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Exploratory Research on the Use of Blockchain Technology in Recruitment

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Abstract: In recent years, human resource (HR) professionals have struggled with problems such as reduced efficiency, increased cost, fraud risks, and time-consuming procedures in the process of finding and hiring the right talent for companies. Blockchain technology has emerged as a powerful tool to solve these problems and transform the recruitment process. The aim of this study is to investigate the opportunities, challenges, possible solutions, and prospects for blockchain technology adoption in recruitment. In order to achieve this aim, exploratory research has been conducted through a combination of a comprehensive literature review and a structured interview with experts in the field of human resource management (HRM) and blockchain. Thematic analysis has been used to analyze qualitative data. The findings reveal that blockchain-based recruitment systems enhance the recruitment processes by offering opportunities such as increasing the speed and reliability of the transactions and reducing costs and routine workload. Thus, it provides a sustainable competitive advantage to the companies. However, these systems have some technological, organizational, and environmental challenges that can be addressed in the long term. In the future, it is expected that the use of blockchain technology in recruitment processes will be a gradual process and will change the role of recruiters.

Keywords: human resource management; recruitment; technology; blockchain

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1. Introduction

Currently, employers have difficulty in hiring appropriate candidates with the right skills [1]. This can be attributed to the fact that the vast majority of job seekers around the world include false or misleading information in their CVs so as to increase their chances of finding a job in the dynamic and competitive business world. That is why companies pay special attention to research candidate backgrounds and verification of credentials. However, using traditional approaches for the recruitment process can be costly, time-consuming, and inefficient due to the high number of job applicants [2]. Recently, businesses that are in a fierce and ongoing competition with their competitors to select and hire the best candidates from the labor market [3] have made use of technological tools to increase the effectiveness of their recruitment practices [4].

One of these tools is blockchain technology, which has advanced features to match candidates' skills and performances with the requirements of the job [5]. Blockchain is a decentralized calculation and information-sharing platform which supports people's rational decision-making processes. It is also defined as a distributed ledger technology that can record transactions between parties in a verifiable and permanent way [6]. Blockchain, which is constantly growing this ledger that keeps a chronological record of all transactions that have taken place, focuses on the principles of value creation and building trust through consensus [7] and provides opportunities to create more sustainable practices [8].

Many companies throughout the world closely follow the developments in blockchain technology. Determining what kind of effects blockchain technology will have on businesses is a significant research topic. In the literature, there are studies regarding the use of

blockchain technology in several fields such as finance [9], supply chain management [10], voting systems [11], real estate management [12], and healthcare [13], etc. This developing technology has remarkable effects in the HRM field as well. HRM applications based on blockchain provide innovative solutions for recruitment, wage management, reward management, and occupational health and safety, etc. [14]. For example, candidates' employment history and detailed performance indicators such as transfers, promotions, and layoffs in public ledgers can be recorded via blockchain. In addition, thanks to this technology, the implementation of applications such as automatic verification of CVs, preparing smart business contracts, and using crypto money for international payrolls changes the role of HR professionals [15].

Nonetheless, the effects of blockchain technology on recruitment function of HRM have not been sufficiently discussed in the literature. In this study, exploratory research is conducted with the aim of determining the possible opportunities, challenges, and prospects for blockchain-based recruitment systems. In order to achieve this aim, the study makes four main contributions to the current literature. First, the study presents a systematic discussion on blockchain-based recruitment systems. Second, it analyses the perceptions of HRM and blockchain experts regarding the potential opportunities and challenges of blockchain-based recruitment. Third, it offers solutions to popularize the adoption of the blockchain-based recruitment process. Fourth, it explores the future trends of blockchain-based recruitment. In brief, it is expected that this study will contribute to understanding the transformative effect of blockchain technology on recruitment processes and making predictions for the future.

The rest of the study is organized as follows. Section 2 reviews previous studies on blockchain-based recruitment while Section 3 describes materials and methods including details about data collection and data analysis. Section 4 discusses the key findings from the analysis, with subsections on opportunities, challenges, and prospects of blockchain-based recruitment. Finally, Section 5 concludes the study with limitations and possible future directions.

2. Literature Review

Studies examining the use of blockchain technology in recruitment, which is one of the most important functions of HRM, are new and relatively few. These studies can be classified into two categories.

The studies on the design and application of recruitment systems are included in the first category. One of these studies was conducted by Onik et al. [16]. The authors proposed a blockchain-based recruitment management system and a blockchain-based HRM system algorithm in their studies. The results obtained through the case study revealed that the suggested system performed better than the current HRM systems. Jeong and Choi [17] developed a digital certificate management platform so that it could be used in the recruitment processes. In order to manage blockchain servers and digital certificates, they utilized the Blockcerts platform. On this platform, candidates are given certificates based on their previous performance; the validity of the certificates is checked, all certificates are stored, and it is impossible to make changes on the stored records.

Dhanala and Radha [18], who underlined that blockchain technology is an effective tool to verify and secure data, developed a recruitment system supported by blockchain technology in their study. They explained the process of this system as follows: First of all, the recruitment company submits the candidate list to the system and the system automatically checks the candidate information from databases such as schools and law enforcement agencies, and the verified data are stored in the blockchain. Next, the company evaluates the approved candidates on the blockchain and decides to recruit. This system, which has been developed through smart contract tools on the Ethereum platform, has been tested via Rinkeby and Ganache software. Serranito et al. [19] designed an ecosystem for certificate validation on a global scale which is based on the blockchain running smart contracts on the Ethereum platform. While higher education institutions in the ecosystem

automatically save their education certificates to the blockchain, recruitment companies can question the certificate accuracy of the candidate by examining the registered information. This system was applied to recruitment processes in the public sector through a pilot study.

Rhemananda et al. [5] pointed out that the candidate information obtained in the traditional recruitment process has many shortcomings such as the risk of being inaccurate, the risk of data loss, being costly, and requiring a long time in the data validation process. Moreover, they stressed that blockchain technology can minimize the disadvantages of traditional recruitment methods by listing the stages of the blockchain-based recruitment and selection process as follows: First, the candidates register in the system. Second, the candidate information is verified via the blockchain system. Third, the managers make a decision and employees are hired in the right positions.

Al Hamrani and Al Hamrani [20], who used the science of the design research method in their study, developed a model proposal in which blockchain technology is used for the recruitment processes of people with disabilities in the United Arab Emirates. By means of this model proposal, they aimed to give the authorities with decision-making power support by accessing the education, health, course, and promotion information of disabled people accurately and at a low cost. Similarly, Marella and Vijayan [2], who used the science of the design research method in their study, developed a blockchain-based solution for the background verification process of candidates in the recruitment process. They remarked that the advantage of the proposed solution was to eliminate the waste of time. Chhetri [1] discussed current issues in the recruitment process, analyzed the possible benefits of blockchain technology in recruitment, and developed a blockchain-based model for recruitment. Through this model, the author explained which factors were needed by the blockchain developer during the creation of a new recruitment system, and discussed strategies on how to approach organizations while forming a network.

In the second category, there are studies focusing on the possible consequences of the transition to blockchain-based recruitment systems. Lukic et al. [21], who claim that blockchain technology can completely change HRM, analyzed the effects of this technology on the recruitment process and new job positions. They emphasized that the use of blockchain in the recruitment process is still developing and will present significant opportunities for HR managers. Furthermore, they listed some of the new blockchain job positions in an organization, which are blockchain developer, blockchain designer, blockchain project manager, blockchain quality engineer, blockchain counsel, and blockchain analyst.

Abdullah and Abdullah [22] carried out a survey in their research on multinational companies in Malaysia in order to identify future trends and determine whether HR managers are ready or not to use the blockchain application in verification of candidate information. They concluded that HR managers are ready to use blockchain technology in the recruitment process and blockchain technology is becoming more and more popular in developed countries. Yi et al. [23] evaluated the effect of blockchain technology on hiring and off-boarding practices in the telecommunications industry in Hong Kong via a survey method. The majority of employees and managers who participated in the survey agreed that blockchain technology speeds up the hiring and off-boarding practices, and it is an effective and safe tool for background control and verification of the authenticity of documents.

In general, there are studies in the literature that explain the design and operation of blockchain-based recruitment systems and evaluate the perceptions of employees and managers towards the transition to the new system. However, there is a research gap in analysis of together opportunities, challenges, possible solutions, and prospects for blockchain technology adoption in recruitment. The present study attempts to fill the gap by providing a comprehensive assessment on blockchain-based recruitment. In order to achieve this, exploratory research is carried out using a literature review and an interview.

3. Materials and Methods

Much as there is great interest in blockchain technology in the business world, the adoption of blockchain technology in the HRM departments of companies is a recent phenomenon. In addition, limited scientific research with regard to blockchain-based recruitment systems has been conducted. Therefore, this research employs an exploratory approach, which is a suitable method to discover new relationships, patterns, themes, ideas, etc. [24]. In this context, interviews were carried out with experts in HRM and blockchain so as to understand the effects of blockchain technology on recruitment processes. To ensure the reliability of the study, primary data acquired from interviews were supported with evidence from literature review. The data were analyzed through thematic analysis.

3.1. Data Collection

In this study, a qualitative research design was planned. Qualitative research involves the use of different data sources such as documents, interviews, and observations [25]. The literature review and interview were used in the collection of data in this study. Secondary data were collected from books, articles, reports, and internet sources, and a general insight into blockchain-based recruitment was developed. Since the emergence of blockchain technology is new, the literature review is based on the current research from 2015 to 2022. In addition, primary data were collected by means of interviews with experts.

A voluntary participation form which includes information about the purpose, procedures, and confidentiality of the interview was presented to the participants. The following research questions in the interview form (see Appendix A) were included, in addition to personal information questions such as name, country, company, position, and experience:

- What are the opportunities offered to recruitment processes via blockchain technology?
- What are the challenges of blockchain technology adoption in recruitment processes?
- What are the possible solutions to overcome these challenges?
- What are your thoughts on the future of the blockchain-based recruitment process?
- How will blockchain technology affect the role of recruiter in the future?

The final form was given to the structured interview form based on expert opinions. The interview form was applied to the study group in various countries and continents, and was determined by the snowball sampling method between February 2022 and May 2022. Snowball sampling is based on the recommendation of interviewees who initially took part in the interview to interview other people they think are relevant to the topic [26]. Thus, it is aimed at reaching the participant group that is likely to play a key role in the use of blockchain technology in HRM.

There is no formula to determine the sample size for snowball sampling since it typically continues until achieving data saturation [27]. For data saturation, samples must be adequate (large enough for replication to occur) and appropriate (interviewees must be experts). Interviews can be stopped and the sample chosen can be justified when data saturation is achieved [28]. Transparency of data saturation improves the quality of research, increases reliability, and reinforces validity.

This study reached data saturation with 18 participants by the utilizing code meaning approach that achieves full understanding of codes [29]. The group of participants included professionals such as recruiter, recruitment consultant, talent acquisition, and human resources manager as well as chief research officer, chief technology officer, the founders of companies, and senior managers of companies. In general, the selection of participants is based on the criteria of being an expert in HRM and blockchain. Detailed information about the participants' profiles is seen in Table 1. Participants are denoted as PT.

Table 1. Description of participants.

Participant	Position	Work Experience	Location of the Company
PT1	Chief Research Officer	13 years	United Kingdom
PT2	Talent Acquisition	13 years	Australia
PT3	Human Resources Manager	5 years	Spain
PT4	Director	27 years	United Kingdom
PT5	Managing Director	15 years	Hong Kong
PT6	Chief Executive Officer	15+ years	United Kingdom
PT7	Founder/Educator	34 years	United States
PT8	Founder/Chief Executive Officer/Educator	25 years	Australia
PT9	Founder/Managing Director	50+ years	Australia
PT10	Executive Chairman	21 years	United Arab Emirates
PT11	Chief Executive Officer	25 years	Canada
PT12	Vice President	30+ years	Belgium
PT13	Recruitment Consultant	2.5+ years	United Kingdom
PT14	Founder/Managing Director	25+ years	United Kingdom
PT15	Chief Visionary Officer	35 years	United States
PT16	Chief Technology Officer	20+ years	France
PT17	Chief Executive Officer/Educator	29 years	Singapore
PT18	Recruiter	13 years	Uruguay

In order to obtain expert opinions on the research topic, interviews were conducted by e-mail, which helps researchers work with participants, such as managers and geographically dispersed groups, who are difficult to contact face-to-face or over the phone. The main reasons for choosing the e-mail interview method in this study are the absence of local participants who apply the blockchain-based recruitment processes and the potential participants' being in different countries. Moreover, interview by e-mail is considered an effective way of collecting qualitative data, as it allows participants to think about the questions for a long time and give answers in detail. Data obtained from this low-cost interview type are produced electronically and require little editing before being processed for analysis. This method enables researchers to interview more than one participant simultaneously with a standard question list. Yet, the completion of the interviews may take a long time, depending on the availability of the participants [30].

3.2. Data Analysis

The data obtained during the data collection process are evaluated by the thematic analysis method, which is one of the most widely used qualitative research methods. This method helps researchers to provide description and interpretation through themes and patterns extracted from a large range of data [31]. In addition, it is possible to determine the relations between concepts and the frequency of their repetition in the whole content with thematic analysis [32]. In this study, the secondary data obtained from the literature review and the primary data obtained from the interviews are classified according to the relevant themes and sub-themes. The coding technique for qualitative data analysis is used and the interview forms are also analyzed in detail by another person in order to improve the validity of the coding process [33].

4. Results and Discussion

It is very important to evaluate the current situation and future for a better understanding and common adoption of blockchain-based recruitment systems. In this study, the findings related to blockchain-based recruitment processes are presented under three themes: opportunities, challenges and possible solutions, and prospects.

4.1. Theme 1—Opportunities of Blockchain Technology for Recruitment

The results confirm that blockchain technology offers the following opportunities for recruitment processes: (1) building a careers network in a digital, secure, and decentralized manner; (2) providing effective, faster, and cheaper verification of candidates' credentials; (3) facilitating performance reviews of employees; (4) conducting interviews on the metaverse. All these opportunities are expected to improve the quality of recruitment practices by enabling more effective job matching.

4.1.1. Building a Careers Network in a Digital, Secure, and Decentralized Manner

Digital technologies are changing work, employment, processes, methods, and approaches related to the HRM field in today's companies [34]. Blockchain technology, which is one of these technologies, performs recruitment activities through digital career networks. Since this technology provides both the standardization of career profiles and records, and tracking of career development, it makes career management of candidates easier [21]. Regarding the subject, among the interviewees, PT3 points out "*candidates could have an Avatar or Digital identity based on NFTs*" with blockchain technology while PT7 states that "*blockchain will allow applicants to store verified copies of credentials*".

Blockchain is defined as a career platform that brings job applicants, educational institutions, governments, recruiters, and potential employers, etc., together [35]. Transactions on this platform can be followed by all participants of the network [36]. As one participant (PT16) put it: "*blockchain technology can be leveraged as a decentralized store for candidate background history, work proofs, and certifications achieved*". The decentralized system protects the data by preventing them from being deleted or changed [37]. In this system where accurate, consistent, and transparent data are provided for all participants [36], different computers can contain certain information about all transactions and everyone on the network can access this information [15].

In addition, it is vital that the documents such as degrees, diplomas, and certificates, which are necessary for the job search and career development of the candidates, are kept in long-term usable and tamper-proof ledgers. The blockchain-based recruitment platform is a safe solution for validating and sharing certificates [35]. One participant, who was interviewed, mentions:

> *"Blockchain enables tamper proof recording of non-perishable personal credentials (e.g., employment history, education history etc.). Perishable credentials (e.g., identity documents, criminal record status etc.) can also be placed on blockchain, but would have to be updated on lapse of the credential end date." PT14*

Since data are protected by multi-layered keys and hash encryption in blockchain-based systems, information leakage and data alteration are unlikely. This distributed system is secure, as it is almost impossible to edit or change database information. That is why the existing system cannot be easily broken by hackers or system administrators [5,16]. In this context, two participants affirm that:

> *"These documents would be cryptographically signed by the issuer and cannot be forged or tampered with." PT7*

> *"It is difficult to change or hack the information in the blockchain." PT10*

Similarly, previous research carried out by Dhanala and Radha [18] revealed that blockchain-based recruitment systems create an advanced and strong security structure compared to traditional recruitment systems. In addition, Peisl and Shah [38] concluded that these systems have the potential to transform recruitment processes with their decentralized transactions, transparency, and immutability.

4.1.2. Providing Effective, Faster, and Cheaper Verification of Candidates' Credentials

While some candidates present false information on their CVs, diplomas, and qualification certificates during the recruitment process, others tend to exaggerate their abilities [39].

Some candidates may misrepresent themselves and change their CVs according to their job applications in order to increase the chance of employment [40].

One of the main roles of an HR manager is to place the most talented people in suitable positions throughout the organization. Since the accuracy of the candidate information affects the cost and efficiency of HRM during this process [39], recruiters need to thoroughly scan, check, and verify CVs [41]. In particular, contacting relevant institutions one by one for the verification of certificates can be a time-consuming and costly process [19]. Moreover, when there are a large number of job applications for a vacancy, the verification of CVs become even more challenging. There is a risk that the decisions made in this process may result in unsuitable recruitments [22]. Thus, ensuring the accuracy of candidate information is a critical problem that needs to be solved in the HR department [39].

Blockchain-based recruitment systems may support the decision-making processes of recruiters by verifying the identity of candidates thanks to smart employment contracts [40]. There are some of the quotes from participants declaring that verification of candidate credentials is one of the opportunities afforded by blockchain for the recruitment process below:

> *"The primary opportunity offered by blockchain technology is a recruiting process where skill data are validated and portable." PT1*
>
> *"Recruiters will be able to instantly verify these credentials with confidence." PT7*
>
> *"Verified and immediate information" PT8*
>
> *"Identity verification for employment" PT14*

In this system, initially, candidates who will apply for a job register in the system. They record their data such as credentials, educational background, work history, certifications, etc., in the system. Then, these data are verified by the relevant institutions [5]. Similarly, PT9 shares the following statement for the working procedure of blockchain-based recruitment: "*Once qualifications are verified by the education source, they remain on a person's private blockchain record. Skills, licenses and experience can be stored and become part of a candidate's CV*". Based on some of the participants' opinions, it can be concluded that the blockchain allows the following information to be verified:

> *"In the shorter-term new technology such as digital credentials will allow employers to validate a candidate's work credentials, from employment history to qualifications." PT4*
>
> *"Identity verification can authenticate a candidates' work history, current role and employer, education and certificates and achievements." PT17*
>
> *It enables "the worker to have direct control of verified information related to their identity, employment history, education, certifications & licences, and assessments." PT12*
>
> *" . . . A person could apply for a job and the company can see all of their skills they've picked up over the course of their career. This could include not only jobs, but also training they have taken, mentoring relationships relevant to work, etc." PT1*

Above all, blockchain-based authentication systems are useful in terms of reducing fraud risk and building greater trust in the recruitment system by weeding out fake resumes and misinformation [5]. In this regard, PT8 remarks that it ensures "*trustworthy data*", while PT11 specifies that "*this reduces resume fraud or misrepresentation which leads to mis-hires and poor performance after the hire is made*".

In addition, this technology enables various operations performed by companies to be carried out effectively, quickly, and inexpensively [37]. Unlike manual recruitment systems which are time-consuming, costly, and insecure [18], everything is digitally interconnected in blockchain-based recruitment systems. Recruiters can view and check the credentials of candidates through the system by means of blockchain-based solutions [40]. Blockchain-based authentication systems, which provide real-time, accurate, and complete access to candidates' information, reduce the time spent on data control and increase the time efficiency of data validation [5]. In addition, making transactions without an intermediary

provides a reduction in the transaction cost in the system and brings cost efficiency to companies [16,23,36].

Likewise, the findings of Michailidis [15] and Chillakuri and Attili [40] indicated that data verification operations in recruitment processes with blockchain technology may provide significant time and cost savings. These aspects of blockchain-based applications are highlighted by the participants with similar points of view as follows:

> It enables "*cheaper and faster vetting and screening function if candidate credentials are verified on chain*" *PT14*.
>
> *"The person's private data can be shared with an employer to fast-track the onboarding process." PT9*
>
> *"It allows resume claims and credentials to be validated earlier in the recruitment process." PT11*

Furthermore, the distributed structure of the blockchain and its ability to match candidates with employment opportunities accurately and effectively present the opportunity to access candidates with various skills and cognition from different geographical regions [42] and increase the efficiency of the recruitment processes. PT4 supports this judgment with a similar statement: "*this will enable more effective work-matching, better use of platforms in certain industry verticals and geographies*".

4.1.3. Facilitating Performance Reviews of Employees

Performance management is a strategic approach to maximizing and sustaining individual and organizational performance via a broad collection of activities such as performance appraisal, training, and rewarding. Employers care about the previous performance of candidates, as it can be an indicator of their behavioral and technical competencies and a significant factor in deciding whether they are the right candidate for the job or not [43]. HR professionals handle high volumes of data such as employee performance and personal identifiable information (PII), and share this data with other departments within the organization and third parties.

In recent years, one of the major concerns for HR professionals in data sharing is cyber threats [40]. On the other hand, there is a need for technology that eliminates human bias in the performance appraisal process, provides confidence and transparency, and offers the staff a rewarding experience [44]. These functions can be performed with blockchain technology which adds value to the performance appraisal process. Regarding this, PT14 reported "*employees' performance evaluations can be recorded in the chain*".

This result was clarified by Chillakuri and Attili [40] in a former study as follows: Blockchain is known as an innovative technology for effective performance management as it can reduce bias and provide greater objectivity. By using blockchain-based performance evaluation system, blocks where performance can be verified by all stakeholders such as customer, team leader, and peers can be created.

A participant, who emphasized that particularly small businesses do not have effective performance appraisals systems and for larger organizations the default appraisal is a simple annual or bi-annual assessment based on achieving pre-assigned goals, adds that:

> *"The future of performance management is continuous feedback (with scoring performed at least monthly) not just on delivery of goals, but on skill improvements or declines and a measurement of team, peer and customer relationships." PT17*

All blocks can be verified by giving an accurate picture of individual performance at the end of the year [40]. PT17 describes the frequency of performance review as follows:

> *"Performance management can be seen as "blocks" of data on an individuals' on-the-job delivery measured every month, quarter, six-months or per year." PT17*

4.1.4. Conducting Interviews on the Metaverse

Following the desktop internet connection and the mobile internet connection, the metaverse has paved the way for the next technological era by providing the perfect connection of the virtual world with reality [45]. Metaverse, which is defined as the post-reality universe and a multi-user environment merging physical reality with digital virtuality, is based on the union of technologies enabling multi-sensory social interactions with digital objects, people, and virtual environments [46].

It creates a new platform where users are represented by digital avatars in order to visit a virtual world with strong connections to the physical world. It utilizes a multitude of services backed by current key technologies such as blockchain, artificial intelligence (AI), and extended reality for large-scale mapping of entities from the physical spaces to the virtual universe [47]. With the development of technology, the more users there are, the more activities there are, and this leads to an increase of the amount of data in the metaverse ecosystem. As a result, this raises the issue of data reliability and data security. Blockchain technology is utilized to overcome this issue [48].

In metaverse, people can come together to spend time and engage with one another by using their virtual avatars. Concerts, work meetings, and family celebrations are some of the activities that may be conducted in this digital area. So, the metaverse is likely to be a functional and diverse environment. In this context, it will also influence employment and job searches. Metaverse job interviews may be more effective than remote approaches such as Zoom. People gather in real-like spaces, which makes digital interviews more comfortable [49]. As shown by the quotes below, conducting interviews on the metaverse is also considered by the participants as one of the opportunities of blockchain-based recruitment:

> *"Holding interview on the metaverse." PT5*

> *"We will be able to do the interviews in the Metaverse, so instead of doing digital interviews on Zoom, Meets or Skype we can meet the candidate in the metaverse and assess even non-verbal communication. The metaverse would allow interviews as if they are onsite." PT3*

As a matter of fact, when the opportunities presented by blockchain technology for recruitment processes are evaluated, it can be said that it helps companies create a digital database or network structure that can provide accurate and reliable information about past, present, and future employees [50]. Opportunities of the blockchain-based recruitment process with its sub-themes and codes are shown in Table 2.

Table 2. Opportunities of blockchain-based recruitment process.

Themes	Sub-Themes	Codes
T1. Opportunities	T1.1. Building a careers network in a digital, secure, and decentralized manner	- Transparent and distributed digital identity platform - Secure and tamper-proof recording system
	T1.2. Providing effective, faster, and cheaper verification of candidates' credentials	- Authentication system that reduces the risk of fraud - Cheaper and faster vetting and screening function
	T1.3. Facilitating performance reviews of employees	- More timely and accurate performance measurement - Performance appraisal with feedback from stakeholders
	T1.4. Conducting interviews on the metaverse	- Interviews which feel as if they are onsite - More comfortable digital interviews

Source: Constructed by the author.

4.2. Theme 2—Challenges of Blockchain Technology Adoption in Recruitment and Possible Solutions

HR professionals can benefit from technologies such as AI and blockchain as a tool for both individual and organizational productivity in recruitment processes. However, these tools create some challenges in practice [15]. The challenges of adopting blockchain technology in the recruitment practices can be classified into three main categories: technological, organizational, and environmental.

4.2.1. Technological Challenges and Possible Solutions

The first technological challenge is the concern about the security and privacy of the data [51]. Private keys used to sign transactions on the blockchain can cause serious security attacks if they are not managed properly [52]. One participant, who addresses the issue from the employer's perspective, tells us in the interview: "*On trustless non permissioned blockchains, identity is obfuscated behind cryptographic keys. Keys may be more difficult to counterfeit, but they can still be stolen. As a recruiter, How will I ensure that this key belongs to the person I'm considering hiring?" PT16*

In addition, there is a concern that employee data may be at risk [43]. In this context, there are also some participants who evaluate the security issue from the perspective of the candidates:

> *"Agencies often offer incentives for individuals to put personal data on their blockchain leading to mistrust" PT9*

> *"Increasing concern about the processing of personal data has made candidates much warier about using centralized networks." PT10*

The details were also explained in a previous study by Jena et al. [53] as follows: User identity can be considerably hidden by means of public key encryption algorithms in transactions on the blockchain. Since transactions are publicly visible, transaction anonymity cannot be guaranteed. The findings of Treiblmaier et al. [54] confirmed that there may be a general loss of privacy due to data transparency. Two participants also discuss the importance of privacy in public blockchains as can be seen below:

> *"Public ledgers are public by nature meaning that they should not contact Personal Identifiable Information (PII) as this data is also immutable." PT11*

> *"On public blockchains, privacy is a challenge. By nature anything written on the blockchain stays forever. Hence, if we start writing our CVs on chain, it will be impossible to alter in the future. One involvement in some communities at some point of your life may be undesirable in another context or at a later stage." PT16*

PT4 states that for high adoption of new technology applications, it must be reliable and easy to use. Participants suggest some solutions to ease security and privacy concerns in blockchain-based recruitment systems. While PT8 suggests that "*convincing people the data on a blockchain is trustworthy*"; PT9 recommends "*total transparency in how and where data is actually stored and algorithms that are applied to candidate selection*". Additionally, a permissioned blockchain application can be adopted where only authorized people can access the data [55]. In this sense, PT11 and PT16 evaluate current examples of implementation in industry:

> *"By using a hybrid model of blockchain technology for access control and private data bases to store encrypted PII, users gain the advantage of permission control and privacy. Hyper Ledger Fabric by IBM is a good option with proprietary smart contracts." PT11*

> *"Verifiable credentials are a promising standard to allow anyone to earn credentials and equip them with a way to prove them. They keep full control of these credentials and may or may not choose to unveil them. There are emerging solutions (such as Polygon ID) around decentralized identity management to keep record of these credentials while keeping control on what to disclose to whom." PT16*

The second of the technological challenges is the issue of scalability and cost-effectiveness. Scalability is the ability of the system to maintain its performance as the network grows, by increasing the number of nodes, storage requirements, and response time per transaction [55]. In the blockchain system, which works well enough for a small number of users, when mass integration occurs, the number of users in the network increases and the system slows down [56]. In other words, a growing number of transactions on the blockchain leads to the challenge of processing large amounts of data in real time [53,57]. Moreover, blockchain-based recruitment systems have a high power consumption rate as they require significant storage. This requires more investment in the initial setup process compared to present systems [16]. Opinions put forward by the participants also support this:

> *"The biggest problem I have identified in the last few years of watching this space? Ownership/payment." PT1*

> *"Traditional public blockchain technology is expensive and slow. It cannot transact at a commercially viable speed and demands too much energy (cost) to run and store large payloads." PT11*

> *"Many of the current technology solutions adopted by organizations don't have blockchain capabilities. The cost of changing the technology to adopt blockchain native tech is too high." PT14*

This is in line with the findings of Salah et al. [43], who emphasize that practitioners may not adopt this system, thinking that implementation costs will be high. Therefore, the issue of scalability and cost plays an important role in the adoption of this technology. Currently, there are projects investigating ways to keep transaction speeds high with a large number of users [58]. In fact, scalability is an issue for public blockchains rather than private blockchains. It is expected that the scalability problem of general blockchains will be solved with the development of new protocols [55]. In this context, two of the participants suggest:

> *"Storing only hashes on the blockchain denoting transactions or pointing to the encrypted data base for data access" PT11*

> *"Avoidance of blockchains that use Proof-of-Work consensus to perform transactions and incur expensive 'gas' fees." PT9*

4.2.2. Organizational Challenges and Possible Solutions

One of the organizational challenges in adopting blockchain technology is about organizational business models mismatch. As blockchain is decentralized, it may not comply with traditional business models and processes. Some companies better comprehend the nature of innovation that blockchain enables and seek opportunities to build new ventures that take into account the technology's design features such as disintermediation, decentralization, and transparency. On the contrary, established companies in the private and public sectors compromise some of the features of blockchain technology and try to integrate it with current systems and business processes [55].

However, Kartha [52] has declared that it was very difficult to integrate blockchain with existing systems because of the fact that systems or software require a lot of time, expertise, and funds to meet blockchain requirements. As indicated by the quote, PT13 has a similar concern:

> *"I imagine it is difficult to integrate new software into the workplace when employees are used to employing certain tools."*

The findings regarding the possible solutions suggested by the participants to overcome the challenge of integrating the blockchain into their existing business models are presented below:

> *"User interfaces and match making tools need rebuilding in the decentralized paradigm to offer same efficiency as current, centralized tools." PT16*

"Dominant design being adopted by leading companies" can be adopted. PT8

The second organizational challenge is lack of knowledge, skills, and abilities. Most of the solutions that blockchain technology brings about are new and technical for practitioners [58]. So, a high demand for talented and knowledgeable employees has emerged after businesses began to invest in blockchain technology. Nonetheless, the problem of qualified personnel who can understand blockchain technology and its effects on potential business opportunities has emerged [7,59]. Regarding this, PT3 highlights that it is a difficult technology to learn.

As a result, while some businesses decide not to use blockchain technology due to a lack of in-house capabilities [52], others may need training to adopt the emerging technology [22,43]. Some participants argue that education is necessary to overcome the lack of knowledge, skills, and abilities as in the following:

"Educating the masses about the blockchain and its benefit" is required. PT5

"The solution could be in education and maturity not only in the industry but also for those who the industry serves." PT6

"Training for employees on new tools may be needed." PT13

"I think the best solution is to give new courses and trainings about Blockchain for free. Then, we have to be patient about it and give people time to learn and understand." PT18

On the other hand, PT14 mentions that the adoption of the technology is a strategic or financial decision rather than a functional one. However, some participants indicate that reluctance of senior executives to adopt new technology is one of the biggest challenges:

One of the important issues is "reluctance of senior executive to go on the blockchain or even explore it." PT5

"This move to reinvent performance management is happening slowly and is being hampered by the reluctance of HR managers to embrace data-driven decision-making." PT17

The previous studies revealed that support from top management is necessary for successful adoption of blockchain [43], and well-informed senior management, with visionary and innovative leadership mentality, is necessary in the adoption of blockchain technology [55]. PT14 also claims that clarifying the benefits of new technology will increase the willingness of senior management to adopt technology, saying:

"There needs to be a business case that justifies the medium to long term benefits associated with the technology." PT14

4.2.3. Environmental Challenges and Possible Solutions

The first of the environmental challenges is lack of awareness and understanding of blockchain technology. In particular, awareness of technology is low in sectors except banking, and there is a common lack of understanding of its implementation [51]. Blockchain is a constantly evolving technology and it is also difficult to understand due to its complex network structure. The common lack of knowledge about blockchain technology prevents the exploration of ideas for different uses of this technology [36]. In this context, it is revealed that most people think that Bitcoin is the only blockchain network, and they are not aware of the existence of this technology and its potential uses [56]. Participants point out that it is a matter of time with the following statements:

"In my experience—the industry is still trying to figure out how to adapt to web1.0 a small section is figuring out web2.0—none are even close to understand impact of web3.0." PT6

"I think it is a matter of time. 20 years ago, hardly anyone knew what an email or even internet is, and right now even my mother has an Instagram account. Adoption is coming step by step." PT3

> *"It's just a matter of time for the normal evolution to take shape, much like the development of e-mail and browser protocols for the Internet, which was just as clunky and non-user friendly at the outset." PT7*

HRM professionals may need proofs of successful applications in various companies as an effective factor in adopting this technology [43]. According to PT17, "*there is a general inertia in the industry right now. Blockchain technology offers benefits but they are unclear and have not been proven at scale*". In order to overcome this challenge, PT5 recommends "*more case study to show the benefits and Return on Investment (ROI)*", which needs to be conducted.

The second challenge addressed within the scope of environmental challenges is the lack of cooperation between stakeholders. The cross-border nature of blockchain technology can lead to data misuse and unauthorized access to data. Regulatory principles and cooperation are necessary to prevent this situation [55]. In this context, it is critical to protect the confidentiality of job applicant information and to create new laws and regulations [60]. At this point, governments can formulate policies for the application of new technology in verifying job applicant information [22].

As blockchain projects are multidisciplinary, they involve not only governments but also various stakeholders such as companies, financial actors, developers, regulators, accountants, audit firms, and consultants. Therefore, collaboration between stakeholders is regarded as a main component in the successful adoption of this technology [55]. In this respect, the HR blockchain system also needs an interconnected and digitized economy. For example, it is not enough for only a few universities to process their education data on the blockchain [7]. Organizations can make use of the benefits of blockchain when they work together [22].

This is also supported by Toufaily et al. [55], who stress the necessity of multiple stakeholders in the adoption of blockchain to take advantage of the network effects of technology, and point to the importance of public-private partnerships. This is consistent with data obtained from participants. PT12 draws attention to the fact that a broad ecosystem of participants must be engaged across all sectors to connect people with work, while PT5 refers to the need for government involvement and encouragement. Furthermore, examples of collaboration are given by PT1 and PT12, who share:

> *"The Velocity Network Foundation is taking the approach of having the HR Technology community come together to do this. That would seem to be more palatable for employers." PT1*

> *"Collaboration . . . across both specific industry sectors (WEC has done this across the private employment industry sector) and across the ecosystem as a whole (Velocity Network Foundation being a great example here)." PT12*

Table 3 demonstrates challenges of the blockchain-based recruitment process with its sub-themes and codes as well as the possible solutions offered to overcome these challenges.

4.3. Theme 3—Prospects for Blockchain Usage in Recruitment

The findings on the prospects for the blockchain-based recruitment process are presented in two sub-themes: the overview of prospects and the role of the recruiter in the future.

Table 3. Challenges of blockchain-based recruitment process and possible solutions.

Themes	Sub-Themes	Codes	Possible Solutions
T2. Challenges	T2.1. Technological Challenges	- Security and privacy concerns	· Adopting a permissioned blockchain · Convincing people about the data security · Providing total transparency on how and where data is stored
		- Issues of scalability and cost-effectiveness	· Developing of new protocols · Storing only hashes on the blockchain · Avoidance of blockchains that incur high gas fees
	T2.2. Organizational Challenges	- Challenge of integrating blockchain into existing business models	· Rebuilding user interfaces and matchmaking tools in a decentralized paradigm · Implementing dominant designs of leading companies
		- Lack of knowledge, skills, and abilities	Providing education on blockchain
		- Reluctance of senior executives to adopt technology	· Clarifying the medium- and long-term benefits of using blockchain
	T2.3. Environmental Challenges	- Lack of awareness and understanding	· Having a case study to show the benefits of blockchain
		- Lack of cooperation	· Engaging a broad ecosystem of participants · Increasing government encouragement

Source: Constructed by the author.

4.3.1. Overview of Prospects

An ever-increasing group of new technologies, new sectors and markets, more interconnected global economic systems, and wide-ranging information is involved in the future of the business world [61]. Blockchain technology with transparency and immutability features is known as one of the important technologies that will facilitate work in the business of the future [62]. In recent years, it has begun to reshape and decentralize many industries [63].

Although one of the participants (PT14) expresses concern about blockchain, saying that it will remain a topic of discussion for a long time, some other participants (PT5, PT13, PT15) note that they are hopeful for the future:

> *"Too much emphasis has been placed on the tech, rather than the outcomes the tech provides. I fear that until the outcomes are discussed, it will be a topic of discussion rather than a tool for change." PT14*

> *"It will get better and easier and it is here to stay, with the adoption of Web3 a lot will be happening. The future is bright." PT5*

> *"Strong thoughts. I feel it is inevitable." PT15*

> *"As blockchain the technology will be used more and more in just about every industry." PT13*

In the meantime, mass adoption and diffusion of technological developments take time. Thus, the implementation of new-generation blockchain-based solutions in recruitment processes is expected to be a gradual process.

In this regard, it is evaluated that the first stage towards the use of blockchain technology in recruitment processes will be around blockchain-based candidate verification. The second stage is predicted to be about accessing better talent markets through matching jobs and employees. The third stage is anticipated to be a transition to more autonomous organizations and team networks from permanent employees and long-term

employment contracts [64]. This transition process is also confirmed by participants with similar statements:

> *"Digital wallets will enable the first wave. Mainstream adoption remains 3–5 years out." PT12*

> *"This will enable more effective work-matching, better use of platforms in certain industry verticals and geographies." PT4*

> *"In the longer-term, blockchain technology will enable new types of organizations to form such as DAOs, which will give individuals with complementary skills new ways to operate. This changes the way that work is sourced, and therefore what is needed from recruitment services. This has the potential to change the employee-employer contract and how work is designed and managed." PT4*

In addition, some participants highlight that current problems need to be solved in order to predict the future of blockchain-based recruitments. For example:

> *"Solve the current state problems before we even begin to think about solutioning around blockchain—the saying goes it could be a 'square peg in a round hole'." PT6*

> *"I can see a lot of barriers to overcome until adoption is widespread (and adoption needs to be widespread for full benefit)." PT8*

Minimizing the cost of implementing (PT2), increasing the willingness of HR leaders (PT17), and ensuring the visibility of company's brand (PT16) are among the recommendations offered by participants for widespread adoption of this technology.

Considering the following expressions, some participants mention failed company practices and limited future applications while evaluating the future of the blockchain-based recruitment systems:

> *"I have been researching and piloting prototypes for commercial application for 4 years and have seen several companies come and go. I gave up on the technology because the market was not ready. Those who survive will run the future of recruitment as credentials will all be decentralized and job applicants will own and control their issuer granted verified credentials in a digital repository that can be shared in real-time . . . " PT11*

> *"Unless there is a shining use case by a very recognizable brand, then the state of blockchain HR tech will remain at 'pilot' only stage for near future." PT17*

> *"Blockchains used exclusively for the recruitment process will have a limited future. Blockchains are the wrong Distributed Ledger Technology (DLT). The recruitment function is a plug-in component of corporate DLT systems. Along with other components, they will become standardized for interoperability. Many early go-to-market applications have made mistakes that will be hard to reverse or modify in order to be integrated with corporate DLT systems at the point of onboarding." PT9*

4.3.2. Role of Recruiter in the Future

Recently, there have been concerns that developments in blockchain technology may eliminate the need for recruiters. To clarify this issue, the participants were asked "how will blockchain technology affect the role of recruiter in the future?" Most participants argue that the need for recruiters will not disappear. Examples for quotes are:

> *" . . . I do believe that the human touch will remain, the role will become more AI-IT but humans will still be in control. I hope so." PT5*

> *"This has always been a myth. Recruiters will never be replaced as long as human emotion and discernment is required in human beings." PT15*

> *"There has been speculation that blockchain or other data-driven recruitment technology will 'kill' recruitment agencies. This hasn't happened so far, and is very unlikely to happen in the future." PT17*

However, the role of recruiters may need to change. As reported by PT17 *"There is a real opportunity for recruitment agencies or talent acquisition teams to move beyond the current focus of building a talent pool or reactively trying to source a candidate when a job ad arises. This opportunity is for agencies to become more product-centric, offering background screening and verification services, facilitating blockchain-enabled HR tech, and creating new business models such as content creation, consulting on data and data governance, and new types of subscription and on-demand talent acquisition (e.g., gig workers, contractors or niche roles)"*.

Blockchain technology, which is predicted to play a key role in the future of work, may reshape job search and building the right teams [65]. In this context, previous research conducted by Treiblmaier et al. [54] pointed out that blockchain is expected to increase efficiency for routine activities by automating processes and providing common access to immutable data. This expectation is consistent with the opinions of some participants in the present study:

> *" . . . much of the current activities of the recruiter will be automated by technology and the changing nature of the organization." PT4*

> *"It will make their job easier and more efficient." PT7*

> *"They will be able to place candidate faster into roles. There will be less vetting and compliance activities. There will be less contract management." PT14*

> *"Blockchain will empower recruiters and speed their screening process. The time spent having to validate claims and credentials will be reduced on more situational & behavioral questions can be asked providing deeper insight for a better job match in less time." PT11*

With the use of blockchain technology in businesses, current qualifications and skills may lose value [54], and new qualifications may be needed. As specified by Participant 4, "*sourcing work becomes more tactical and broader and requires different skill set to that of the current recruiter*". Therefore, recruiters are expected to be ready for the future, to acquire new knowledge, skills, and requirements resulting from technology, and to adapt to the environment.

In this context, PT9 and PT18 note that recruiters need to learn more as to how technology works. Even more, PT2 states "*blockchain can't give you an understanding about a person's emotional concerns, drives and reason for leaving their current company and joining this next company*". Within this regard, recruiters support the recruitment process by analyzing candidates in detail. In addition, recruiters may have more time to focus on candidates' acculturation levels [66]. This is also indicated by two participants who said:

> *"This will allow the recruiter role to move from one that spends significant time on matching capabilities, to one that is focused on their role as a career coach and better understanding where the cultural and personal fit exists in addition to the skills based match." PT12*

> *"It will make their job easier, but not obsolete. Evidence of human skills is difficult to capture, and companies will still want to ensure a suitable cultural fit for new employees. In such cases, recruiters will need to be better skilled at analyzing and decoding human skills." PT8*

Moreover, recruiters in blockchain-based recruitment systems spend more time building relationships with key candidates, focusing on ROI and business impact, and generally doing higher-level work. This is explained by PT1 as follows:

> *"If we're spending less time filtering through and trying to validate someone's technical skills and more time understanding how they solve problems, how they innovate, or how they collaborate with others, that could ultimately lead to a better and more valuable hiring experience for all involved."*

Furthermore, blockchain-based recruitment processes are based on finding candidates on a global scale. One participant describes its effects:

"Blockchain (and decentralization that it offers) will encourage globalization of the knowledge workers job market. The remote work trend is indeed not going away and recruiters will have to offer contracts across the borders. With a more fluid job market, recruiters may have to offer more short-lived and attractive (lucrative, instructive, meaningful) jobs as employee retention rate will inevitably decrease." PT16

Table 4 presents summary findings on prospects regarding the use of blockchain in recruitment.

Table 4. Prospects for blockchain-based recruitment.

Themes	Sub-Themes	Codes
T3. Prospects	T3.1. Overview of Prospects	- Implementation of blockchain-based solutions may be a gradual process. - There may be a lot of barriers and challenges to overcome for widespread adoption. - Except for well-known brands in the world, there may be a limited future for blockchain used exclusively in recruitment.
	T3.2. Role of Recruiter in the Future	- Human touch may continue to remain important in recruitment. - Routine tasks may be automated and screening process of recruiters may become faster. - Recruiters may need to learn more about how the blockchain works. - Recruiters may need to be better skilled at analyzing human skills. - The recruiter may have more time to focus on the cultural and personal fit of the candidates. - Recruiters may offer more contracts across the borders and more short-lived and attractive jobs.

Source: Constructed by the author.

5. Conclusions

In today's competitive world, businesses need to integrate their business processes with advanced technologies and redesign their current business models in order to be successful. Undoubtedly, the most significant recent breakthrough is the increasing use of digital technologies which provide value-creating solutions. In particular, recruitment, one of the most important functions of HRM, is changing and developing with the common use of digital technology trends such as artificial intelligence, machine learning, chatbots, big data, and blockchain [5,15,21].

In this study, exploratory research is conducted using a comprehensive literature review and a structured interview with experts to investigate the effects of blockchain on recruitment processes. The opportunities, challenges, and prospects offered by blockchain-based recruitment are discussed in detail with a holistic approach. Within the scope of the results obtained in the study, it has been revealed that blockchain technology offers innovative opportunities for recruitment processes in terms of security, cost, time, and quality. Building a digital, secure, and decentralized careers network; providing effective, faster, and cheaper verification mechanism; facilitating performance reviews and conducting interviews on the metaverse have been identified as the main opportunities of blockchain technology in recruitment.

In particular, it is pointed out that blockchain technology, which is used as an influential tool in matching the right employees with the right jobs at the right time, improves the recruitment processes and creates a sustainable competitive advantage for organizations. Depending on this, it is anticipated that recruitment practices will be more closely aligned with company goals and strategies in the future. In addition, as blockchain technology will create a more fluid job market by making it easier to access the global talent market for companies, a growing number of companies will begin to place more emphasis on developing employer branding strategies for attracting and retaining qualified employees.

On the other hand, it is discussed that there are some challenges resulting from the transition to blockchain-based recruitment processes. It has some technological, organi-

zational, and environmental challenges such as security and privacy concern; scalability and cost issues; business models mismatch; lack of knowledge, skills, and abilities; reluctance of senior managers; lack of awareness and understanding; and lack of cooperation. Although these challenges are expected to be eliminated in parallel with the development of technology, analyzing the best practices of leading companies, providing education on blockchain, and increasing government encouragement can be considered as possible solutions in facilitating the transition to blockchain-based business models.

What is more, the prospect for blockchain usage in recruitment is identified. Regarding future trends, it is predicted that blockchain-based recruitment practices may emerge as a gradual process. Additionally, the job descriptions of recruiters may change. Recruiters may need to devote more time to comprehending the operation of technology, analysing the cultural and personal harmony of candidates, preparing cross-border contracts, solving problems, conducting innovation, and collaborating with others, instead of routine work.

As a result, this study is the first attempt to discuss together the opportunities, challenges, and possible solutions and prospects of blockchain-based recruitment. That is why it is considered to make significant contributions to promoting awareness and understanding among researchers and practitioners on the use of blockchain in the recruitment. However, the research has some limitations which offer directions for future research. This exploratory study is carried out with a combination of a limited number of experts and literature review. The widespread use of technology in the future can allow one to have a larger sample size. The survey method can be used for a more representative sample size in order to address the different aspects of the topic. Moreover, the study is limited to recruitment function. Numerous new lines of research are possible in the HRM field. In this regard, new studies on the use of blockchain can be conducted for the functions of training and development, career planning, performance appraisal, and compensation management.

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Institutional Review Board Statement: The study was approved by the Human Research Ethics Committee of Zonguldak Bülent Ecevit University (protocol code 58 and date of approval 24 February 2022).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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Abbreviations

The following nomenclature and abbreviations are used in this manuscript.

AI	Artificial Intelligence
CV	Curriculum Vitae (resume)
DAO	Decentralized Autonomous Organization
DLT	Distributed Ledger Technology
HR	Human Resource
HRM	Human Resource Management
IT	Information Technology
NFT	Non-Fungible Token
PII	Personal Identifiable Information
PT	Participant
ROI	Return on Investment
Tech	Technology
WEC	World Employment Confederation

Appendix A. Interview Form

Title of Research Article: Exploratory Research on the Use of Blockchain Technology in Recruitment

Researcher and Institution: Assoc. Prof. Dr. Nermin Kişi/Department of Management and Organization, Çaycuma Vocational School, Zonguldak Bülent Ecevit University, Turkey.

Research Purpose: The purpose of the research is to investigate the opportunities, challenges, possible solutions, and prospects of blockchain technology adoption in recruitment.

Expert opinions are needed to achieve this purpose. The following interview questions are prepared to provide data for this study. Thank you for your interest, time, and contribution to the study.

Part 1

1. What is your name?
2. What is the name of the company you work for?
3. In which country is your company located?
4. What is your position at work?
5. How many years of work experience do you have?

Part 2

You can write your answers in the blank space below. If you need more space please expand the line spacing on this form.

1. What are the opportunities offered to recruitment processes via blockchain technology?
2. What are the challenges of blockchain technology adoption in recruitment processes?
3. What are possible solutions to overcome these challenges?
4. What are your thoughts on the future of the blockchain-based recruitment process?
5. How will blockchain technology affect the role of recruiter in the future?

Participant's Name and Surname:
Interview Date:

References

1. Chhetri, R. Implementation of Blockchain Technology in Human Resource Recruitment. Bachelor's Thesis, JAMK University of Applied Sciences, Jyväskylä, Finland, February 2022.
2. Marella, V.; Vijayan, A. Document Verification Using Blockchain for Trusted CV Information. In Proceedings of the Americas Conference on Information Systems (AMCIS 2020), Virtual Conference, 15–17 August 2020.
3. Taylor, M.S.; Collins, C.J. Organizational recruitment: Enhancing the intersection of research and practice. In *Industrial and Organizational Psychology*; Cooper, C.L., Locke, E.A., Eds.; Blackwell Publishing: Oxford, UK, 2000; pp. 304–334.
4. Chapman, D.S.; Webster, J. The use of technologies in the recruiting, screening, and selection processes for job candidates. *Int. J. Sel. Assess* **2003**, *11*, 113–120. [CrossRef]
5. Rhemananda, H.; Simbolon, D.R.; Fachrunnisa, O. Blockchain Technology to Support Employee Recruitment and Selection in Industrial Revolution 4.0. In Proceedings of the International Conference on Smart Computing and Cyber Security: Strategic Foresight, Security Challenges and Innovation, Kosong, Korea, 28–29 October 2021.
6. Ganesh, N.S.G. Identification of blockchain-enabled opportunities and their business values: Interoperability of blockchain. In *Blockchain Technology and Applications*; Raj, P., Saini, K., Surianarayanan, C., Eds.; CRC Press: Boca Raton, FL, USA, 2021; pp. 160–184.
7. Nagarathinam, A.N. Potential impact of blockchain on HR and people management. *J. Emerg. Technol. Innov. Res.* **2021**, *5*, 127–130.
8. Rana, R.L.; Giungato, P.; Tarabella, A.; Tricase, C. Blockchain applications and sustainability issues. *Amfiteatru Econ.* **2019**, *21*, 861–870. [CrossRef]
9. Varma, J. Blockchain in finance. *Vikalpa J. Decis. Mak.* **2019**, *44*, 1–11. [CrossRef]
10. Hald, K.S.; Kinra, A. How the blockchain enables and constrains supply chain performance. *Int. J. Phys. Distrib. Logist. Manag.* **2019**, *49*, 376–397. [CrossRef]
11. Pawlak, M.; Poniszewska-Maranda, A. Trends in blockchain-based electronic voting systems. *Inf. Process. Manag.* **2021**, *58*, 102595. [CrossRef]
12. Harris, J.; Nikbakht, E. Blockchain applications in real estate. In *The Emerald Handbook of Blockchain for Business*; Baker, H.K., Nikbakht, E., Smith, S.S., Eds.; Emerald Publishing Limited: Bingley, WA, UK, 2021; pp. 311–323.
13. Attaran, M. Blockchain technology in healthcare: Challenges and opportunities. *Int. J. Healthc. Manag.* **2022**, *15*, 70–83. [CrossRef]

14. Kişi, N. Organizational knowledge management, blockchain and human resources. In *New Directions in Human Resources Management*; Akif Özer, M., Ed.; Gazi Publishing House: Ankara, Turkey, 2022; pp. 267–286.
15. Michailidis, M.P. The challenges of AI and blockchain on HR recruiting practices. *Cyprus Rev.* **2018**, *30*, 169–180.
16. Onik, M.M.H.; Miraz, M.H.; Kim, C.-S. A Recruitment and Human Resource Management Technique Using Blockchain Technology for Industry 4.0. In Proceedings of the Smart Cities Symposium (SCS-2018), Manama, Bahrain, 22–23 April 2018.
17. Jeong, W.-Y.; Choi, M. Design of recruitment management platform using digital certificate on blockchain. *J. Inf. Process. Syst.* **2019**, *15*, 707–716. [CrossRef]
18. Dhanala, N.S.; Radha, D. Implementation and Testing of a Blockchain Based Recruitment Management System. In Proceedings of the 5th International Conference on Communication and Electronics Systems (ICCES), Coimbatore, India, 10–12 June 2020.
19. Serranito, D.; Vasconcelos, A.; Guerreiro, S.; Correia, M. Blockchain Ecosystem for Verifiable Qualifications. In Proceedings of the 2nd Conference on Blockchain Research & Applications for Innovative Networks and Services (BRAINS), Paris, France, 28–30 September 2020.
20. Al Hamrani, N.R.; Al Hamrani, A.R. People of determination (disabilities) recruitment model based on blockchain and smart contract technology. *Technol. Invest.* **2021**, *12*, 136–150. [CrossRef]
21. Lukic, J.M.; Salkic, H.; Ostojic, B. New Job Positions and Recruitment of Employees Shaped By Blockchain Technologies. In Proceedings of the Fourth International Scientific Business Conference LIMEN, Belgrade, Serbia, 13 December 2018.
22. Abdullah, N.; Abdullah, N.H. Future application of blockchain technology in verification for recruitment. *Int. J. Recent Technol. Eng.* **2020**, *8*, 1231–1238. [CrossRef]
23. Yi, C.S.S.; Yung, E.; Lee, S.; Fong, C.; Tripathi, S. Blockchain technology impact HR hiring and off-boarding practices in the Telco sector in Hong Kong. *Int. J. Sci. Res. Manag.* **2020**, *8*, 1695–1702. [CrossRef]
24. Hair, J.F.; Page, M.; Money, A.; Brunsveld, N. *Essentials of Business Research Methods*; Routledge: New York, NY, USA, 2003; p. 163.
25. Myers, M.D. Qualitative Research in Information Systems. *MIS Q.* **1997**, *21*, 241–242. [CrossRef]
26. Johnson, T.P. Snowball sampling: Introduction. *Wiley StatsRef Stat. Ref. Online* **2014**, 1–3. [CrossRef]
27. Naderifar, M.; Goli, H.; Ghaljaie, F. Snowball sampling: A purposeful method of sampling in qualitative research. *Stride. Dev. Med. Educ.* **2017**, *14*, 1–6. [CrossRef]
28. Morse, J.M. Data were saturated . . . . *Qual. Health Res.* **2015**, *25*, 587–588. [CrossRef]
29. Hennink, M.; Kaise, B.N. Sample sizes for saturation in qualitative research: A systematic review of empirical tests. *Soc. Sci. Med.* **2022**, *292*, 114523. [CrossRef] [PubMed]
30. Meho, L.I. E-mail interviewing in qualitative research: A methodological discussion. *J. Assoc. Inf. Sci. Technol.* **2006**, *57*, 1284–1295. [CrossRef]
31. Majumdar, A. Thematic analysis in qualitative research. In *Qualitative Techniques for Workplace Data Analysis*; Gupta, M., Shaheen, M., Reddy, K.P., Eds.; IGI Global: Hershey, PA, USA, 2018; pp. 197–220.
32. Jnanathapaswi, S.G. *Thematic Analysis & Coding: An Overview of the Qualitative Paradigm. An Introduction to Social Science Research*; APH Publishing Corporation: New Delhi, India, 2021.
33. Yin, R.K. *Qualitative Research from Start to Finish*; The Guilford Press: New York, NY, USA, 2011; p. 19.
34. Bejtkovsky, J.; Rozsa, Z.; Mulyaningsih, D.H. A phenomenon of digitalization and e-recruitment in business environment. *Policy J. Manag. Stud.* **2018**, *18*, 58–68. [CrossRef]
35. Prinz, W.; Kolvenbach, S.; Ruland, R. Blockchain for education: Lifelong learning passport. *ERCIM News* **2020**, *120*, 15–17.
36. Komalavalli, C.; Saxena, D.; Laroiya, C. Overview of blockchain technology concepts. In *Handbook of Research on Blockchain Technology*; Krishnan, S., Balas, V.E., Julie, E.G., Robinson, Y.H., Balaji, S., Kumar, R., Eds.; Academic Press: London, UK, 2020; pp. 349–371.
37. França, R.P.; Monteiro, A.C.B.; Arthur, R.; Iano, Y. An introduction to blockchain technology and their applications in the actuality with a view of its security aspects. In *Transforming Cybersecurity Solutions Using Blockchain*; Agrawal, R., Gupta, N., Eds.; Springer: Gateway East, Singapore, 2021; pp. 31–53.
38. Peisl, T.; Shah, B. The impact of blockchain technologies on recruitment influencing the employee lifecycle. In *Systems, Software and Services Process Improvement*; Walker, A., O'Connor, R., Messnarz, R., Eds.; Springer: Cham, Switzerland, 2019; pp. 695–705.
39. Wang, X.; Feng, L.; Zhang, H.; Lyu, C.; Wang, L.; You, Y. Human Resource Information Management Model Based On Blockchain Technology. In Proceedings of the 2017 IEEE Symposium on Service- Oriented System Engineering (SOSE), San Francisco, CA, USA, 6–9 April 2017.
40. Chillakuri, B.; Attili, V.S.P. Role of blockchain in HR's response to new-normal. *Int. J. Organ. Anal.* **2021**. [CrossRef]
41. Yi, C.S.S.; Yung, E.; Fong, C.; Tripathi, S. Benefits and use of blockchain technology to human resources management: A critical review. *Int. J. Hum. Resour. Stud.* **2020**, *10*, 131–140. [CrossRef]
42. Spence, A. *Blockchain and the Chief Human Resources Officer: Transforming the HR Function and the Market for Skills, Talent, and Training*; Blockchain Research Institute: Mountain View, CA, USA, 2018; p. 23.
43. Salah, D.; Ahmed, M.H.; ElDahshan, K. Blockchain Applications in Human Resources Management: Opportunities and Challenges. In Proceedings of the Evaluation and Assessment in Software Engineering (EASE'20), Trondheim, Norway, 15–17 April 2020.
44. Sifah, E.B.; Xia, H.; Cobblah, C.N.A.; Xia, Q.; Gao, J.; Du, X. BEMPAS: A Decentralized Employee Performance Assessment System Based on Blockchain for Smart City Governance. *IEEE Access* **2020**, *8*, 99528–99539. [CrossRef]

45. Deloitte. Metaverse Report- Future Is Here Global XR Industry Insight. Available online: https://www2.deloitte.com/content/dam/Deloitte/cn/Documents/technology-media-telecommunications/deloitte-cn-tmt-metaverse-report-en-220321.pdf (accessed on 12 March 2022).
46. Mystakidis, S. Metaverse. *Encyclopedia* **2022**, *2*, 486–497. [CrossRef]
47. Dhelim, S.; Kechadi, T.; Chen, L.; Aung, N.; Ning, H.; Atzori, L. Edge-enabled Metaverse: The Convergence of Metaverse and Mobile Edge Computing. *J. Latex Cl. Files* **2015**, *14*. [CrossRef]
48. Jeon, H.-J.; Youn, H.-C.; Ko, S.-M.; Kim, T.-H. Blockchain and AI meet in the metaverse. In *Advances in the Convergence of Blockchain and Artificial Intelligence*; Fernández-Caramés, T.M., Fraga-Lamas, P., Eds.; IntechOpen: London, UK, 2022; pp. 1–10.
49. Simpson, M. How to Prepare for Job Interviews in the Metaverse. Available online: https://theinterviewguys.com/job-interviews-in-the-metaverse/ (accessed on 20 April 2022).
50. Juneja, P. How Using Blockchain Can Transform the HR Function and Change the Way it Works. Available online: https://www.managementstudyguide.com/how-using-blockchain-can-transform-the-hr-function-and-change-the-way-it-works.htm (accessed on 25 April 2022).
51. Deloitte. Blockchain: Enigma. Paradox. Opportunity. Available online: https://www2.deloitte.com/content/dam/Deloitte/xe/Documents/technology/Blockchain.pdf (accessed on 25 April 2022).
52. Kartha, R.S. Challenges and its Solutions with Blockchain Technology Adoption in Enterprises. *Turk. Online J. Qual. Inq.* **2021**, *12*, 1236–1246.
53. Jena, A.K.; Dash, S.P. Blockchain technology: Applications and challenges. In *Blockchain Technology: Introduction, Applications, Challenges*; Panda, S.K., Jena, A.K., Swain, S.K., Satapathy, S.C., Eds.; Springer: Cham, Switzerland, 2021; pp. 1–11.
54. Treiblmaier, H.; Umlauff, U. Blockchain and the future of work: A self-determination theory approach. In *Blockchain Economics: Implications of Distributed Ledger Technology: Markets, Communications Networks, and Algorithmic Reality*; Swan, M., Potts, J., Takagi, S., Witte, F., Tasca, P., Eds.; World Scientific Publishing Europe Ltd.: Toh Tuck Link, Singapore, 2019; pp. 105–123.
55. Toufaily, E.; Zalan, T.; Dhaou, S.B. A framework of blockchain technology adoption: An investigation of challenges and expected value. *Inf. Manag.* **2021**, *58*, 103444. [CrossRef]
56. Iredale, G. Top 10 Blockchain Adoption Challenges. Available online: https://101blockchains.com/blockchain-adoption-challenges/ (accessed on 30 April 2022).
57. Gayvoronskaya, T.; Meinel, C. *Blockchain: Hype or Innovation*; Springer: Cham, Switzerland, 2021; p. 56.
58. Geroni, D. Top 10 Enterprise Blockchain Implementation Challenges. Available online: https://101blockchains.com/enterprise-blockchain-implementation-challenges/ (accessed on 30 April 2022).
59. Wiles, J. 5 Ways Blockchain Will Affect HR. Available online: https://www.gartner.com/smarterwithgartner/5-ways-blockchain-will-affect-hr (accessed on 5 May 2022).
60. Mkaouar, H. Blockchain Impact on Human Resources. Available online: https://medium.com/@hichem.mkaouar/blockchain-impact-on-human-resources-6f2e78634498 (accessed on 5 May 2022).
61. World Economic Forum. The Future of Jobs Report 2020. Available online: https://www3.weforum.org/docs/WEF_Future_of_Jobs_2020.pdf (accessed on 8 May 2022).
62. Kaveri, A. Transparent Future of Work Enabled by Blockchain. Available online: https://www.dqindia.com/transparent-future-of-work-enabled-by-blockchain/ (accessed on 5 May 2022).
63. Attaran, M.; Gunasekaran, A. Blockchain-enabled technology: The emerging technology set to reshape and decentralise many industries. *Int. J. Appl. Decis. Sci.* **2019**, *12*, 424–444. [CrossRef]
64. Verlinden, N. Blockchain in HR: Challenges, Applications and the Future of Work. Available online: https://www.aihr.com/blog/blockchain-hr-challenges-applications-future-of-work/ (accessed on 8 May 2022).
65. He, E. Blockchain's Role in Reshaping the Future of Work. Available online: https://www.forbes.com/sites/emilyhe/2020/09/01/blockchains-role-in-reshaping-the-future-of-work/?sh=58f4e08b2c80 (accessed on 5 May 2022).
66. Impellam Group. How Blockchain Technology Will Impact Recruitment. Available online: https://www.impellam.com/articles/how-blockchain-technology-will-impact-recruitment (accessed on 10 May 2022).