thematic focus often associated with conference proceedings.
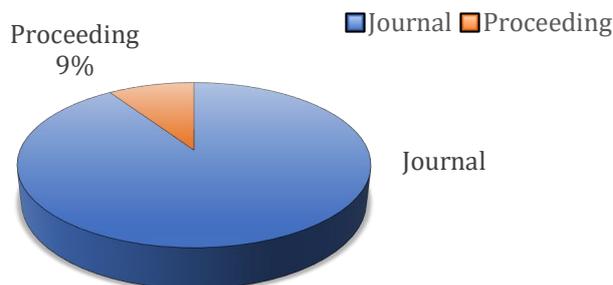
Type of Article (Frequency)

Fig. 2 *Frequency based on type of article for this study*

The bar chart, as shown in Figure 3, displays the frequency of publications per year from 2020 to 2024, highlighting trends in research output over this period. Starting with 3 publications in 2020, there is a steady increase, reaching 7 publications in 2021 and 6 in 2022. This upward trend peaks in 2023, with 12 publications, indicating a significant surge in research activity. However, in 2024, the frequency slightly declines to 5 publications. Cumulatively, the total number of publications across these years is 33. This distribution suggests an overall growth in research interest or productivity up until 2023, with a slight drop in 2024, which may either indicate a temporary decline or reflect incomplete data if the year is still in progress.

Frequency of Publication Based on Year

	2020	2021	2022	2023	2024	TOTAL
FREQUENCY	3	7	6	12	5	33
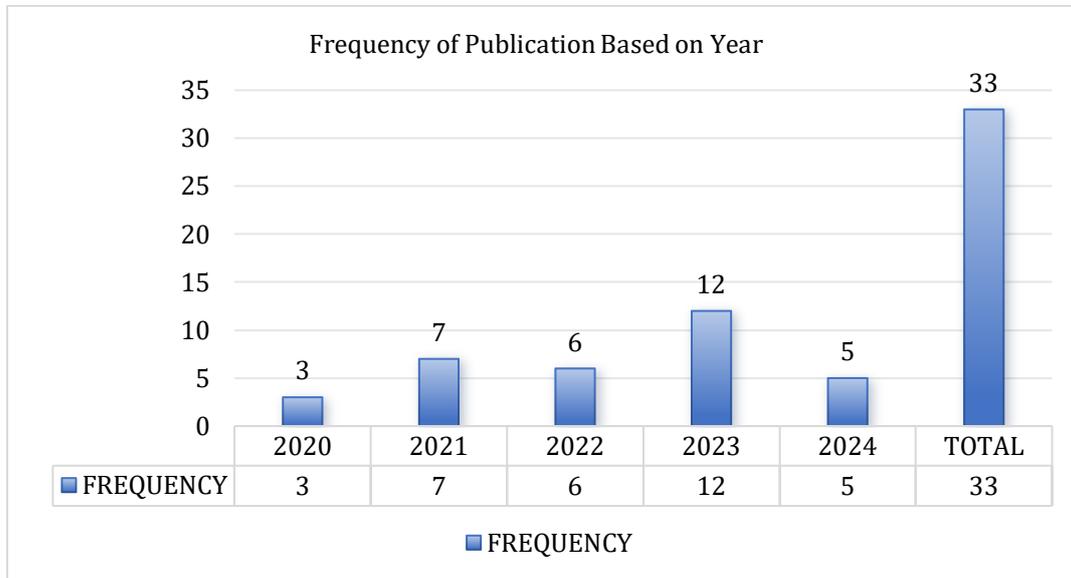
Fig. 3 *Frequency of publication based on year*

The bar chart in Figure 4 illustrates the frequency of three types of studies: Empirical, Review, and Conceptual. Among these, Conceptual studies have the highest frequency, with a count approaching 20. Review studies follow, with a frequency slightly above 10. Empirical studies have the lowest frequency, with a count just above 5. This suggests a greater emphasis on the occurrence of Conceptual studies compared to the other two categories in the dataset.

Frequency Based on Types of Studies
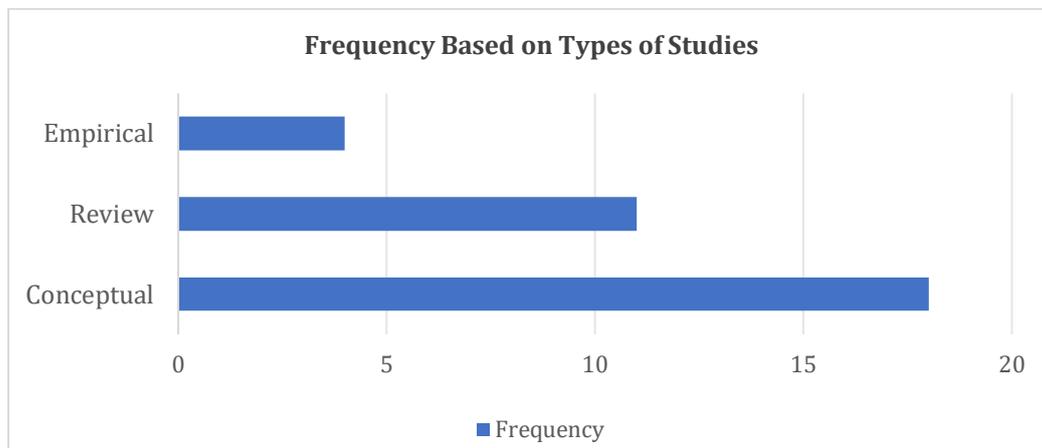
Fig. 4 *Frequency based on types of studies*

Table 4 presents the outcomes of the quality assessment based on sources and enquiries (see Table 2). All articles provide a clear delineation of the aims and objectives of the inquiry. Thirty-three publications demonstrate that the study objectives are well defined and the analytical methods are discussed appropriately and enough. Twenty-three studies were supported by primary data, while twenty-one papers provided a detailed explanation of the model structure.

Table 4 *Quality assessment result based on sources and questions*

Paper ID	Q1	Q2	Q3	Q4	Total
P1	1	0.5	0.5	0.5	2.5
P2	1	1	0.5	1	3.5
P3	1	1	0	0.5	2.5
P4	1	1	1	1	4
P5	1	1	1	1	4
P6	1	1	1	1	4
P7	1	1	1	1	4
P8	1	1	0.5	0	2.5
P9	1	1	0	0.5	2.5
P10	0.5	0.5	0	0	1
P11	1	1	0	0.5	2.5
P12	1	1	0.5	0	2.5
P13	1	1	0	0	2
P14	1	1	0	0.5	2.5
P15	1	1	0	0	2
P16	1	1	0.5	0	2.5
P17	1	1	1	0	3
P18	1	1	0.5	1	3.5
P19	1	1	0.5	0.5	3
P20	1	1	0	1	3
P21	1	1	1	1	4
P22	1	1	0	1	3
P23	1	1	1	1	4
P24	1	1	0	0	2
P25	1	1	0.5	0	2.5
P26	1	1	0.5	0	2.5
P27	1	1	1	1	4
P28	1	1	1	1	4
P29	1	1	0.5	1	3.5
P30	1	1	0.5	1	3.5
P31	1	1	0.5	1	3.5
P32	1	1	0.5	0	2.5
P33	1	1	0.5	0	2.5

Table 5 presents a quality assessment summary for a set of 33 papers, classified into four quality categories based on a scale from "Very Poor" to "Very Good." The categories are defined by specific score ranges: Very Poor (<1): No papers fell into this category, indicating that none of the assessed papers scored below 1. Poor (1 - <2): Only 1 paper, representing 3% of the total, was rated in this range, suggesting a low level of quality for this paper. Good (2 - <3): A substantial portion, 15 papers (45% of the total), scored between 2 and less than 3. This implies that nearly half of the papers were of a satisfactory quality level. Very Good (3 - 4): The highest quality category, "Very Good," includes 17 papers, making up 52% of the total. This indicates that over half of the assessed papers demonstrated a high level of quality. Overall, the distribution shows that the majority of papers (97%) were rated as either "Good" or "Very Good," with no papers in the "Very Poor" category and only one paper in the "Poor" category. This suggests a generally high-quality level among the papers assessed.

Table 5 *Quality assessment result summary*

Quality scale	Very poor	Poor	Good	Very good	Total
	(<1)	(1 - < 2)	(2 – < 3)	(3 – 4)	
No. of papers	0	1	15	17	33
Percentages (100%)	0	3	45	52	100

Blockchain technology is gaining traction in the education sector due to its potential to enhance security, reduce costs, and improve transparency in academic processes. The application of blockchain in education includes verifying students' educational backgrounds, issuing and verifying educational certificates, managing competencies and learning outcomes, and securing collaborative learning environments. Various authors have proposed blockchain-based solutions for the education sector (Manohar Reddy, 2024; Tahora, 2023; Mohammad, 2022), highlighting the benefits of using blockchain technology to streamline administrative processes and ensure the integrity of academic credentials. The use of blockchain in education is still in its early stages, with limited real-world implementations reported, indicating the challenges and issues associated with integrating blockchain technology into existing educational systems. The concept of Education 4.0, which focuses on innovation-based education and advanced digital technologies, aligns well with the potential of blockchain technology to revolutionize traditional educational practices.

In terms of framework and policy, Auyezbekova (2019) suggests that Kazakhstan and Malaysia have the potential to become leaders in the adoption of blockchain technology in education, given their strong support for innovation and technology. However, there is a need for a comprehensive and collaborative approach to address the challenges and limitations of blockchain adoption, including increased awareness and training, stakeholder engagement, and regulatory frameworks. A valuable overview of the current state of blockchain adoption in education in Kazakhstan and Malaysia, and identifies opportunities for future research and development. Furthermore, Iftikhar (2021) suggests that Malaysian higher education institutes should focus on increasing awareness and providing training for blockchain technology, as well as encouraging top management support for successful adoption. Additionally, Mahmood (2020) suggests that regulatory frameworks should be developed to address the legal and ethical issues associated with blockchain technology. Research by Tahir (2023) has proposed a smart education framework that integrates blockchain technology with other emerging technologies such as the Internet of Things (IoT) and Artificial Intelligence (AI). The proposed framework aims to provide a comprehensive and holistic approach to education that is both technologically advanced and student-centered. They also highlight the benefits of using blockchain technology in education, such as increased transparency, security, and efficiency in data management, as well as the potential of blockchain technology to enhance the certification and accreditation process in education.

Blockchain technology can enable secure and transparent knowledge sharing among stakeholders, creating a tamper-proof record of data and preventing data manipulation. The technology can also be used to manage intellectual property rights and verify the authenticity of knowledge assets such as research papers and scientific data. Research by Al-Emran (2020) proposed the Block-Chained Knowledge Management Model (BCKMM), which consists of four components: knowledge acquisition, knowledge sharing, knowledge storage, and knowledge evaluation. The BCKMM is designed to provide a more transparent, efficient, and secure way of managing knowledge compared to traditional knowledge management practices. The potential applications of the BCKMM in various domains, such as healthcare, finance, and education. Furthermore, The BCKMM provides a secure and decentralized platform for managing knowledge, which has the potential to transform the way organisations manage knowledge in various domains. Overall, the use of blockchain technology in the education sector has the potential to transform the way we manage and integrate knowledge, creating a more secure, efficient, and collaborative learning environment.

4.2 Proposed Model Blockchain-Based Knowledge Integration for Higher Learning Institutions

The knowledge integration of Blockchain Technology (KIBCK) model for Higher Learning Institutions represents an initial conceptual framework proposed by the authors following a systematic literature review as shows in Figure 5. This review involved analysing current research trends, theoretical underpinnings, and practical implementations of blockchain in educational contexts. The model is based on the Technology-Organisation-Environment (TOE) framework introduced by Tornatzky and Fleischer (1990), which is a widely accepted lens for examining technology adoption. By synthesizing insights from the literature, the authors developed the KIBCK model to highlight the critical role of knowledge integration as a mediator between contextual factors and blockchain adoption within higher learning institutions.

Technological factors in the model include key blockchain-related attributes such as security and privacy, transparency and trust, and data integrity. These elements are foundational to institutional confidence in blockchain systems. In educational contexts, where privacy and accuracy of records are paramount, blockchain's cryptographic security features reduce the risk of unauthorised data breaches (Zhao et al., 2016). Transparency, enabled by distributed ledgers, builds trust among stakeholders, while the assurance of data integrity supports accurate credentialing and institutional reputation (Casino et al., 2019). These attributes are therefore essential enablers of knowledge processes required for effective adoption.

Organisational factors focus on the internal dynamics of an institution, including institutional readiness, leadership support, and financial and technical resources. Research indicates that these internal capacities

significantly influence technology uptake (Ifinedo, 2011). Institutions that are ready to innovate, supported by proactive leadership and adequate resources, are better positioned to foster knowledge creation, sharing, and application related to blockchain. The presence of a strategic vision and coordinated effort across departments enhances the institution's ability to integrate blockchain technologies into its core functions.

Environmental factors encapsulate the broader ecosystem influencing adoption. These include government policies and regulations, industry collaboration, and societal expectations. The regulatory environment can either encourage or inhibit adoption, depending on the clarity and supportiveness of national policies (Saberi et al., 2019). Meanwhile, collaborations with industry offer access to expertise, pilot testing opportunities, and innovation networks. Furthermore, rising societal demand for transparency, accountability, and digital credentials in education makes blockchain adoption both a strategic and a socially responsible decision.

At the core of the model lies Knowledge Integration, which comprises knowledge creation, sharing, and application, the key processes that translate external and internal inputs into actionable adoption strategies. The construct of Perceived Usefulness (PU) is incorporated as a mediating/moderating factor influencing how institutions evaluate the value of blockchain. According to Davis (1989), technologies perceived as useful are more likely to be embraced. The KIBCK model, therefore, not only provides a theoretical basis for understanding blockchain adoption but also emphasises that successful implementation depends on how well knowledge is mobilized within and around the institution.
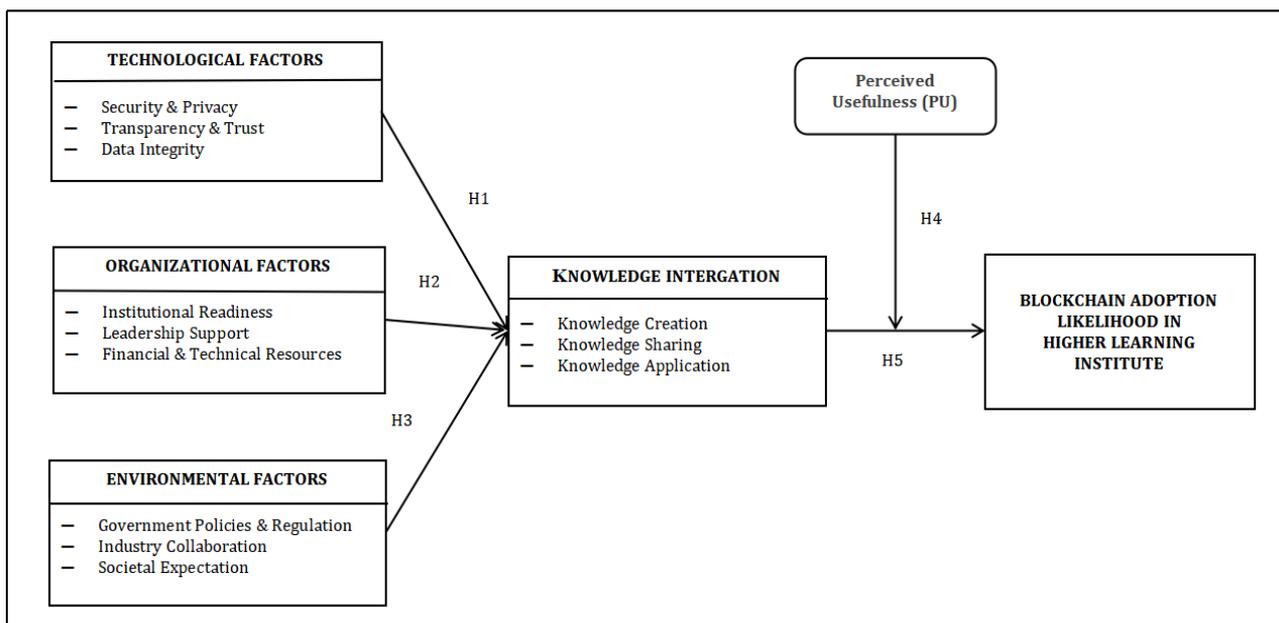

Fig. 5 *Proposed model for blockchain-based knowledge integration for higher learning institutions*

5. Conclusion

In conclusion, integrating blockchain technology into higher learning institutions holds transformative potential for enhancing knowledge management, academic transparency, and operational efficiency. The proposed Knowledge Integration (KI) model based on blockchain provides a secure, transparent, and decentralized framework that aligns well with the evolving needs of the educational sector. By leveraging blockchain's capabilities, institutions can not only safeguard sensitive academic records and streamline administrative processes but also foster a collaborative and trusted environment for knowledge sharing and research. However, the path to successful integration requires careful consideration of challenges, including high implementation costs, data privacy concerns, and interoperability with existing systems. To maximise the benefits of this model, institutions should adopt a phased implementation strategy, starting with pilot projects in areas such as credential verification or research publication tracking. Additionally, cross-institutional collaboration and standardized governance protocols will be crucial for widespread adoption and operational success. Overall, the application of blockchain in higher learning institutions offers an innovative approach to knowledge integration, one that aligns with the goals of data integrity, transparency, and efficient resource management. As HLIs strive to meet the demands of a digital age, blockchain-based KI models could play a pivotal role in creating a more resilient, adaptive, and interconnected academic landscape

While this study provides a foundation through a systematic review, future research should explore the empirical validation of blockchain-based KI models through real-world pilot implementations in diverse

educational settings. Comparative studies between regions with differing regulatory frameworks can yield insights into policy implications and adoption barriers. Furthermore, integrating established theoretical frameworks, such as the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), or Knowledge Management models, into empirical research will strengthen the conceptual grounding of future investigations. There is also a need for longitudinal studies to assess the long-term impact of blockchain on institutional performance, knowledge sharing behaviors, and academic collaboration across institutions.

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Conflict of Interest

Authors declare that there is no conflict of interest regarding the publication of the paper.

Author Contribution

The authors confirm contribution to the paper as follows: **study conception and design:** *Tajuddin, N.I.I., Izni, N.A., Mohd Anim, N.A.H.;* **analysis and interpretation of results:** *Nor, R.N.H., Noor, N.M., Sudin, M.N.;* **draft manuscript preparation:** *Nor, N.M, Aziz, K.A. All authors reviewed the results and approved the final version of the manuscript.*

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