







Blockchain in education: a bibliometric study and future research agenda

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ABSTRACT

Blockchain technology (BT) has the potential to transform a number of industries, including education. This bibliometric study examines the state of the field of research in education regarding blockchain, highlighting key developments, influential publications and emerging themes. The study uses a comprehensive dataset from Web of Science and Scopus to examine important trends, prominent writers, organizations, publications and cooperative networks to identify critical areas, including credential verification, academic record management and decentralized learning platforms, where blockchain offers unexplored opportunities. By analyzing 134 articles, we uncover a growing interest in blockchain's applications within the education sector, with research clustered around technology, strategy, finance, broader implications and educational transformation. This study provides a roadmap for future research. The implications provide useful insights for policymakers, educators, and developers of technology. This study draws attention to the potential of blockchain to redefine educational paradigms by bridging technological innovation with pedagogical needs, and invites stakeholders to take part in shaping its transformative journey. However, limitations include data bias and the absence of temporal analysis. Future research should explore ethical and practical challenges, assess blockchain's impact on education and contribute to a deeper understanding of its role in higher education.

ARTICLE HISTORY

Received 30 January 2024
Revised 13 January 2025
Accepted 13 May 2025

KEYWORDS

Blockchain; higher education; education; bibliometric; education technology

SUBJECTS

Engineering Education; Theory of Education; Research Methods in Education

1. Introduction

Due to its status as one of the most innovative and important breakthroughs, blockchain technology (BT) has been more fascinating to academics and professionals over the past several years (Aste et al., 2017; Iansiti & Lakhani, 2017; Tapscott & Tapscott, 2017). BT has been incorporated into a wide range of fields, including supply chain management, data retention, system integration, digital registries, manufacturing data aggregation, finance, accounting, information security, digital procurement and business operations (Javaid et al., 2021; Kwilinski, 2019).

The numerous uses of BT may be grouped by emphasizing how important a part it plays across several industries. These include financial applications, big data, edge computing, education, healthcare management, governance (including public administration, digital identity and data collection), business and industrial sectors like supply chain, logistics and energy, as well as security and privacy, the Internet of Things, digital identity and education. Notably, BT is gaining prominence in the realm of education due to its vital role in securing academic records and offering reliable solutions to combat academic fraud (Alshahrani et al., 2020). Its adoption in higher education is on the rise, particularly for information monitoring through intelligent applications (Sowmiya & Poovammal, 2022). It's important to mention that BT originally emerged from the cryptocurrency world but has now found diverse applications in higher education (Awaji et al., 2020). Moreover, its utilization is driven by the objectives of cost reduction, enhanced information security and simplification of document verification processes (Huynh et al., 2018). With the growing number of international students worldwide and the persistent issue of document forgery, BT is

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emerging as a secure means for digital transactions (Castro & Au-Yong-Oliveira, 2021). Recent research has unveiled a concerning surge in the production of fraudulent educational certificates by unscrupulous individuals seeking admission to higher education institutions globally (Dharmalingam et al., 2022).

Over the past few years, several literature reviews have been carried out on the use of BT in higher education. Consequently, Castro and Au-Yong-Oliveira (2021) undertook a study on the application of blockchain in diploma verification using the Scopus database. Additionally, Alzahrani et al. (2021) focused on identifying articles related to the intersection of blockchain and higher education with a view toward quality 4.0 transformation, while others have provided broad overviews of this topic. However, these reviews have primarily taken a straightforward approach, summarizing published articles and topical areas (Keogh et al., 2020). While each of these studies has offered valuable insights, a more rigorous analysis of this literature, including bibliometric, co-citations, bibliographic connections and co-occurrences, can yield previously undiscovered insights. Bibliometric analysis is a potent method for identifying emerging research areas (Ellegaard & Wallin, 2015; Fahimnia et al. 2015; Merediz-Solà & Bariviera, 2019). Moreover, it aids in recognizing influential researchers, research clusters, affiliated organizations and the countries contributing the most to this field (Jalali et al., 2019; Mishra, 2015; Muhuri et al., 2019). This study offers a comprehensive assessment of the field by conducting bibliometric analyses of co-citations, bibliographic connections and co-occurrences, starting with a dataset of 134 published articles on the use of blockchain in higher education. Specifically, our study aims to reveal the publication and citation structure, influential authors, affiliated institutions and countries, prevalent research themes and research methodologies. To achieve this, we collected and analyzed all 134 documents from Scopus without imposing any year restrictions, employing various bibliometric techniques and the Visualization of Similarities (VOS) viewer software (Adams et al., 2017).

This study is one of the first to systematically use bibliometric analysis to this burgeoning field of research, which adds something new to the body of literature already available on blockchain in education. In contrast to earlier research that concentrated on certain applications, including credentialing or decentralized learning, this study provides an exhaustive, data-driven summary of the state of the art in blockchain-related education research. Through an examination of publishing trends, citation patterns, prominent authors and important research clusters, the study offers fresh perspectives on the development and situation of BT in education today. Some related issues, such as ethical considerations of blockchain adoption in education are also taken into account.

Furthermore, the research highlights significant deficiencies in the existing body of literature, namely with extensive real-world application, cross-disciplinary cooperation, and the amalgamation of BT with artificial intelligence (AI) and cloud computing (IoT). Based on these bibliometric results, a future research agenda is suggested that emphasizes untapped potential for field advancement and emphasizes the need for empirical research, policy development and innovative pedagogy. This article offers a strategic framework for guiding future academic efforts and practical implementations, in addition to serving as a guide for scholars and educators interested in understanding blockchain's role in education.

2. Literature review

2.1. Blockchain literature in general

The capacity of BT to provide safe, unchangeable records has been used to enhance the administration of student data. BT, according to Yaga et al. (2019), can completely transform student information systems by enabling the creation of a decentralized repository that securely stores student data, grades and learning histories. Blockchain guarantees that data is immutable and available to authorized users only, in contrast to traditional centralized databases that are vulnerable to hacking or data loss. This data management process simplification might improve data privacy and reduce administrative overhead, particularly in light of the rising concern about student data protection.

An increasing corpus of research examines how decentralized learning systems powered by BT might upend established educational paradigms. Chen et al. (2019), for example, suggest blockchain-based platforms that support peer-to-peer learning settings, eschewing institutional control and allowing students to communicate with content authors directly. These kinds of platforms have the potential to

provide teachers and students more autonomy, which would promote a more open and democratic educational system. Blockchain may also be used to monitor how well students are learning, giving them immediate feedback and encouraging them to keep learning by rewarding them with tokenization systems when they finish classes or acquire particular abilities (Turkanovic et al., 2018).

In an effort to improve educational institutions, recent research has started looking at how blockchain may be integrated with other cutting-edge technologies like smart contracts, the Internet of Things and AI. In order to provide individualized learning experiences, for instance, Alammary et al. (2019) propose mixing blockchain with AI. In this scenario, the blockchain safely records and monitors each learner's unique learning path, and AI uses the data to create educational content that is specifically suited to the individual. It has also been suggested that blockchain and IoT be integrated to create 'smart classrooms,' where digital and physical infrastructures collaborate to improve learning results and student engagement (Zhang et al., 2020). However, much of the literature in this area remains theoretical, with few practical implementations in educational settings.

2.2. Literature review on blockchain in education

Ever since the emergence of BT in the realm of higher education, scholars have shown a keen interest in exploring its effects, functionalities, advantages and the hurdles encountered by educational institutions during its implementation. Adams et al. (2017) underscored the importance of establishing suitable regulatory frameworks to keep pace with technological advancements. It has become evident that a continuous demand exists for practical use cases, real-world demonstrations, standardization, and linguistic consistency. Taskinsoy (2019) asserted that BT has ushered in a transformative era in the way educational institutions operate and influence lifestyles.

The utilization of quantitative tools in conjunction with bibliographic data is known as the 'bibliometric approach' (Baier-Fuentes et al., 2019). Bibliometric research is a well-established field of inquiry across various scientific disciplines, including management (Bonilla et al., 2015). Researchers can now effectively handle large volumes of bibliographic data while avoiding biases (Börner et al., 2003). 'Bibliometrics' involves the measurement and statistical analysis of books and other literary works (Broadus, 1987). In contrast, bibliometrics aims to describe the process of textual communication and track the evolution of various communication aspects by means of counting and analysis (Broadus, 1987). To comprehend how written communication functions and has evolved over time within a specific field, bibliometrics can be employed (Pradana et al., 2019).

After gathering information through an analysis of the Scopus database, we defined terms, phrases, and keywords related to the research topic. Prior to eliminating duplicates, non-peer-reviewed articles and irrelevant contents, we defined the time range, subject area, document type (articles, reviews and conference papers) and language. The network visualization of co-citation, bibliographic coupling and keyword co-occurrence was then done using VOSviewer. Following that, a descriptive analysis of the findings was conducted, taking into account the most prolific authors, institutions, countries, document types and publication trends. We used clustered algorithms to find key research themes and trends, as well as citation networks and keyword co-occurrence to identify research themes and trends for discussion of potential future research directions. Using overlay visualization, we also looked at how the focus of our research has changed over time.

This study focuses on the application of blockchain in higher education and related topics using international publications available in the Scopus database, without any restrictions on the publication year. To gain an overall understanding of the publications, we conducted a search for terms we deemed relevant to this research, specifically (TITLE-ABS-KEY ('blockchain') OR TITLE-ABS-KEY ('block-chain') AND TITLE-ABS-KEY ('higher education') OR TITLE-ABS-KEY ('universit*')) AND (LIMIT-TO (SUBJAREA, 'SOC') OR LIMIT-TO (SUBJAREA, 'BUS') OR LIMIT-TO (SUBJAREA, 'ECON')) AND (LIMIT-TO (DOCTYPE, 'ar')) in titles, abstracts, or keywords. There were 134 results for this search. As of 29 October 2023, we have gathered the information required for examination. Since we would want to investigate the applications of blockchain in education as have been covered in social science literature, we restrict the scope to those fields. However, in order to broaden the discussion, we also include accounting, finance, econometrics and business management.

3. Research methodology

The year of publication trends in blockchain research within higher education reveal a notable growth in recent years. While the field saw limited activity in 2016 and 2017 with only one publication each year, there has been a substantial increase in research output from 2018 onwards. In 2018, the number of publications increased to seven, and it continued to rise steadily in the following years. The most significant growth occurred between 2020 and 2022, with publications increasing from 26 to 37, reflecting a strong interest and investment in BT within the higher education sector. In 2023, there was a slight decrease to 26 publications, which might indicate a stabilization or a temporary shift in research focus. Overall, the increasing trend from 2018 to 2022 suggests that BT is becoming a more prominent topic in higher education research (Table 1).

The reviewed articles are also categorized according to the authors who have published articles on the topic of blockchain in higher education; Table 2 displays the top 3 authors with their articles title.

According to Table 2, one notable author published three publications between 2016 and 2023, while the other authors wrote just one piece each. As can be seen from Table 3's top ranking of cited article titles from the time of publication to the writing of this work, the majority of citations are from articles published in 2020.

The table above shows the ratings for the most citations. With 147 citations, the 2020 article by Lizcano et al. published in the *Journal of Computing in Higher Education* is presently (in 2023) at the top of the list. By utilizing BT to establish a decentralized trust model for academic transactions, encompassing material, teaching and competences, Lizcano et al. (2020) focus on the scope of higher education. This study makes a strong case for the application of BT to promote confidence in accessible, all-encompassing higher education. The authors present a blockchain-based approach that tackles important issues such credential verification, academic record security and the requirement for process openness in education. Their study demonstrates how BT might be used to create decentralized, impenetrable systems that improve educational institutions' efficiency and trustworthiness.

The research highlights how BT may foster confidence between instructors and students by guaranteeing that academic records and accomplishments are safe, vetted and easily available to all. It also shows that BT may be used in higher education to foster trust, but the authors also point out that further research is necessary to determine how scalable these systems might be and what ethical and legal ramifications might arise from their broad use. Overall, our work lays the groundwork for the application of BT to improve trust in transparent, open learning settings, opening the door to more safe, open and effective educational institutions. This research and the one by Jirgensons & Kapenieks (2018) aim to overcome the difficulties of contemporary, distributed higher education by bridging the knowledge gap between academics and employability through the use of consensus among students, trainers, and employers. Any training facility can use the suggested methodology, which has been confirmed by industry employers through a prototype, to customize instruction to meet the needs of certain professional profiles. Jirgensons & Kapenieks. (2018) demonstrate how BT may completely change the issuance, verification and management of educational certificates, assuring increased security, dependability and transparency in the credentialing procedures. The authors contend that the problems with traditional systems – diploma fraud, inefficient verification processes and a lack of confidence between employers and educational institutions – can be solved by blockchain's decentralized and tamper-proof nature. According to the study, BT can expedite the credentialing procedure, improving its effectiveness and

Table 1. Numbers of article (2012–2022).

Year	Number of article
2016	1
2017	1
2018	7
2019	12
2020	26
2021	24
2022	37
2023	26
Total	134

Table 2. Top authors.

Author	Numbers of article	Article title
Bucea-Manea-țoniș, R.	3	Artificial Intelligence Potential in Higher Education Institutions Enhanced Learning Environment in Romania and Serbia The Potential of Blockchain Technology in Higher Education as Perceived by Students in Serbia, Romania, and Portugal
Cassandra, C.	2	Blockchain technology enhances sustainable higher education Recording of student attendance with blockchain technology to avoid fake presence data in teaching learning process
Flanagan, B.	2	Education value Chain model for examination, grading, and evaluation process in higher education based on blockchain technology Managing lifelong learning records through blockchain Learning analytics platform in higher education in Japan

Table 3. Top citations.

Citation	Authors	Titles	Year	Journal
147	Lizcano, D., Lara, J. A., White, B., & Aljawarneh, S	Blockchain-based approach to create a model of trust in open and ubiquitous higher education	2020	Journal of Computing in Higher Education
138	Jirgensons M. & Kapenieks, J.	Blockchain and the Future of Digital Learning Credential Assessment and Management	2018	Journal of Teacher Education for Sustainability
93	Ocheja, P., Flanagan, B., Ueda, H., & Ogata, H	Managing lifelong learning records through blockchain	2019	Research and Practice in Technology Enhanced Learning
75	Williams P.	Does competency-based education with blockchain signal a new mission for universities?	2019	Journal of Higher Education Policy and Management
62	Fedorova E.P & Skobleva, E.	Application of blockchain technology in higher education	2020	European Journal of Contemporary Education
56	Flanagan B. & Ogata, H.	Learning analytics platform in higher education in Japan	2018	Knowledge Management and E-Learning
41	Ralston S.J.	Higher Education's Microcredentialing Craze: a Postdigital-Deweyan Critique	2021	Postdigital Science and Education
38	Arndt T. & Guercio, A.	Blockchain-based transcripts for mobile higher-education	2020	International Journal of Information and Education Technology
34	Kuzior A. & Sira, M.	A Bibliometric Analysis of Blockchain Technology Research Using VOSviewer	2022	Sustainability (Switzerland)
34	Li, Z. Z., Tao, R., Su, C. W., & Lobonț, O. R	Does Bitcoin bubble burst?	2019	Quality and Quantity

accessibility for educators, employers and students. Additionally, it implies that BT can help the lifelong learning paradigm by facilitating learners' ability to securely gather, organize and share their accomplishments across various platforms and institutions.

4. Result and discussion

In this section, the study employs a visual graphic representation with the assistance of VOSviewer software to delve deeper into the findings of a meta-analysis on blockchain in higher education. The analysis identifies significant terms in various articles and maps their co-occurrence relationships. This mapping reveals the interplay between different elements of knowledge and configuration. Figure 3 provides a visual representation akin to a cloud map, illustrating word frequencies in articles and their connections. Each term is represented by a circle, with circle size indicating its frequency in publications. Colors group related terms into clusters, and the connections' curvature roughly indicates the frequency of their interactions. The line thickness signifies the strength of associations between thematic areas or keywords, effectively illustrating relationships between various topics.

The network visualization resulted in a map with 111 items divided into five clusters (Cluster 1 with 28 items, Cluster 2 with 38 items, Cluster 3 with 21 items, Cluster 4 with 19 items and Cluster 5 with 15 items). There are a total of 654 links with a link strength of 868. The network map is presented in Figure 1.

In the realm of higher education, the integration of BT has given rise to diverse clusters of interest and exploration. Cluster 1 (red color) underscores the foundational technological aspects of blockchain

divided into five distinct clusters, each representing a key area of blockchain-related research in higher education. These clusters illustrate a multifaceted landscape, where different elements of BT are explored in relation to educational applications.

As seen in Figures 1 and 2, network and overlay analysis reveal 654 links and a link strength of 868, demonstrating strong interconnections between different blockchain-related topics in higher education. The overlay analysis provides additional insights by tracing the historical trajectory of research, indicating that research activity in this domain has seen a decline since 2022. This decline could indicate a shift in focus to other emerging technologies or a saturation in the existing body of research. The density visualization (Figure 3) further illustrates the concentration of research activity within the topic area. The deeper yellow hues indicate areas where blockchain, higher education, AI and bitcoin have been subjects of intensive academic inquiry, while bluer areas show topics that have received less attention. The network, overlay and density analyses underscore the diverse and dynamic nature of blockchain research in higher education. The five clusters provide a comprehensive view of the thematic areas being explored, from technological foundations to strategic integration and pedagogical transformation.

The findings highlight both the areas of strong research activity and those requiring further investigation, offering a roadmap for future research in this evolving field. Afterwards, the visualization helps to identify areas ripe for further exploration. Finally, the study includes a country-level analysis, highlighting the geographical distribution of blockchain research in higher education. The United States leads in published articles, followed by China, India and the United Kingdom. Some similar tendencies appear, even if the US, China, India and the UK all take different approaches to the implementation of BT in education. In all four of the nations, credentialing and verification are the most common use cases. Blockchain provides an efficient and safe means of issuing and verifying academic credentials, which is particularly important for international job mobility.

The discussion explores key themes identified in the literature and highlights areas for future research and practical implementation. Various countries are investigating the potential of BT to augment customized education and facilitate data-driven decision-making in academic establishments. Another important trend in education is decentralization, which is facilitated by BT, which enables peer-to-peer learning and the democratization of educational materials. This is relevant in areas like the US and India, where school accessibility is a big challenge. Additionally, blockchain's decentralized nature raises questions about governance and control in countries with more centralized educational systems like China.

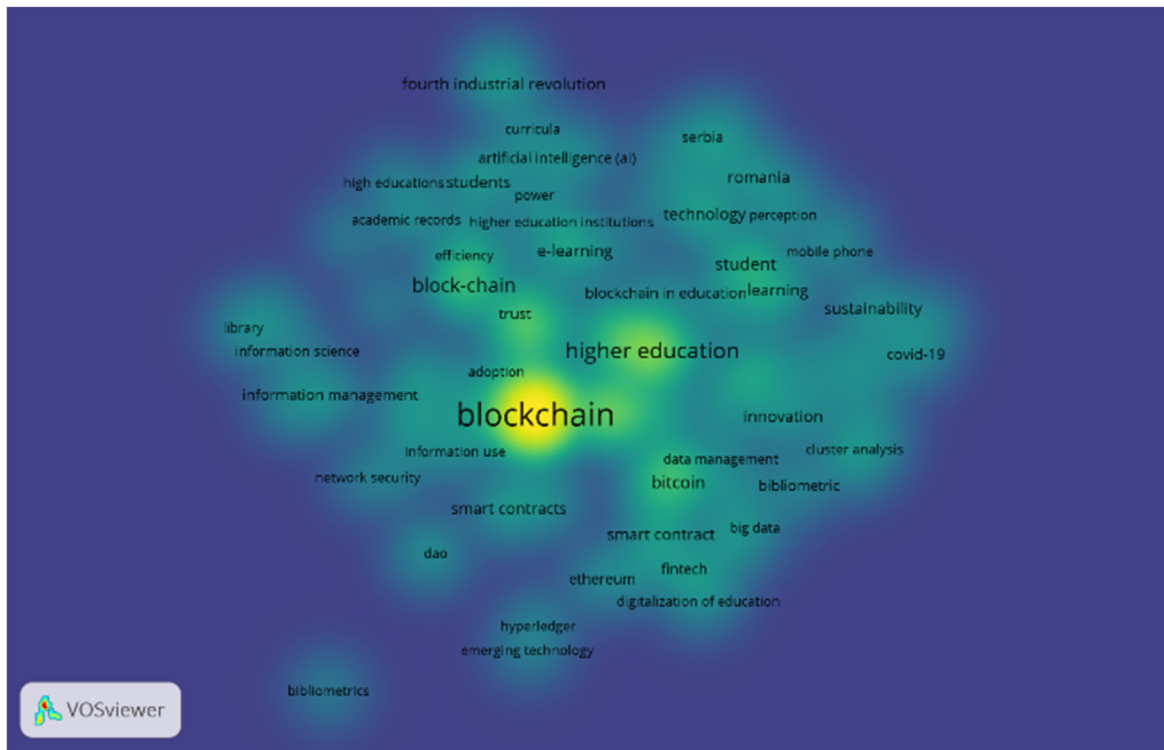
The analysis reveals that BT is being adopted at varying rates and for different purposes in these prominent regions. While credentialing, trust, and data security remain primary drivers, each country is exploring additional use cases based on its educational context and technological landscape. Moving forward, these countries will need to address regulatory hurdles, privacy concerns and the cost of implementation to fully realize the potential of blockchain in transforming education. The findings from this bibliometric study provide valuable insights into the current landscape, challenges and opportunities associated with BT in education.

5. Conclusion

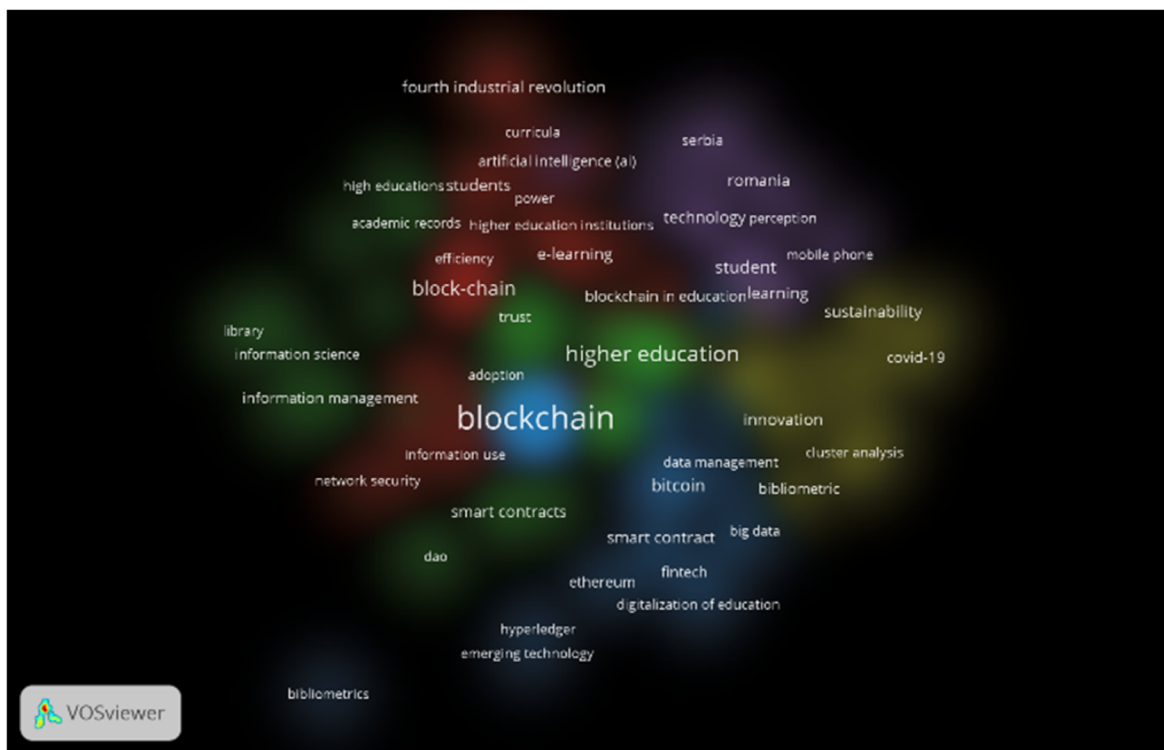
This bibliometric analysis offers a thorough summary of the state of blockchain research in education today, emphasizing important research clusters, prominent writers and emerging trends. It is clear from a thorough network and cluster analysis that BT has the power to completely transform a range of educational processes, including decentralized learning platforms and safe credentialing. Blockchain's disruptive potential is further enhanced by its integration with new technologies like banking, the Internet of Things and AI. Several important research gaps are identified by the study, especially in relation to large-scale deployment, multidisciplinary cooperation and empirical studies into the long-term effects of blockchain in education. The results highlight the necessity of further investigation into underrepresented fields and the provision of factual data to back blockchain-based educational solutions.

5.1. Theoretical and practical implications

The geographical study of major contributors based on the US, China, India and UK further emphasizes the significance of adopting BT from a global viewpoint. There is a growing consensus on the



(a)



(b)

Figure 3. (a) Item density; (b) Cluster density.

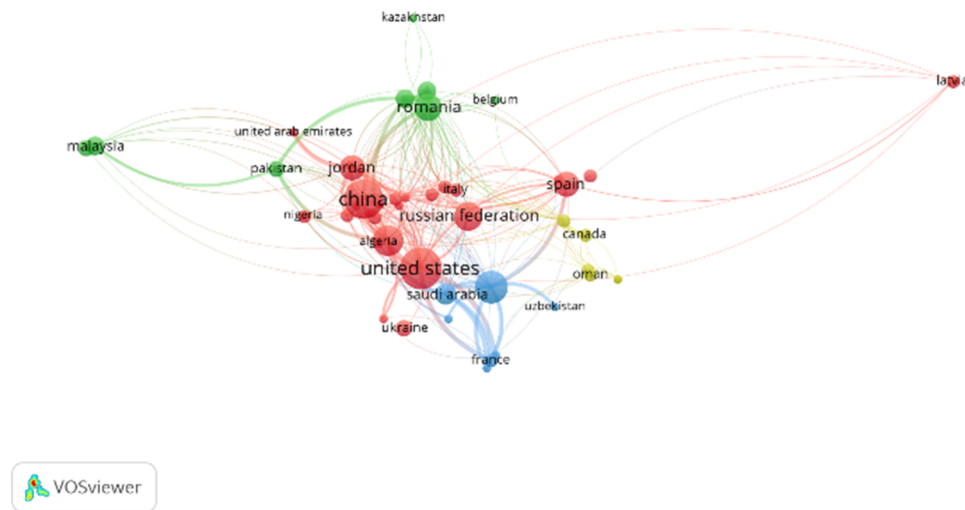


Figure 4. Countries analysis.

Table 4. Top countries.

Countries	Documents	Citations
United States	19	267
China	17	82
India	12	55
United Kingdom	10	197
Russian Federation	9	98
Romania	8	106
Jordan	7	191
Spain	7	191
Saudi Arabia	5	39
Portugal	4	84

importance of blockchain in promoting trust, security and innovation in education, despite the fact that each location has its own set of possibilities and obstacles. The suggested future study agenda asks for more in-depth investigation of real-world applications, regulatory frameworks and innovative teaching strategies powered by BT. Through tackling these domains, forthcoming investigations might augment the efficacious and enduring assimilation of BT in erudition, molding the trajectory of scholarly establishments' operations, cooperation and dissemination of knowledge to students throughout the globe. Conducting cross-cultural studies might help to understand the adoption barriers of blockchain in underfunded and developing educational systems.

For practical implications, we found that there is a need to provide training sessions for educators, administrators and policymakers on blockchain applications and benefits in education. Decentralized and peer-to-peer learning platforms made possible by BT enable direct communication between teachers and students without the need for middlemen. Smart contracts can guarantee equitable remuneration for educators according to their contributions and automate payment procedures. From a practical perspective, the integration of blockchain in education presents both opportunities and challenges. Institutions can leverage blockchain for efficient record-keeping, fraud prevention and reducing administrative burdens. However, the cost of implementation, lack of awareness and resistance to change among educators and administrators are significant hurdles.

5.2. Limitations and future research directions

The study has provided a systematic overview of the evolving landscape of BT in higher education, highlighting its multifaceted applications and the growing interest in this field. However, it is important to acknowledge certain limitations, including the potential bias in data selection from the Scopus database and the absence of a temporal analysis to track trends over time. Future research in this area

should consider conducting a systematic review to offer more in-depth insights and explore the potential challenges and ethical considerations of blockchain adoption in education. Additionally, investigating the impact of blockchain on student experiences and the broader educational ecosystem is an avenue for further exploration. Moreover, a longitudinal study could shed light on the sustained growth and changes in the field over time, providing a more nuanced understanding of the role of blockchain in higher education. The analysis reveals a need for more empirical studies to validate blockchain's practical benefits and its alignment with educational goals. Future research should also focus on addressing ethical concerns and governance issues in blockchain implementations.

Author's contributions

Iis Kurnia Nurhayati carried out the field survey.
Mohamad Ibrani Shahrimin Adam Assim conducted data analysis and the optimization.
Nia Kurniasih was responsible for the writing of the initial draft.
Harry Nuriman was responsible for the final draft and review.
Mahir Pradana was responsible for the field survey.
Alila Pramiyanti was responsible for the conceptualization and review.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The research received no research funding.

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Availability of data and materials

The datasets used and/or analyzed during this investigation are available upon reasonable request from the corresponding author.

References

- Adams, R., Parry, G., Godsiff, P., & Ward, P. (2017). The future of money and further applications of the blockchain. *Strateg. Change*, 26(5), 417–422. <https://doi.org/10.1002/jsc.2141>
- Alammary, A., Alhazmi, S., Almasri, M., & Gillani, S. (2019). Blockchain-based applications in education: A systematic review. *Applied Sciences*, 9(12), 2400. <https://doi.org/10.3390/app9122400>
- Alshahrani, M., Beloff, N., & White, M. (2020). Revolutionising higher education by adopting Blockchain technology in the certification process. *2020 International Conference on Innovation and Intelligence for Informatics, Computing and Technologies (3ICT)* (pp. 1–6). IEEE.
- Alzahrani, B., Bahaitham, H., Andejany, M., & Elshennawy, A. (2021). How ready is higher education for quality 4.0 transformation according to the LNS research framework? *Sustainability*, 13(9), 5169. <https://doi.org/10.3390/su13095169>
- Aste, T., Tasca, P., & Di Matteo, T. (2017). Blockchain technologies: The foreseeable impact on society and industry. *Computer Magazine*, 50(9), 18–28. <https://doi.org/10.1109/MC.2017.3571064>
- Awaji, B., Solaiman, E., & Albshri, A. (2020). Blockchain-based applications in higher education: A systematic mapping study. *Proceedings of the 5th International Conference on Information and Education Innovations* (pp. 96–104). Association for Computing Machinery.
- Baier-Fuentes, H., Merigó, J. M., Amorós, J. E., & Gaviria-Marín, M. (2019). International entrepreneurship: A bibliometric overview. *International Entrepreneurship and Management Journal*, 15(2), 385–429. <https://doi.org/10.1007/s11365-017-0487-y>
- Bonilla, C. A., Merigó, J. M., & Torres-Abad, C. (2015). Economics in Latin America: A bibliometric analysis. *Scientometrics*, 105(2), 1239–1252. <https://doi.org/10.1007/s11192-015-1747-7>
- Börner, K., Chen, C., & Boyack, K. W. (2003). Visualizing knowledge domains. *Annual Review of Information Science and Technology*, 37(1), 179–255. <https://doi.org/10.1002/aris.1440370106>
- Broadus, R. N. (1987). Toward a definition of 'bibliometrics'. *Scientometrics*, 12, 373–379. <https://doi.org/10.1007/BF02016680>
- Castro, R. Q., & Au-Yong-Oliveira, M. (2021). Blockchain and higher education diplomas. *European Journal of Investigation in Health, Psychology and Education*, 11(1), 154–167. <https://doi.org/10.3390/ejihpe11010013>
- Cavanagh, M. (2011). Students' experiences of active engagement through cooperative learning activities in lectures. *Active Learning in Higher Education*, 12(1), 23–33. <https://doi.org/10.1177/1469787410387724>
- Chen, L., Lee, W. K., Chang, C. C., Choo, K. K. R., & Zhang, N. (2019). Blockchain based searchable encryption for electronic health record sharing. *Future Generation Computer Systems*, 95, 420–429. <https://doi.org/10.1016/j.future.2019.01.018>
- Dharmalingam, R., Ugail, H., Shivasankarappa, A. N., & Dharmalingam, V. (2022). Framework for digitally managing academic records using blockchain technology. *Mobile computing and sustainable informatics: Proceedings of ICMCSI 2021* (pp. 633–645). Springer.
- Ellegaard, O., & Wallin, J. A. (2015). The bibliometric analysis of scholarly production: How great is the impact? *Scientometrics*, 105(3), 1809–1831. <https://doi.org/10.1007/s11192-015-1645-z>
- Fahimnia, B., Sarkis, J., & Davarzani, H. (2015). Green supply chain management: A review and bibliometric analysis. *International Journal of Production Economics*, 162, 101–114. <https://doi.org/10.1016/j.ijpe.2015.01.003>
- Grech, A., Venkataraman, B., & Fengchun, M. (2022). *Education and blockchain*. UNESCO. Accessed: Oct. 30, 2023. <https://www.um.edu.mt/library/oar/handle/123456789/108074>
- Hewa, T. M., Hu, Y., Liyanage, M., Kanhare, S. S., & Ylianttila, M. (2021). Survey on blockchain-based smart contracts: Technical aspects and future research. *IEEE Access*, 9, 87643–87662. <https://doi.org/10.1109/ACCESS.2021.3068178>
- Huynh, T. T., Huynh, T. T., Pham, D. K., & Ngo, A. K. (2018). Issuing and verifying digital certificates with blockchain. *2018 International Conference on Advanced Technologies for Communications (ATC)* (pp. 332–336). IEEE.

- Iansiti, M., & Lakhani, K. R. (2017). The truth about blockchain. *Harvard Business Review*, 95(1), 118–127. <https://hbr.org/2017/01/the-truth-about-blockchain>
- Jalali, M. S., Razak, S., Gordon, W., Perakslis, E., & Madnick, S. (2019). Health care and cybersecurity: Bibliometric analysis of the literature. *Journal of Medical Internet Research*, 21(2), e12644. <https://doi.org/10.2196/12644>
- Javaid, M., Haleem, A., Pratap Singh, R., Khan, S., & Suman, R. (2021). Blockchain technology applications for Industry 4.0: A literature-based review. *Blockchain: Research and Applications*, 2(4), 100027. <https://doi.org/10.1016/j.bcra.2021.100027>
- Jirgensons, M., & Kapenieks, J. (2018). Blockchain and the future of digital learning credential assessment and management. *Journal of Teacher Education for Sustainability*, 20(1), 145–156. <https://doi.org/10.2478/jtes-2018-0009>
- Keogh, J. G., Rejeb, A., Khan, N., Dean, K., & Hand, K. J. (2020). Optimizing global food supply chains: The case for blockchain and GSI standards. *Building the future of food safety technology* (p. 171). Elsevier Science.
- Kwilinski, A. (2019). Implementation of blockchain technology in accounting sphere. *Academy of Accounting and Financial Studies Journal*, 23, 1–6. <https://www.abacademies.org/articles/implementation-of-blockchain-technology-in-accounting-sphere-8219.html>
- Lizcano, D., Lara, J. A., White, B., & Aljawarneh, S. (2020). Blockchain-based approach to create a model of trust in open and ubiquitous higher education. *Journal of Computing in Higher Education*, 32(1), 109–134. <https://doi.org/10.1007/s12528-019-09209-y>
- Merediz-Solà, I., & Bariviera, A. F. (2019). A bibliometric analysis of bitcoin scientific production. *Res. Int. Bus. Finance*, 50, 294–305. <https://doi.org/10.1016/j.ribaf.2019.06.008>
- Mishra, A. (2015). IMPULSE PURCHASE BEHAVIOUR: A REVIEW. *International Journal of Management & Information Technology*, 10(7), 2333–2342. <https://doi.org/10.24297/ijmit.v10i7.599>
- Muhuri, P. K., Shukla, A. K., & Abraham, A. (2019). Industry 4.0: A bibliometric analysis and detailed overview. *Engineering Applications of Artificial Intelligence*, 78, 218–235. <https://doi.org/10.1016/j.engappai.2018.11.007>
- Pradana, M., Wahyuddin, S., Syarifuddin, S., & Putra, A. (2019). Gap analysis of Indonesian state-owned bank internet banking website. *Proceedings of the International Conference on Industrial Engineering and Operations Management* (pp. 1235–1244). Springer International Publishing.
- Sowmiya, B., & Poovammal, E. (2022). A heuristic K-anonymity based privacy preserving for student management hyperledger fabric blockchain. *Wireless Personal Communications*, 127(2), 1359–1376. <https://doi.org/10.1007/s11277-021-08582-1>
- Tapscott, D., & Tapscott, A. (2017). How blockchain will change organizations. *MIT Sloan Manag. Rev*, 58(2), 10. <https://sloanreview.mit.edu/article/how-blockchain-will-change-organizations/>
- Taskinsoy, J. (2019). Blockchain: A misunderstood digital revolution. Things you need to know about blockchain. Things you need know blockchain. *SSRN Electronic Journal*, 1–25. <http://dx.doi.org/10.2139/ssrn.3466480>.
- Turkanović, M., Hölbl, M., Košič, K., Heričko, M., & Kamišalić, A. (2018). EduCTX: A blockchain-based higher education credit platform. *IEEE Access*, 6, 5112–5127.
- Yaga, D., Mell, P., Roby, N., & Scarfone, K. (2019). Blockchain technology overview. *arXiv preprint arXiv:1906.11078*.
- Zhang, J., Zhong, S., Wang, T., Chao, H. C., & Wang, J. (2020). Blockchain-based systems and applications: A survey. *Journal of Internet Technology*, 21(1), 1–14.