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Blockchain Technology for Higher Education and Recruitment: A Systematic Literature Review

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Abstract

Blockchain is a recent technological innovation that has undergone significant growth with numerous business applications. One of the most promising applications of blockchain technology lies within the domains of higher education and recruitment. Despite its potential, academic literature on these topics remains limited. In this study, the researchers conducted a systematic literature review to unravel blockchain's potential applications in higher education and recruitment. This paper identifies the current benefits and challenges of blockchain in these fields and delineates key steps in higher education and recruitment processes to determine blockchain practical applications. To analyze the potential benefits and challenges of blockchain for higher education and recruitment, we integrate the resource-based view (RBV) and transaction cost theory (TCT). The RBV is employed to underscore blockchain's potential as a strategic resource that can provide competitive advantages in higher education, while the TCT is utilized to focus on its efficacy in reducing transaction costs related to recruitment. The study concludes by highlighting directions for future research, emphasizing the imperative for empirical investigations into real-world blockchain applications. It also encourages theoretical advancements to deepen our understanding of the impact of blockchain technology on higher education and recruitment.

Keywords: *Blockchain, Human Resources, Recruitment, Systematic Literature Review, Higher Education.*

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1. Introduction

Organizations spend considerable time and money hiring the most qualified and appropriate applicants (Keršič et al., 2019). However, according to a CareerBuilder survey, nearly three in four employers admitted that they had recruited the wrong applicant for a position (CareerBuilder, 2017). Besides the unsatisfactory performance of organizations in the recruitment process, higher education institutions do not fully prepare students for job positions as their education usually falls behind the job market's needs. To address these concerns, more recently, it has been argued that using technology can positively affect higher education (Flavin, 2016) and the recruitment processes (Abdul et al., 2020). Among the different digital technologies, blockchain is one of the most trending technologies that can transform businesses (Chillakuri & Attili, 2021).

Blockchain is a peer-to-peer distributed database consisting of a continuously growing chain of blocks. It can help organizations find the best applicants according to each organization's requirements (Onik et al., 2018), match the right applicants to the right positions more accurately and effectively (Fachrunnisa & Hussain, 2020), accelerate the recruitment process, and decrease the recruitment cost by eliminating the need for a third-party company to verify the applicants' background (Salah et al., 2020). Aside from blockchain's potential for recruitment, it may advance higher education. Learners can receive timely and frequent feedback (Hameed et al., 2019), be motivated to devote more effort to their education process to get digital currency as rewards (Chen et al., 2018), and be involved in a more transparent and straightforward process to validate their credentials (Castro & Au-Yong-Oliveira, 2021). Blockchain also supports instructors by preserving their ownership rights for course materials (Alammary et al., 2019), and updating them on the industry-required competencies for workforces to design their courses based on real market needs (Fachrunnisa & Hussain, 2020).

Despite the blockchain benefits, there is still a lack of research aimed at developing a broader understanding of blockchain benefits for higher education and recruitment processes. This can serve as an obstacle for researchers in identifying the research gaps based on the current knowledge and for practitioners trying to connect the current knowledge to the real world. In addition, there is a dearth of research that addresses the collaboration between higher education and recruitment from the blockchain perspective.

This paper systematically reviews the potential application of blockchain in higher education and recruitment by mapping the relevant steps in these processes. Furthermore, it reviews potential blockchain benefits for higher education and recruitment through the lenses of the resource-based view (RBV) and transaction cost theory (TCT), respectively. In addition to exploring blockchain's benefits in these domains, the paper examines its impact on the collaboration between higher education and recruitment. Such collaboration could narrow the gap between job

market needs and higher education outcomes. Also, this collaboration may lead to a more efficient recruitment process. Therefore, this study specifically aims to address the following three questions:

- What are the applications of blockchain in higher education and recruitment?
- How does blockchain affect the collaboration between higher education and recruitment?
- What are the main directions for future research?

Our contributions to this research can be summarized as follows. First, previous studies mainly focused on the technical aspect of blockchain adoption in higher education and recruitment, primarily through developing systems and platforms (Alnafrah & Mouselli, 2021; Delgado-von-Eitzen et al., 2021b; Mishra et al., 2021; Rama Reddy et al., 2021). In contrast, our study takes a novel approach by providing a comprehensive managerial perspective on the applications of blockchain in these domains. This shift allows us to explore the broader implications of blockchain beyond its technical functionalities. Second, the theoretical underpinnings of blockchain applications in higher education and recruitment remain underexplored. Our study seeks to fill this void by incorporating theoretical frameworks such as the RBV and TCT to analyze the potential benefits and challenges of blockchain. Finally, a few studies analyze whether blockchain can enhance collaboration between higher education and recruitment. By examining this aspect, our study contributes valuable insights into the broader implications of blockchain adoption in bridging the gap between higher education and job recruitment, thereby enriching the current understanding of this technological innovation.

2. Blockchain Definition

Blockchain is one of the most disruptive technologies in today's world (Rahardja et al., 2021). The constantly rising popularity of Bitcoin as the first real-world application of blockchain (Awaji et al., 2020) has attracted researchers' and practitioners' attention to examining blockchain's application for various business purposes (Li et al., 2021). In the blockchain, each new block in the chain is added to the previous block. The chain of blocks works as a digital ledger accessible to all blockchain network members. Once a transaction occurs and is added to a block, it cannot be changed (Saberi et al., 2019), and if data alternation is necessary, permission from all members is needed (Rahardja et al., 2021). Four characteristics of blockchain that differentiate it from other information systems are as follows (Saberi et al., 2019):

Decentralization: Blockchain uses a distributed structure for data storage and transmission in a trustless network. The decentralization feature of blockchain can decrease the risk of hacking or corruption since each peer in the network has a copy of the entire transaction history.

Security: Blockchain provides security and privacy for data transferred among peers in the network (Awaji et al., 2020). In the blockchain, each block consists of a group of transactions, its hash key, and the hash key of the previous block. The chronological order of blocks protects property and information since it allows users to track the records in the database leading to increased security.

Auditability: Every node in the blockchain network can verify the validity of a transaction, which means that no single user controls the network. Blockchain provides the possibility to be auditable through any node in the network.

Smart contract: Smart contracts contain a set of rules embedded in computer codes that are automatically executed after a transaction triggers the action (Awaji et al., 2020; Yumna et al., 2019). Smart contract algorithms function on a distributed peer-to-peer network and as a result, eliminate the need for third-party intermediaries (Sherimon et al., 2020).

3. Methodology

A literature review plays a critical role in any research study. It enables researchers to analyze the existing research, find the potential research gaps, and define a research question that, if it is studied, would extend the body of knowledge (Kamble et al., 2018). In this study, as it is displayed in Figure 1, we use the six-step systematic review process defined by Kamble et al. (2018).

3.1. Database Selection

Among different scientific research databases, this study focuses on Scopus and Web of Science as two of the most reliable and extensive databases for accessing previous research.

3.2. Keyword Selection

To find the most reliable and unbiased studies, relevant keywords were identified, and based on them, search strings were constructed such as blockchain AND “human resources,” blockchain AND employee, blockchain AND “labor,” blockchain AND recruitment, “Smart contracts” AND “human resources,” blockchain AND employment, and blockchain AND education.

3.3. Studies Collection

The next step was to apply search strings to each database to find the most relevant studies published by 2021. The initial search led to the identification of 1,897 studies, including 1,355 in Scopus and 542 in Web of Science.

3.4. Filtering

To reach the final articles for review, inclusion, and exclusion criteria were defined and agreed upon by the researchers to prevent any probable bias related to a single decision-maker.

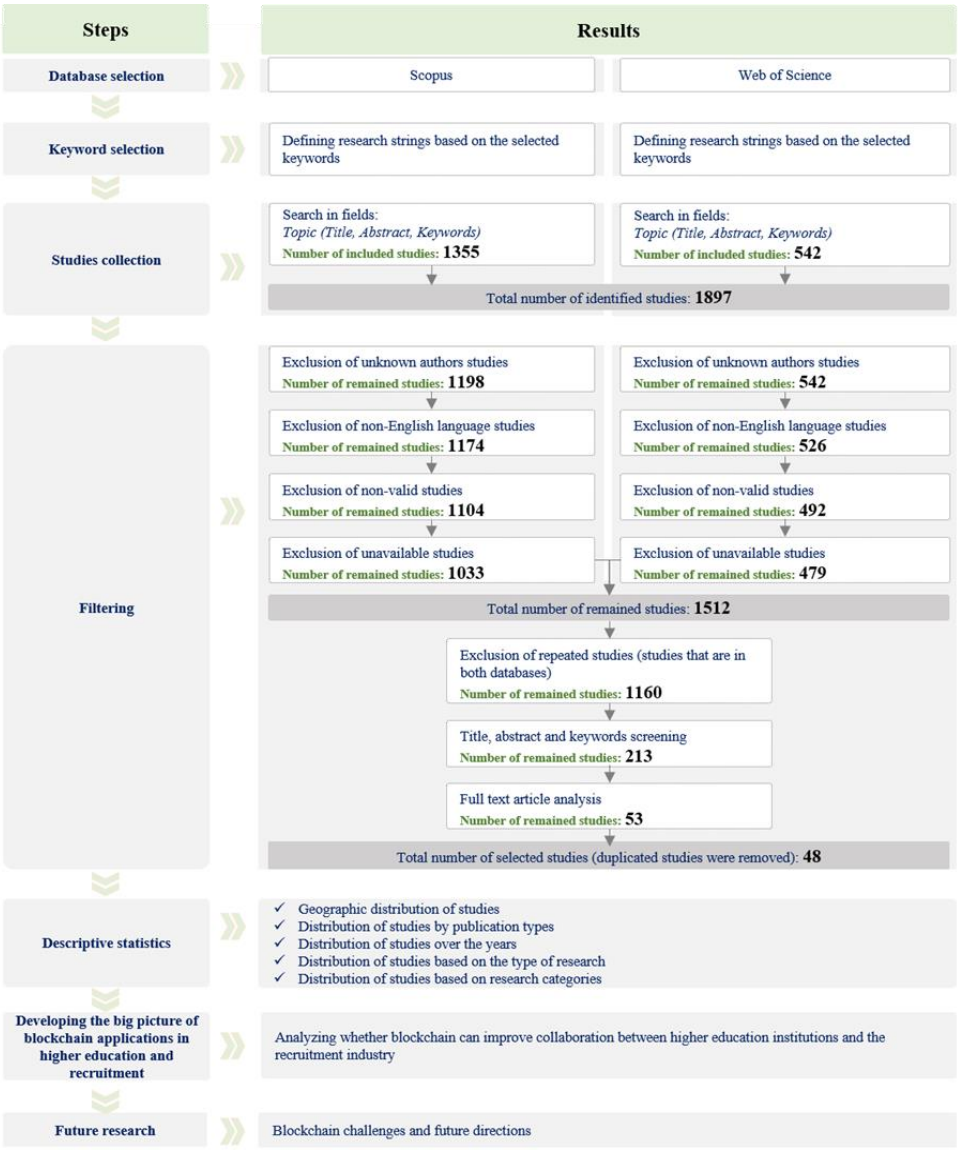

Figure 1. Research Methodology

Studies with unknown authors were removed, leading to a reduction in the number of studies to 1,198 in Scopus and no change in Web of Science. Non-English studies were removed, leading to a decrease to 1,174 and 526 studies in Scopus and Web of Science, respectively. Next, studies published in workshops, symposiums, forums, conventions, or congresses were removed. Studies that were letters, meeting abstracts, or editorial articles were also eliminated, resulting in a reduction to 1,104

studies in Scopus and 492 studies in Web of Science. We included conference papers in our study due to the limited number of papers published in journals, mainly due to the novelty of blockchain. Subsequently, studies that were not available online were removed. Therefore, the number of remaining studies was 1,033 and 479 in Scopus and Web of Science, respectively.

Reviewing both databases, the repeated studies were omitted, giving rise to a further reduction in the total number of studies to 1,160. Next, the studies were discarded if the title, the abstract, and the keywords were not aligned with the three identified research questions. This put the number of remaining studies at 213. Finally, to reach the most appropriate and relevant articles, the full texts of the remaining studies were analyzed. As another exclusion criterion, studies that focused on health education, distance education, and massive online open courses were removed. This resulted in a further decrease in the number of studies to 53. Out of these 53 studies, five of these were duplicates and were therefore removed (e.g., they were presented at conferences and then published in journals as an extension). Therefore, the final number of selected studies was 48.

3.5. Descriptive Statistics

In this step, selected studies were summarized and analyzed from different perspectives in Table 1.

Table 1. Summary of Research Studies

Research category	Authors	Year	Summary	Research approach
Competency Management	Fachrunnisa & Hussain	2020	A blockchain-based human resource framework is presented to fill the competencies gap in the workforce.	Prototype
	Lizcano et al.	2020	A blockchain-based model of confidence in higher education is presented in which students' competencies acquisition is certified.	Prototype
Credit Management	Turkanović et al.	2018	A global blockchain-based higher education credit platform named EduCTX is presented to create a globally trusted higher education credit and grading system.	Prototype
	Srivastava et al.	2018	A blockchain-based credit transfer framework is presented in educational systems.	Conceptual
Document Verification and Certificate Management	Cheng et al.	2018	A blockchain-based digital certificate system is presented to issue and maintain anti-counterfeit certificates.	Conceptual
	Gresch et al.	2018	A blockchain-based system for recording and verifying diplomas according to the University of Zurich's needs is presented.	Case study
	Jeong & Choi	2019	A blockchain-based certificate management platform is presented.	Experimentation

Table 2. Summary of Research Studies (cont.)

Research category	Authors	Year	Summary	Research approach
Document Verification and Certificate Management	Palma et al.	2019	A blockchain-based framework for certificate issuance for higher education in the Brazilian education system is proposed.	Case study
	Kim et al.	2020	A blockchain-based model to create and verify human resources records on a distributed global platform is proposed.	Experimentation
	Caldarelli & Ellul	2021	This study focuses on finding a universally accepted standard for academic transcripts.	Conceptual
	Castro & Au-Yong-Oliveira	2021	This study proposes to benefit from blockchain in higher education certificates and diplomas to minimize the forgery of diplomas.	Conceptual
	Delgado-Von-Eitzen et al.	2021 b	A blockchain-based model to issue, store, and verify formal and informal academic information is proposed.	Conceptual
	Mishra et al.	2021	A blockchain-based system to securely share students' credentials is proposed.	Prototype
	Rahardja et al.	2021	This study investigates the role of blockchain in enhancing e-certificate data security.	Case study
	Rama Reddy et al.	2021	A blockchain-based credential securing, and verification system is designed to store and verify certificates.	Prototype
	Tang	2021	A blockchain-based diploma management solution is presented to store and track diploma data.	Conceptual
	Alnafrah & Mouselli	2021	A national hybrid blockchain-based academic records management platform in the higher education system is designed and tested in low-income countries such as Syria and Sudan.	Case study
	Deenmahomed et al.	2021	A blockchain-based examination, transcript, and certificate system is designed and implemented to improve cross-university collaboration.	Experimentation
Education-Employment Collaboration Management	Liu et al.	2018	An education industry cooperative system based on the blockchain hyperledger framework is proposed.	Conceptual
	Mikroyannidis et al.	2018	This study employs smart blockchain badges in data science education to support learners to improve their career development by offering the most related job aligned to their skills.	Conceptual
	Liyuan et al.	2019	To minimize the difficulty in recruitment background checks, a two-stage blockchain-based education, employment, and skill certification system is proposed.	Experimentation

Table 3. Summary of Research Studies (cont.)

Research category	Authors	Year	Summary	Research approach
Performance Management	Chen et al.	2019	A blockchain-based talent management system is presented to monitor and manage the learning performance and training history.	Conceptual
	Choi et al.	2019	A blockchain-based badge awarding system for performance assessment in education is presented.	Experimentation
	Zhao et al.	2019	A blockchain-based student capability evaluation system is presented to store and trace students' academic performance and achievements.	Conceptual
Recruitment Management	Michailidis	2018	This article investigates how blockchain and AI are affecting human resources practices specifically the recruitment process.	Conceptual
	Onik et al.	2018	A Blockchain-based Recruitment Management System (BcRMS) and Blockchain-based Human Resource Management System (BcHRMS) algorithm are proposed.	Surveys
	Keršič et al.	2019	A blockchain and AI-based platform is proposed to solve employability issues while decreasing cost and time in the recruitment process.	Conceptual
	Dhanala & Radha	2020	A blockchain-based recruitment management system using Ethereum is developed to create a soft and secure recruitment process.	Conceptual
	Sherimon et al.	2020	A blockchain-based platform named "JobChain" is proposed to manage the job recruitment process in the Sultanate of Oman.	Case study
	Rhemananda et al.	2020	Blockchain applications in four stages of the recruitment and selection process is investigated.	Conceptual
Reputation Management	Sharples & Domingue	2016	A blockchain-based reputation management system for education is presented.	Conceptual
Resume Management	Ingold & Langer	2021	The effect of different resume formats such as classical resumes, social media resumes, and blockchain resumes on resume fraud behavior is investigated.	Case study
Scope of Applicability/ Benefits/Challenges	Alammary et al.	2019	The applications of blockchain in education and its benefits and challenges are studied.	Conceptual
	Yumna et al.	2019	This study categorizes common issues faced by educational institutions and discusses how blockchain can help to address the identified issues.	Conceptual
	Hameed et al.	2019	This study explores blockchain-based projects and protocols for academic applications.	Conceptual

Table 4. Summary of Research Studies (cont.)

Research category	Authors	Year	Summary	Research approach
Scope of Applicability/ Benefits/Challenges	Awaji et al.	2020	This study reviews the blockchain applications in higher education and discusses challenges and research gaps needed to be addressed.	Conceptual
	Bhaskar et al.	2020	This study reviews blockchain applications in the education environment and provides its current development, benefits, and challenges in this domain.	Conceptual
	Fedorova & Skobleva	2020	This study reviews the applications of blockchain in the education field to propose an analysis of blockchain opportunities and limitations related to higher education.	Surveys
	Garcia-Font	2020	This study explores the potential education areas in which blockchain can benefit. Associated problems which may hinder its applications are also discussed.	Conceptual
	Salah et al.	2020	Human resource management areas in which blockchain can be applied and blockchain adoption challenges are identified.	Interviews
	Chillakuri & Attili	2021	A conceptual model is developed to illustrate blockchain adoption in human resource management by integrating the resource-based view (RBV) and the unified theory of acceptance (UTAUT) and its extension UTAUT2.	Interviews
	Delgado-Von-Eitzen et al.	2021 a	This study reviews the literature to create an overview of the current status of adopting blockchain in the education field and the potential benefits that it can bring to this domain.	Conceptual
	Li et al.	2021	An integrated blockchain-based human resource management mechanism having a two-level node alliance chain is defined.	Case study
	Loukil et al.	2021	This research reviews blockchain applications in education and identifies research gaps for future study.	Conceptual
	Park	2021	This study explores the potential applications of blockchain in education and discusses its challenges hindering its real-life educational applications.	Conceptual
	Raimundo & Rosário	2021	This paper studies blockchain applications in the higher education field.	Conceptual
	Reis-Marques et al.	2021	The applications of blockchain in higher education are reviewed. In identifying the current gap, future investigations are offered.	Conceptual
	Grech et al.	2021	This article focuses on blockchain applications in education and discusses blockchain-enabled solutions in the European digital credentials sector.	Conceptual

3.5.1. Geographic Distribution of Studies

The research contribution by countries was analyzed based on the authors' affiliations. Figure 2 shows that India, the United Kingdom, Spain, and China are the countries with the most contributions of six, five, four, and four papers, respectively. Portugal, South Korea, and Indonesia follow behind these countries with three studies each.

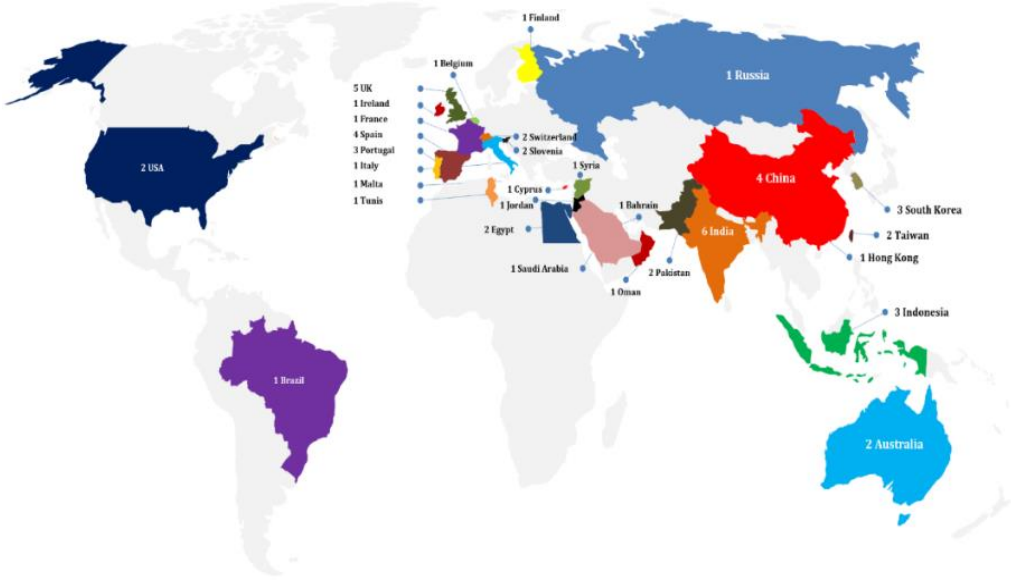

Figure 2. Geographic distribution of studies

3.5.2. Distribution of Studies Over the Years

Research on blockchain applications in education and recruitment started in 2016. The upward trend observed from 2016 to 2021 shows the growing research attention to blockchain in education and recruitment areas (Table 2).

Table 2. Distribution of Studies Over the Years

Year	2016	2018	2019	2020	2021
Number of research	1	8	10	11	18

3.5.3. Distribution of Studies Based on the Type of Research

Figure 3 shows the distribution of the studies based on their methodologies. More than half of the studies adopted a conceptual approach (56%). The remaining studies focused on case studies (15%), prototypes (10%), experimentation (10%), interviews (4%), and surveys (4%).

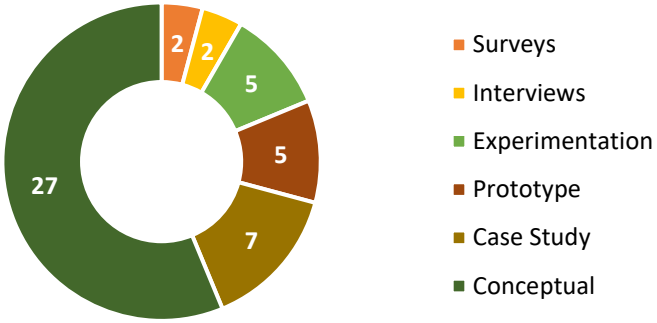

Figure 3. Distribution of Studies Based on the Type of Research

3.5.4. Distribution of Studies Based on Research Categories

The distribution of studies in Figure 4 shows that researchers paid more attention to blockchain applicability in education and recruitment and its benefits and challenges (33%). This is followed by studies that focus on document verification and certificate management (29%), which includes issuing, recording, and verifying academic credentials and certificates. The third category focuses on recruitment management (13%), which mainly analyzes how blockchain can affect the recruitment process. Besides these three main categories, other studies focus on monitoring and managing learning performance (6%), creating collaboration between academia and industry (6%), focusing on competencies needed for students or employees (4%), and managing education credit (4%). The rest of the studies (4%) deal with developing a reputation system for education and analyzing the role of resume formats on resume fraud.

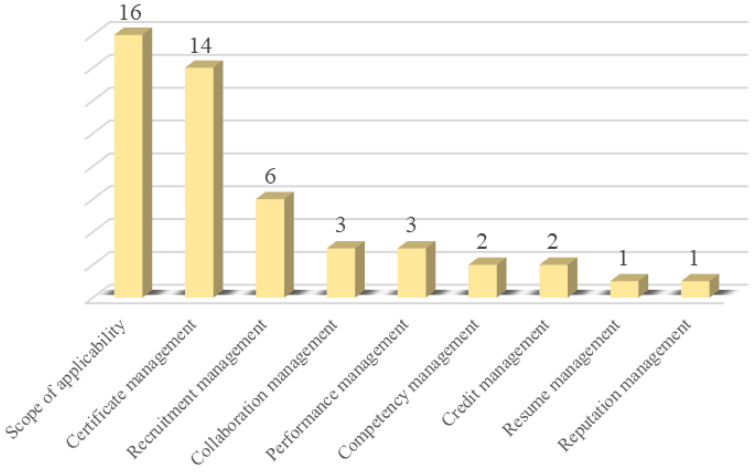

Figure 4. Distribution of Studies Based on Research Categories.

4. Higher Education and Recruitment Challenges

This section delves into the key challenges in higher education and recruitment. These issues can undermine the efficiency and integrity of both higher education and recruitment processes, affecting students, higher education institutions, job applicants, and employers.

4.1. Inefficient information management systems

In today's world, not only do students attend traditional training courses offered by their higher education institutions, but they also boost their knowledge through participating in online courses, workshops, video tutorials, etc. Considering the current centralized information management systems, recording, tracking, and documenting this large number of heterogeneous data is difficult (Lizcano et al., 2020). In addition, higher education institutions record students' educational data in an exclusively specialized and centralized database with restricted access leading to a lack of interoperability among systems used by educational institutions (Turkanović et al., 2018).

The risk of data leakage, data tampering, and data loss is also high in centralized information management systems (Palma et al., 2019). One notable case involving a data breach happened at Indiana University in 2014. The university reported that the personal information of over 146,000 students was exposed due to unauthorized access. The compromised data included students' names, addresses, and Social Security numbers (Foster, 2014). The breach occurred through a centralized system where student data was stored, emphasizing the risks associated with such centralized repositories. Recognizing these challenges, the European Strategy for Universities, as defined by the European committee, includes initiatives to help universities build bridges and enhance transnational cooperation, thereby supporting digital transitions in higher education (European Commission, n.d.).

4.2. Difficulty in transferring academic credentials

Learners have many difficulties in transferring their educational data to other higher education institutions/organizations. Learners need to contact all previous institutions to request official educational documents. In case they lose their certifications and have no access to the online grading system, they need to do this process again. The University Professional and Continuing Education Association (UPCEA) and StraighterLine conducted a survey in 2022 and found that 30% of students lose at least a quarter of their existing academic credit when transferring colleges (UPCEA, 2022). On the other hand, higher education institutions use different academic credentials, formats, and standardization (Srivastava et al., 2018) and are not willing to share their educational data with others (Turkanović et al., 2018).

4.3. Fake resumes

Today, a noticeable number of applicants create fake resumes since (1) there is no mechanism to track students' activities and performance during their academic period. Thus, applicants may submit a fake portfolio without worrying about whether they will face consequences. (2) The current certificate issuance process is bureaucratic, paper-based, error-prone, and non-transparent, which increases the possibility of degree forgery (Palma et al., 2019). (3) The built-in mechanisms that hinder document forgery are costly, which renders them useful only for critical certificates (Garcia-Font, 2020). (4) Companies are having difficulties in finding and hiring qualified employees, which induces applicants to inflate their resumes to increase their chances (Gresch et al., 2018). (5) Educational certificates have obtained growing commercial value, which increases the creation of forged academic documents (Caldarelli & Ellul, 2021), and (6) there is a lack of a universal platform between certificate issuers and certificate verifiers (Tang, 2021) to impede certificate forgery. According to the 2022 StandOut CV survey, approximately 17% of individuals have utilized services for fake job references, involving fabricated employers and hired actors, while about 41% have falsely claimed to have a college degree on their resumes (StandOut CV, 2022).

4.4. Need for a third-party company

In the recruitment process, due to the large number of applicants and the importance of data validity, organizations employ a third-party company to verify applicants' documents (Kim et al., 2020). Relying on a third-party company is costly and time-consuming, and this solution suffers from serious inefficiencies, such as the risk of applicants' information disclosure by the third-party company selling the data (Dhanala & Radha, 2020), cyber-attacks, and a lack of commitment, and poor performance by the third-party company. For example, PageUp, an Australian HR company, encountered a security breach in 2018 that compromised the personal details of thousands of applicants (APSCo Global, 2020).

In summary, the collective impact of these challenges - inefficient data management, credential transfer difficulties, the prevalence of fake resumes, and reliance on third-party verification - hampers the efficiency and integrity of higher education and recruitment processes. These challenges can impact various stakeholders. Students face hurdles in seamlessly transferring credits and credentials, potentially losing academic progress. Educational institutions struggle with maintaining data integrity and interoperability among systems, which can hinder their administrative efficiency and reputation. Employers, on the other hand, encounter difficulties in verifying academic credentials, leading to increased recruitment costs and the risk of hiring underqualified candidates. This complex landscape underlines the need for more innovative solutions in the realm of higher education and recruitment.

5. Higher Education and Recruitment: Blockchain's Potential

In this section, we summarize the identified blockchain benefits by mapping the current processes as a big picture and presenting them in Figure 5.

5.1. Higher Education

Blockchain has the potential to revolutionize education (Mikroyannidis et al., 2018) and provides a benefit to each step of the higher education process before, during, and after taking courses.

- Before taking courses: Teachers must submit their preplanned educational goals and activities as a smart contract (Chen et al., 2018), which will help the institution evaluate the teachers' performance later based on what they have claimed they would do. Blockchain also preserves the ownership rights of course materials for teachers (Alammary et al., 2019).
- During courses: According to Chen et al. (2018), blockchain can be beneficial in different aspects such as (1) recorded data on the blockchain is a fair reference for measuring students' performance. (2) In the case of conflicts between members, traceability and immutability of recorded data can serve as a piece of evidence that protects both sides' interests. (3) Blockchain can be used as a motivation mechanism for students since they can gain digital currency as a reward based on their learning improvement and save it in their virtual education wallet. Using blockchain badge awarding systems for performance evaluations leads to having a more skill-based and appealing education system (Choi et al., 2019). In addition to what Chen et al. (2018) illustrated, blockchain can provide the opportunity for students to receive timely and frequent integrated feedback from teachers and ensure the privacy of recorded data for each member.
- After taking courses: Once a course is completed, blockchain can be used for securely recording and trading educational reputations (Raimundo & Rosário, 2021). Students can build their reputation by paying for a course in a financial currency like bitcoin and getting paid in reputation currency after they complete the course (Sharples & Domingue, 2016), which helps them with employment opportunities (Zhao et al., 2019). Teachers can also gain digital currencies based on their performance progress as appreciation or later for promotions (Chen et al., 2018). Students can evaluate the institution, which can help future students find a well-qualified institution without spending too much money (Salah et al., 2020). Blockchain ensures that the issued certificate is immutable and can be maintained for a long time (Rahardja et al., 2021). It helps students to transfer their academic information from one institute to another more efficiently (Alammary et al., 2019). Higher education institutions involved in the blockchain network can also decrease their cost by using shared infrastructure and services and through opportunities to design joint programs on the platform (Raimundo & Rosário, 2021).

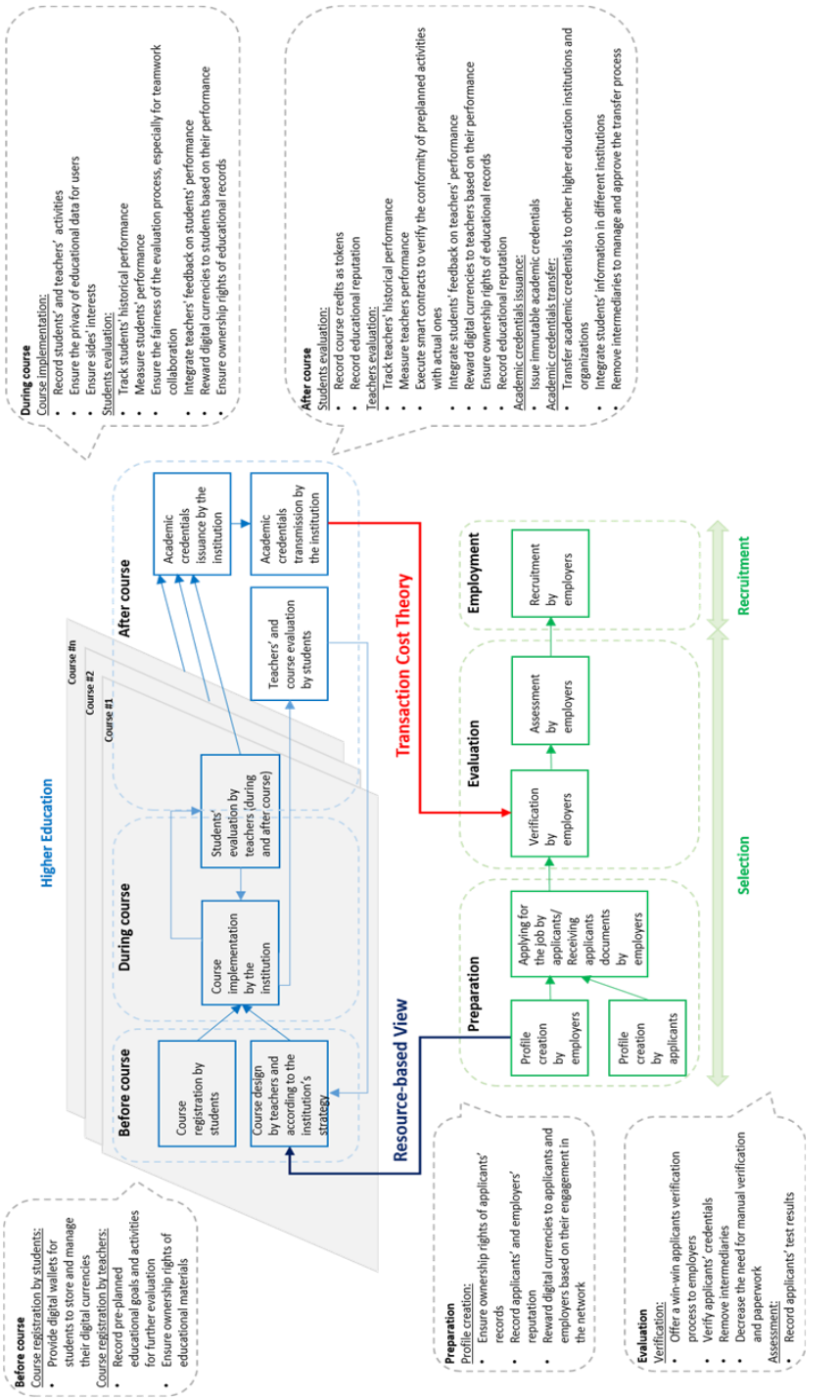

Figure 5. Blockchain Applications in Higher Education and Recruitment

5.2. Recruitment

Blockchain benefits during the different steps of the recruitment process are presented below.

- Preparation: Blockchain is gradually becoming a stronger competitor for other networking sites like LinkedIn due to the inefficiency of those platforms. In a survey by LendEDU, 34% of the respondents lied, to some extent, on their LinkedIn profiles (LendEDU, 2020). In contrast, blockchain immutability ensures data validity since the data cannot be altered without obtaining the network's agreement. It helps applicants find their best career fit based on their learning achievements.
- Evaluation: Many applicants misrepresent their resumes by embellishing, omitting, and fabricating information (Ingold & Langer, 2021). Using blockchain decreases the risk of data manipulation and fraud (Michailidis, 2018). If there is any discrepancy between entered data and reality, such as fake references (Salah et al., 2020) or even if applicants and certificate issuers conspire to falsify the data, the blockchain automatically declares that the data are invalid (Rhemananda et al., 2020). Hence, the long and inaccurate applicant verification process (Liyuan et al., 2019) can be shortened without sacrificing accuracy.

6. Theoretical Perspectives on Blockchain

To advance the literature and illustrate the benefits of blockchain in higher education and recruitment, we applied two theories: RBV and TCT to our research.

6.1. Resource-Based View (RBV)

The RBV suggests that sustainable competitive advantages may be generated by possessing rare, inimitable, and non-substitutable resources (Barney, 1991). Thus, it focuses on resources that a company already owns or could own to create competitive advantages. Due to low rates of blockchain adoption, there is no definitive answer to the question of whether blockchain is a competitive advantage. However, some researchers consider blockchain a strategic resource for organizations to gain competitive advantages. For example, Kant & Anjali (2020) consider blockchain an intangible strategic resource that brings competitive advantages for open and distance learning.

Considering the RBV, specific features of blockchain can create strategic opportunities for fast adopters (Treiblmaier, 2018). Automatic execution of contracts by smart contracts, operating at lower costs, and working at increased speeds are examples of blockchain adding value to the operation process (Jain & Jain, 2020). Taking a more positive approach to blockchain characteristics, organizations can use blockchain in their business models to offer more innovative solutions in the market (Treiblmaier, 2018). For example, to achieve competitive advantages, Woolf University was launched in 2018 as the world's first blockchain university (Kant &

Anjali, 2020). This online university allows teachers to advertise their expertise and students to choose courses, meaning that the university operates like Uber for students and Airbnb for teachers (Jandrić & Hayes, 2021). This blockchain-based university has lower course fees for students and higher pay for teachers, while administrative tasks are minimized (Williams, 2019).

Another project that shows blockchain has the potential to pave the way for offering competitive advantages is the issuance by the Massachusetts Institute of Technology (MIT) of digital diplomas to over 100 graduates. In 2017, MIT developed an application named Blockcerts Wallet that uses blockchain to enable students to have a verifiable version of their diploma easily and rapidly. What distinguishes blockchain-based certificates from other digital certificates is higher security and immutability. In addition, with blockchain-based certificates, autonomy over records is given to students, meaning that the learners hold power over their academic records (Massachusetts Institute of Technology, 2017).

Incorporating blockchain technology into higher education presents a multifaceted set of challenges, ranging from technical hurdles, such as the need for substantial IT infrastructure and the complexity of integrating with existing systems (Kouhizadeh et al., 2021) to cultural and organizational resistance due to its departure from traditional operational methods (Vaezinejad & Kouhizadeh, 2022). Additionally, there are concerns regarding regulatory ambiguity, significant initial and ongoing financial investment, a scarcity of in-house blockchain expertise, and data privacy and security issues (Mathivathanan et al., 2021), especially concerning sensitive student information. Despite the challenges, blockchain's potential to transform higher education necessitates a strategic yet prudent approach to its adoption.

6.2. Transaction Cost Theory (TCT)

TCT focuses on optimal governance to minimize the total cost required to complete an economic exchange or transaction inside and outside the scope of a firm's boundaries (Sarkis et al., 2011). The transaction costs include costs incurred in search and information gathering, drafting and documentation preparation, negotiation, decision-making, monitoring, and maladaptation costs and adjustment (Li et al., 2013; Treiblmaier, 2018). To capture the most qualified and best-fitted applicants, organizations may need to spend money on searching where they should publish a job vacancy and which platforms maximize the visibility of the job advertisement.

Once the interested applicants send their resumes, the company needs to spend many hours verifying the authenticity of applicants' documents, such as education, work experience, certificates, and training (Chillakuri & Attili, 2021) or select a third-party company to verify its applicants' resumes. To ask a third-party company to verify applicants' documents, organizations need to find a trusted and valid third-party company that imposes the company search costs. This is followed by the cost of negotiations and reaching an agreement with the third-party company. In the case of collaboration, the company needs to monitor processes and sometimes may need

to solve interest conflicts, all of which add extra costs to the company. Finally, the company incurs the costs of exchanging information and ownership rights.

By using blockchain, organizations can reduce recruitment transaction costs. Blockchain-based recruitment platforms provide the opportunity for employers to create job vacancies and publish their job advertisements. In addition, to verify applicants' data, organizations can connect to the credential issuer institution on a peer-to-peer network to accelerate its hiring process while decreasing third-party verification costs.

While blockchain technology presents opportunities to streamline recruitment processes and reduce transaction costs, it is crucial to recognize potential challenges. The adoption of blockchain for verifying credentials may face resistance and skepticism from applicants and educational institutions, necessitating efforts to build trust and address privacy concerns. Initial implementation costs could pose a barrier for smaller organizations, requiring careful assessment of the feasibility and cost-effectiveness of adopting blockchain solutions. The decentralized nature of blockchain may introduce challenges in standardization and interoperability, highlighting the need for industry collaboration. Additionally, the dynamic nature of technology and evolving regulations may introduce uncertainties that organizations need to navigate. Organizations should proactively address these potential challenges to ensure the successful and effective adoption of blockchain technology in recruiting practices.

The insights from RBV and TCT highlight blockchain's potential strategic and efficiency benefits in higher education and recruitment. This understanding lays the groundwork for envisioning how blockchain technology can serve as a bridge, facilitating collaboration between higher education and recruitment sectors. Such collaborations can leverage blockchain's capabilities to innovate and streamline processes across these two interconnected fields.

7. Collaboration Between Higher Education Institutions and the Recruitment Industry

In today's world, due to an unprecedented rate of change, human resources should align their abilities and skills to the market's needs. To meet this goal, a seamless convergence between education and recruitment is required (Liu et al., 2018). Higher education institutions have critical roles in preparing students for the future, but their training often falls behind the job market needs, which leads to a misalignment between the student's training and the real need in the market.

When a training program is designed for students, it takes a few years for the first graduate student to enter the market and enable higher education institutions to evaluate their training effectiveness (Lizcano et al., 2020). However, if higher education institutions access the real-time needs of markets, they can design more

up-to-date, competitive, and beneficial courses for students who are future applicants.

A higher education institution usually designs its course within an isolated academic environment and according to the institution's strategy, the teacher's current information on the subject, and available materials. Since higher education institutions are usually less aware of the newest skills that the industry needs, there may be a mismatch between its syllabus and companies' requirements (Fachrunnisa & Hussain, 2020).

To overcome this concern, the higher education institution may consult a few companies in the industry to offer more updated courses; however, there is no guarantee whether the information from the industry is trustworthy, or whether the needed skills by companies are the real needs of the market (Fachrunnisa & Hussain, 2020).

However, if the higher education institution joins a blockchain network, it can access the most up-to-date information on the market's needs since many organizations on the blockchain network publish the needed skills and experiences for their companies. Therefore, higher education institutions can access the cumulative real-world data that may make them distinct from those institutions that design their courses based on their expertise. The higher education institution with blockchain adoption can upgrade its courses based on what organizations are seeking right now or even design some new and specific courses aiming to reduce the distance between job market needs and applicant qualifications.

Besides the critical role of higher education institutions, organizations that are seeking employees may also affect this collaboration. As already discussed in this research, blockchain eliminates the need for a third-party company to validate transactions, which reduces transaction costs (Han et al., 2018). Opportunistic behaviors that increase the cost of monitoring and control can be diminished through blockchain. Using smart contracts can decrease opportunistic behaviors since exchange parameters and execution rules are determined in advance in smart contracts (Schmidt & Wagner, 2019). Therefore, to verify applicants' credential certificates, organizations can directly connect with relevant institutions to request to confirm the validity of applicants' certificates.

8. Future Research

Although our review found many blockchain applications in higher education and recruitment, the real-world applications of identified benefits need to be investigated. In addition, several gaps in current knowledge listed below should be addressed in future research.

8.1. Theoretical research

Looking at blockchain adoption with theoretical lenses can reduce the risk of adoption and facilitate its applications. Despite the necessity of a theoretical underpinning, only very few studies have considered theoretical perspectives on blockchain applications in higher education and recruitment. More theoretical research is required to investigate blockchain applications in higher education and recruitment. For example, considering the principal-agent theory, how can blockchain benefit the relationship between higher education institutions and the government?

8.2. Incentive mechanisms

The blockchain adoption focus has been on "when" and "how" questions while the "why" question has remained unanswered (Schmidt & Wagner, 2019). An example of a "why" question in our study is as follows: Should rival companies share their information on the blockchain? More research focusing on defining incentive mechanisms to increase members' involvement in a blockchain network is required.

8.3. Large-scale blockchain adoption

Despite a wide variety of blockchain advantages, there has not been a large-scale blockchain adoption so far (Park, 2021) due to blockchain's novelty and its limitations and challenges as follows:

- Data scalability: Blockchain has weaknesses in handling many transactions (Raimundo & Rosário, 2021). Due to this challenge, educational institutions have difficulty deciding which data should be recorded and managed in a blockchain network (Alammary et al., 2019) because, if the number of transactions and users in the network increases, verification by members in a peer-to-peer network becomes a time-consuming process. On the other hand, members' participation in the blockchain platform should reach significant numbers to generate value for the network (Schmidt & Wagner, 2019). More research is needed to analyze the appropriate number of participants in education blockchain networks while overcoming the scalability problem.
- Immutability: Although the immutability feature of blockchain makes it appealing for many human resource professionals and higher education institutions to utilize it, it can bring challenges when there is a need to modify inaccurate data in the network (Loukil et al., 2021). Modified data can only be added through new blocks to the network, which may result in data scalability problems. Further research is needed regarding the trade-off between immutability and scalability problems.
- Decentralization: The decentralized feature of blockchain that reduces the risk of data fraud can increase ambiguity in blockchain ownership and responsibility (Hunt et al., 2021). For example, in a blockchain decentralized structure, it is not

clear who would be responsible if a problem like a system failure occurred in the network. More research is needed to specify members' responsibilities in the network.

- Human resources readiness: Lack of skilled and knowledgeable resources and lack of top management commitment to support can impede blockchain adoption (Saberi et al., 2019). More research is needed to analyze how higher education institutions/human resources industry can be prepared and motivated to adopt blockchain by using change management methodologies.

8.4. Empirical research

Considering the blockchain limitations, this study does not aim to claim that blockchain adoption can be helpful for any organization/higher education institution under any circumstances. Adopting blockchain is a costly process due to the cost of the high computing power it needs, the cost of changing existing infrastructure to the required one, and the cost of handling big data in the network (Hunt et al., 2021). To adopt blockchain, organizations should investigate whether they truly need this technology, to what extent they should adopt it (Alammary et al., 2019), and whether there is any evidence of successful blockchain adoption in other organizations (Salah et al., 2020). Therefore, more empirical research to analyze and compare the costs of blockchain adoption versus its long-term benefits is needed for decision-making. In this regard, a research question is: What is the blockchain adoption effect on students' learning outcomes? (Reis-Marques et al., 2021)

8.5. Scope of application

Reviewing the literature, this study shows that the majority of the previous studies have focused on the scope of blockchain applicability and its benefits and challenges (Bhaskar et al., 2020; Delgado-von-Eitzen et al., 2021a; Fedorova & Skobleva, 2020; Grech et al., 2021) and document verification and certificate management (Cheng et al., 2018; Deenmahomed et al., 2021; Gresch et al., 2018; Jeong & Choi, 2019; Rama Reddy et al., 2021; Tang, 2021). However, there is a lack of studies focusing on other areas such as reputation management, competency management, competition management, etc. More research is needed to expand blockchain applications in areas with less attention.

With these areas identified for future research, we now turn to our concluding thoughts, where we consolidate the key insights gained from our review of blockchain in higher education and recruitment.

9. Conclusion

Our systematic literature review has provided a comprehensive overview of blockchain's potential applications in higher education and recruitment processes, visually illustrating its capacity for improvement. Utilizing the RBV and TCT, we identified that blockchain can offer innovative solutions for higher education

institutions to remain competitive and streamline recruitment processes, thereby reducing costs and enhancing transparency. Additionally, we have pinpointed challenges associated with blockchain applications in higher education and recruitment.

However, our study is not without its limitations. While we focus on the impact of blockchain on the collaboration between higher education and recruitment, we didn't delve into other essential human resource functions such as human resource planning, performance management, employee and labor relations, compensation and rewards, and health, safety, and well-being. Furthermore, our examination centered on higher education institutions and hiring organizations, overlooking the involvement of other stakeholders such as government agencies, industry associations, etc. which are crucial to effective collaboration. Future research should expand to incorporate the role of other key stakeholders, providing further insights into blockchain's potential applications in facilitating collaboration across the higher education and human resources domains.

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