Exploring the Potential of Adopting Blockchain in Human Resource Management

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***Abstract*—Human resource management (HRM) faces persistent challenges in ensuring data security, verifying credentials, and improving process efficiency. The subject of this research is the development of a blockchain-based HRM ecosystem to address these issues by leveraging decentralized data management and smart contract automation. The paper analyzes the concepts of blockchain technology with a focus on its application in HRM. The practical part of the work involves a survey of HR stakeholders, guided by the adapted Blockchain Adoption Model, to examine their readiness for blockchain adoption. This approach highlights the potential of blockchain to enhance trust and efficiency in HRM processes.**

Keywords - human resource management, blockchain, Blockchain Adoption Model, smart contract, Artificial intelligence

I. INTRODUCTION

The ongoing wave of digital transformation is reshaping every aspect of organizational operations, and Human resource management (HRM) is no exception. Organizations are rethinking how they attract, manage, and support talent in response to growing demands for speed, transparency, and trust. As organizations strive for greater efficiency, agility, and employee-centric approaches, traditional HRM practices are increasingly being challenged [1]. Conventional HR practices still struggle with long-standing challenges verifying candidate credentials, ensuring data integrity, and building trustworthy systems for employees and employers. These challenges underscore the need for innovative, secure, and decentralized solutions.

Blockchain technology, with its decentralized structure and ability to securely record and verify information, offers a promising path forward. It has the potential to transform HR processes by making them more transparent, secure, and efficient. From background checks to smart contract automation, it could reshape how we handle sensitive HR data and interactions. This paper explores the viability and potential impact of adopting blockchain technology in HRM. The central contribution of this work is the conceptualization of a HRM ecosystem based on blockchain, aimed at enhancing trust, transparency, and operational efficiency. The research examines the current readiness of HR stakeholders to implement blockchain-driven HR solutions, offering insights into both the opportunities and barriers to adoption.

The remainder of this paper is organized as follows. The second section provides an overview of existing literature, followed by a presentation of the proposed HRM ecosystem based on blockchain. The research methodology section outlines the approach employed to assess organizational readiness for blockchain adoption in HRM. The results section presents the main findings interpreted in the discussion. Finally, the paper provides a summary of key insights and suggests directions for further research and development.

II. BLOCKCHAIN IN HRM: THE STATE OF THE ART

Human resource management encompasses processes such as recruitment, candidate verification, credentialing, and payroll administration. These processes are traditionally manual and time-consuming, often leading to inefficiencies, increased costs, and data integrity issues [2]. The verification of resumes, degrees, and work experience remains a critical bottleneck in HR workflows.

Recent literature identifies blockchain as a promising tool to improve transparency and trust in HR systems by automating credential validation, reducing fraud, and providing immutable records [3] [4] [5]. As a distributed and tamper-proof ledger, blockchain technology enables decentralized data management and enhances information authenticity [3]. In HRM, blockchain facilitates verifiable digital credentials, decentralized identity management, and automation of contracts through smart contracts [4]. Technology has also been linked to transaction cost theory, as it reduces uncertainty and the need for intermediaries in employment agreements [3].

A. Credential Validation and Automation

One of the key challenges in HRM is the manual and often unreliable process of verifying candidates' educational qualifications, certifications, and previous work experiences. HR departments commonly face delays and inaccuracies when cross-checking credentials, especially in international or remote hiring contexts. Blockchain addresses this challenge by enabling trusted institutions to issue cryptographically signed, verifiable credentials that HR systems can automatically validate without intermediaries. The EduCTX platform, developed by [6], demonstrates a practical implementation of blockchain-based credential verification. Designed on a Hyperledger, EduCTX enables accredited higher education institutions to act as validating nodes that issue verified academic credits in the form of blockchain tokens tied to individual students. These credits conform to the European Credit Transfer and Accumulation System (ECTS), ensuring standardization and cross-border recognition of qualifications within the European Higher Education Area. Human resource departments can verify a candidate's academic background by obtaining their public blockchain address, which grants access to verifiable records without the need for third-party intermediaries. The authors [3] introduced a blockchain-based system that allows universities to digitally issue diplomas as cryptographically signed records on a permissioned blockchain. Each diploma is linked to a unique digital identity and verified through hash-based validation, ensuring authenticity and resistance to forgery. Projects like MIT's Blockcerts demonstrate how academic institutions can issue blockchain-based diplomas, which employers can validate without third-party services [4]. Smart contracts can streamline recruitment processes by filtering candidates based on predefined conditions such as experience or qualifications [6].

B. Fraud Reduction in Recruitment and Employment

Credential fraud, such as fake diplomas or inflated experience, remains a major HRM challenge, especially in competitive or remote hiring. Blockchain technology is increasingly used in the public sector HR systems to improve the integrity and traceability of personnel records. In the study by authors [7], real-life deployments show how employee-related events such as recruitment, promotion, and credential registration are stored as individual, time-stamped transactions on a permissioned blockchain network. Each record is validated through consensus among authorized nodes and secured using cryptographic hashing, ensuring it cannot be altered retroactively. Access control is enforced through role-based authorization mechanisms, allowing only verified stakeholders to retrieve or validate specific information. This approach significantly strengthens the auditability of HR processes while reducing opportunities for internal manipulation or unauthorized data changes.

Recent research emphasizes the effectiveness of blockchain in preventing recruitment-related fraud by ensuring the authenticity and integrity of candidate credentials. Rahman [8] proposes Verifi-Chain, a system that combines blockchain and InterPlanetary File System (IPFS) to store academic certificates as digital files, while recording their cryptographic hash on the blockchain.

C. Providing Immutable and Transparent HR Records

Maintaining reliable HR records is often hindered by fragmented data and inconsistent updates, leading to issues in evaluations, compliance, and audits. Blockchain addresses this by recording every HR action such as promotions or evaluations as timestamped, immutable transactions, creating a secure audit trail that ensures accountability and legal transparency. Recent studies confirm that blockchain technology enhances the security and transparency of HR records by ensuring tamper-proof audit trails. Darodjat and Arapah [4] demonstrated how blockchain implementation in talent management at PT Pertamina Gas improved verification processes and protected sensitive employee data from unauthorized access. A recent study by authors [9] investigates how blockchain technology can improve transparency and security within talent management processes, with a particular focus on recruitment. The authors highlight that blockchain effectively addresses common issues such as data manipulation, inefficiencies in document verification, and lack of authenticity in submitted credentials [10]. Blockchain enables secure credential verification and preserves recruitment data integrity, speeding up decision-making and reducing administrative workload.

D. Readiness and Adoption of Blockchain in HRM

Key factors influencing readiness include the availability of infrastructure, awareness among HR professionals, and top management support. While many stakeholders recognize blockchain's potential to enhance data integrity and automate workflows, challenges such as regulatory uncertainty and a lack of integration with existing systems slow down implementation. Successful adoption will depend on aligning blockchain initiatives with strategic HR goals and demonstrating value through pilot projects. Recent empirical studies further confirm these findings. A survey conducted among employees in the pharmaceutical sector in Jordan found that institutional support significantly influences readiness to adopt blockchain in HRM [11] [12]. Similarly, a cross-sectional study involving 158 employees from various organizations revealed low levels of awareness and highlighted the need for additional training and education to overcome organizational resistance and increase adoption rates [12]. Both studies point to the importance of building internal capacity and promoting a supportive environment to successfully implement blockchain-driven HR solutions.

III. HUMAN RESOURCE MANAGEMENT ECOSYSTEM BASED ON BLOCKCHAIN

This paper presents a developed model of human resource management ecosystem that integrates blockchain and other emerging technologies such as artificial intelligence (AI) and cloud computing to improve efficiency, trust, and automation across employment processes. The model is designed to support key HRM stakeholders such as candidates, previous employers, educational institutions, state institutions, recruitment agencies, employers, and human resources sectors (Fig. 1). Using a permission blockchain network, these actors can interact securely and transparently through decentralized identity mechanisms, smart contracts, and shared data infrastructures [13].

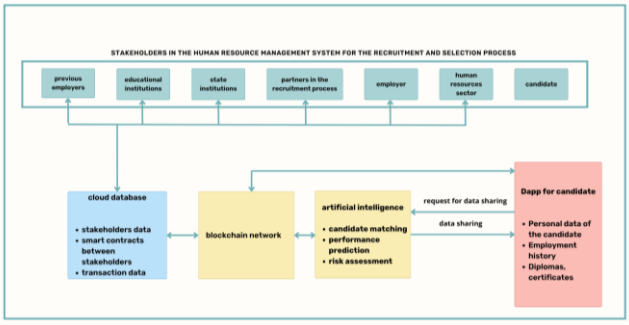

Fig. 1. Model of HRM ecosystem based on blockchain

The proposed model enables mutual trust by recording employment history, qualifications, and verification attestations on a tamper-proof ledger, eliminating resume fraud and streamlining hiring workflows [14]. Blockchain's role in identity management, credential validation, contract enforcement, and payroll processing are enhanced by AI modules that optimize decision-making, detect inconsistencies, and automate processes such as candidate screening and performance assessment [15]. AI modules are deployed off-chain to ensure computational efficiency, enabling advanced tasks such as candidate matching, performance prediction, and risk assessment, while their outputs, used to inform HR policies or trigger smart contract actions, are recorded on-chain as cryptographic hashes to guarantee transparency and auditability [16] [17]. Cloud databases complement the blockchain infrastructure to store large data volumes off-chain and provide scalability. These databases contain hashed references to sensitive personal or institutional data, supporting data minimization principles in line with privacy regulations like GDPR [3]. A decentralized application (DApp) allows candidates to manage their professional profiles, share verified credentials with authorized stakeholders, and access job opportunities. The application gives individuals control over who can access their data, using key-based permission management. Employers and recruiters, in turn, can verify applicant credentials in seconds, reducing the burden of manual checks and increasing hiring transparency [19].

The proposed HRM ecosystem incorporates the following blockchain-AI integrations [17-20]:

- **Identity verification and credential management.** Blockchain secures verified credentials, while AI checks consistency and detects forgeries across systems.
- **Smart contracts and hiring automation.** Smart contracts automate employment, compensation, and onboarding, while AI enhances them by verifying eligibility and optimizing decision-making.
- **Payroll and compensation.** Smart contracts automate payroll upon verified work, while AI detects anomalies in time logs, benefits, and salaries.
- **Performance management.** Immutable records store employee reviews and training, while AI provides personalized development and performance insights.
- **Recruitment analytics.** Blockchain ensures authenticity of applicant data, while AI ranks candidates, detects skill gaps, and matches profiles to job requirements.
- **Fraud detection and compliance.** AI continuously monitors transactional patterns for signs of manipulation or non-compliance. Blockchain guarantees data traceability.

In the blockchain-enabled recruitment ecosystem, various stakeholders participate in distinct phases of the HR process. Candidates initiate the process using decentralized digital identities linked to verifiable credentials stored on the blockchain, while universities, previous employers, and government institutions contribute authenticated educational, employment, and legal records. During recruitment, recruiters and external partners access these records, upon candidate consent, to validate qualifications and reduce fraud, with AI algorithms deployed off-chain to support automated matching, risk profiling, and performance predictions. In the selection and onboarding phase, HR managers and employers interact through smart contracts that automate offer issuance, contract execution, and payroll based on predefined rules, all recorded immutably on the blockchain. Once employment begins, updates from training providers and internal HR systems are logged on-chain, creating a trusted, candidate-controlled digital profile. This ecosystem ensures transparency, efficiency, and secure data access while balancing automation (AI) and trust (blockchain) across all participants.

To ensure interoperability in HR data exchange, the system can adopt or align with existing frameworks such as HR-Open Standards (HR-XML) or draw inspiration from domain-specific models like HL7 FHIR used in healthcare. Standardized schemes for representing employment history, competencies, and certifications would enable consistent and reliable data exchange across platforms. This would allow integration with legacy HR information systems and third-party recruitment platforms. Role-based access control ensures only authorized parties can view or interact with sensitive data [3]. The system is designed to reduce operational costs by minimizing intermediaries, automate trust in recruitment and employment processes, and enable scalable, privacy-compliant HR operations. Challenges such as legal liability for smart contracts, AI bias mitigation, and global regulatory alignment must be addressed to enable full deployment [11]. Early pilots and academic prototypes suggest strong potential for real-world implementation of this architecture [14].

IV. METHODOLOGY

A. Research context

To examine HR stakeholders' readiness for blockchain adoption, an adapted version of the Blockchain Adoption Model (BAM) [2] is used. The proposed model consists of specific constructs, key factors for technology adoption: relative advantage, compatibility, complexity, trialability, observability, top management support, organizational readiness, size, maturity and performance, competitiveness, market conditions, legal support, collaboration, and ecosystem scope (Fig. 2).

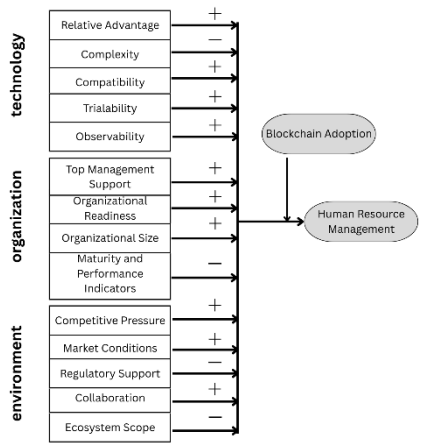

Fig. 2. Blockchain adoption model (adapted from [2])

The technological factors include the characteristics of all available technological solutions important for a company in particular conditions. It consists of five attributes. Relative advantage (RA) refers to the benefits of implementing new technology compared to any other traditional method of operation. It considers what adds additional value to the current way of doing business. Complexity (CX) indicates the level of difficulty in adopting new technology and the organization's ability to adapt to it. Compatibility (CT) explains the extent to which the innovation aligns with the existing values of the organization that would implement it. Trialability (TR) is defined as the ability to test the process and the innovative idea before deciding to adopt it. Observability (OB) describes how the visibility of technology's positive results spreads and influences the decision of new organizations to adopt the technology. The following hypotheses are formed:

H1: Relative advantage positively affects the decision of an organization to adopt blockchain technology.
H2: The greater complexity of blockchain technology will negatively affect the decision to adopt it within the organization.
H3: Compatibility positively affects the decision of an organization to adopt blockchain technology.
H4: Trialability positively affects the decision of an organization to adopt blockchain technology.
H5: Observability positively affects the decision of an organization to adopt blockchain technology.

The second important factor is the organization, with its categories. Top management (TM) support indicates the willingness of the highest management to support the entire process of introducing innovative technology and to face all obstacles. Organizational readiness (OR) refers to the organization's preparedness to adjust its processes, culture, and resources to be capable of introducing new technologies. Organization size (OS) provides information on how the organization's size in terms of workforce, resources, capabilities, processes, and procedures influences decision-making. Maturity and performance (MP) are linked to the previous category, which shows how the abilities and experience the company has gained over the years can affect its potential to implement innovation. The following hypotheses are formed:

H6: Greater support from top management increases the likelihood of implementing blockchain technology in human resources management.
H7: Employees in the organization who are more willing to undergo education will more easily adopt new technologies like blockchain.
H8: Larger organizations will benefit more from introducing blockchain technology because they have more complex procedures in human resources and more complex data structures.
H9: Organizations that do not have sufficiently developed employees and are not willing to invest in employee education for using the technology will not be able to successfully adapt to this technology.

The final group of factors pertain to environmental factors. Competitive pressure (CP) is a category that shows whether the organization aims to achieve a competitive advantage through innovation adoption and whether this motivates it to progress. Market conditions (MC) observe the readiness of external stakeholders to accept and implement innovative technologies. Regulatory support (RS) has a significant impact on innovation adoption as it explains the constraints and opportunities in aligning innovative processes with existing legal rules and procedures. Collaboration (CO) provides information on whether collaboration with stakeholders would facilitate the organization's adaptation to new technologies. Ecosystem scope (ES) relates to how the size of the business ecosystem influences the decision to apply blockchain technology.

The following hypotheses have been formulated:

H10: Companies that introduce blockchain technology faster than others will gain a competitive advantage over other organizations in the same industry.
H11: Greater awareness of the use of blockchain technology enables greater willingness of candidates to apply for positions within organizations that use this technology.
H12: Legal restrictions may influence organizations to decide not to use blockchain technology.
H13: The possibility of collaboration with other stakeholders would positively contribute to the decision to implement blockchain technology.
H14: A broader scope of the business ecosystem negatively affects the decision to adopt blockchain technology because more complex ecosystems can hinder the integration of new technologies.

B. Instruments

The structure of the questionnaire consists of three segments, each corresponding to a specific construct. Accordingly, the questions were organized to align with these constructs. Respondents were reached through various channels, including email, LinkedIn messages, and other direct communication methods. This multifaceted approach allowed us to connect with HR professionals and gather

insights pertinent to our research. The results were gathered during a three-and-a-half-month period.

The measurement model of latent variables refers to establishing the connection between collected data and the latent variables observed in the model, i.e., the reliability and validity of indicators measuring individual constructs. The structural model analyzes the interrelationships among the latent variables themselves, i.e., it examines how independent variables influence dependent ones. Outer loadings were examined to assess indicator reliability, and those with values below 0.70 were excluded from the model. After removing these items, the PLS algorithm was reapplied, and the updated results were presented. We eliminated the construct related to top management support based on the results shown in the outer loadings table after the first application of the PLS methodology.

C. Sample

Regarding the target group we focused on in this study, it includes individuals working in human resources positions. A total of 63 participants took part in this research. The age of the respondents ranges between 20 and 30 years, with an equal number of respondents between 30 and 40 years and under 20 years. Only 11.1% of respondents are over 40 years old. At the beginning of the survey, each respondent answered several demographic questions, which helped us draw some initial conclusions about the participants. Most respondents are female, which is expected considering that human resources roles are predominantly occupied by women. Most respondents have completed higher education or university degrees.

V. RESULTS

The R-squared parameter indicates the proportion of variance in the dependent variable that can be explained by the independent variables in the model. A higher value of this coefficient suggests better explanatory power of the model. In our case, the coefficient of determination is 0.466 (46.6% of the variation), indicating a moderate ability to explain the variation in the dependent variable.

Regarding the measurement model, all constructs in the proposed model were modeled as reflective. Table 1 presents the assessment of reliability and convergent validity for most constructs using standard criteria: Cronbach's Alpha (> 0.6), Composite Reliability (> 0.7), and Average Variance Extracted (AVE > 0.5). Composite reliability, which measures internal consistency similarly to Cronbach's Alpha, is considered ideal between 0.7 and 0.9, with values above 0.95 potentially indicating redundancy among items. All constructs included in Table 1 meet the stated thresholds, confirming acceptable internal consistency and convergent validity. However, several constructs were excluded from Table 1 because they were measured using a single indicator. As reliability and validity statistics such as Cronbach's Alpha, Composite Reliability, and AVE require at least two indicators to be computed, SmartPLS omits single-indicator constructs from this output. Their exclusion from the measurement model summary does not imply invalidity, their inclusion in the structural model is methodologically acceptable when the constructs are conceptually well-defined and empirically justified. Discriminant validity was confirmed via the Fornell-Larcker criterion, and collinearity diagnostics using the Variance Inflation Factor (VIF) showed that all constructs had values below 5, indicating no multicollinearity issues in the model.

To determine the statistical significance of these relationships, bootstrapping analysis with 5,000 resamples was performed. This method provided stable estimates of the β coefficients and enabled the calculation of t-values and p-values (see Table 2). Hypotheses were supported when the t-value exceeded the critical threshold ($t > 1.96$, $p < 0.05$) in a two-tailed test. As part of the evaluation of the structural model, collinearity was assessed using the VIF parameter, which indicates the possible presence of multicollinearity among variables. VIF values below 5 are considered acceptable. In our research, all values meet this criterion, meaning there is no collinearity among the variables in the model.

Table 1. Assessment of the measurement model validity

Construct	Cronbach's Alpha	Composite Reliability (ρho_a)	Composite Reliability (ρho_c)	Average Variance Extracted (AVE)
Maturity and performance	0.570	0.601	0.820	0.696
Compatibility	0.691	0.711	0.865	0.762
Complexity	0.557	0.712	0.805	0.677
Competitive pressure	0.653	0.757	0.845	0.733
Organizational Readiness	0.787	0.827	0.902	0.822
Relative advantage	0.833	0.846	0.923	0.856
Market Conditions	0.498	0.503	0.799	0.665
Human resource management	0.889	0.891	0.919	0.694
Blockchain Adoption	0.653	0.703	0.849	0.738

Table 2. Hypothesis testing

	Original Sample	Sample Mean	SD	T Statistics)	P values
OS→BA	0.199	0.191	0.142	1.398	0.162
RS → BA	0.106	0.109	0.113	0.931	0.352
MP→ BA	0.223	0.205	0.174	1.279	0.201
CT→ BA	-0.253	-0.209	0.132	1.910	0.056
CX→ BA	0.012	-0.003	0.156	0.079	0.937`
CP → BA	0.183	0.191	0.128	1.425	0.154
ES→ BA	-0.110	-0.097	0.101	1.091	0.275
OR→ BA	-0.089	-0.095	0.127	0.702	0.483
TR→ BA	-0.187	-0.178	0.104	1.802	0.072
RA→ BA	0.166	0.175	0.166	0.999	0.318
CO → BA	0.218	0.245	0.115	1.896	0.058
MC → BA	0.308	0.288	0.145	2.131	0.033
OB→ BA	0.077	0.055	0.178	0.435	0.663
BA→ HRM	0.683	0.700	0.068	10.101	0.000

It is observed that the market condition indicator emerged as the most significant, important, and relevant in this research. The results show that this is the indicator with the greatest influence on the adoption of blockchain technology in human resources. The only accepted hypothesis is the one related to this indicator, which is Hypothesis 11. All other defined hypotheses in this case were not found to be relevant, had no impact, and are not significant for this sample. This suggests that greater focus is needed on improving practice, raising awareness, and educating users about blockchain benefits, as both awareness and market conditions significantly influence adoption willingness and talent attraction.

VI. DISCUSSION AND CONCLUSION

This paper presented a model of HRM ecosystem based on blockchain, illustrating how decentralized technologies can enhance credential validation, automate recruitment, and secure employment records. The BAM framework validated blockchain's relevance and identified key adoption factors in HR settings. Limitations include reliance on self-reported survey data, limited geographical scope, and conceptual modeling.

Recommendations for future work include conducting longitudinal case studies and experiments comparing blockchain-based and traditional hiring workflows, as well as analyzing legal implications across different jurisdictions. Further efforts should focus on developing GDPR-compliant blockchain architectures and integrating AI systems for candidate analytics. In addition, it is important to improve measurement and analysis methods to gain more precise insights into factors that influence blockchain adoption in HRM. More attention should be directed toward adopting indicators that currently show limited importance, to better understand their potential relevance. Finally, future research should explore how demographic characteristics may correlate with these indicators, as different respondent groups may respond differently to specific factors not yet recognized as critical.

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