EXPLORING THE INFLUENCE OF BLOCKCHAIN ON HRM IN INDUSTRY 4.0

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ABSTRACT

The advent of blockchain technology initially devised to support cryptocurrencies, has emerged as a revolutionary influence spanning multiple sectors. This research paper explores into the potential ramifications of blockchain on the practices of Human Resource Management (HRM) in Nigeria, underscoring its effects on efficiency, openness, security, and employee involvement. Through its provision of a decentralized and unalterable ledger, blockchain presents remedies for persistent predicaments within HRM. Prior investigations have revealed that integrating blockchain technology in enterprises can yield more dependable and streamlined procedures in diverse operational domains, together with human resource management. This evaluation examines how HR departments are integrating blockchain technology, using the perspective of transaction cost economics theory to identify several key factors that lead to increased transaction costs for organizations. These factors encompass limited rationality, the ever-present potential for opportunistic conduct, and unpredictability. The study explores how deploying blockchain, including smart contracts, can alleviate these hurdles. Furthermore, this article pinpoints certain constraints related to utilizing blockchain and smart contracts that could potentially escalate transaction expenses, thus curtailing the anticipated savings in transaction costs.

Keywords: blockchain technology, Human Resource Management, smart contracts, transaction cost economics, bounded rationality, opportunism, uncertainty, etc.

INTRODUCTION

The current transformative changes in production, consumption, and communication, collectively termed the Industrial Revolution 4.0 (Schwab, 2016), are primarily driven by the growing digitization of processes. Among these changes, blockchain technology, hereafter referred to as "blockchain," stands out as a significant driving force. It is anticipated that blockchain will enhance various organizational processes, including bolstering the precision of supply chain tracking (Subramanian et al., 2020), ensuring the security of contractual agreements (Fauziah et al., 2020), and countering fraudulent activities (Sarda et al., 2018).

In the realm of human resource management, blockchain is poised to have a profound impact on basic HR functions such as recruitment and selection, contract management, training, and compensation (Li et al., 2021; Pal et al., 2021). This paper investigates the potential benefits of blockchain for HR sections through the lens of transaction cost economics (TCE) theory,

particularly as articulated by Coase (1937, 1960) and Williamson (1979, 1989). The central research question addressed is how the implementation of blockchain, from the TCE perspective, could lower the transaction costs associated with HR department activities. Specifically, the study delves into the critical TCE factors of bounded rationality, opportunism, and uncertainty. The analysis demonstrates that by addressing these three issues, the adoption of blockchain technology can result in cost savings for HR departments. What sets this paper apart is its original examination of blockchain integration in HRM within the framework of the core principles of TCE theory. While numerous scholars have discussed the potential of blockchain for HR departments, no previous work seems to have examined its advantages from the TCE perspective, which highlights the role of bounded rationality, opportunistic behavior, and instability in driving transaction costs.

So after this first section, this research paper is organized into distinct sections. The second section provides a review of the literature on blockchain and TCE theory. In the third section, the research methods employed are elucidated. The subsequent fourth Section presents a detailed analysis. The Fifth Section engages in a discussion, while the findings are summarized in the sixth section of the study. The paper concludes with the final section containing comprehensive references in the end.

LITERATURE REVIEW

The Blockchain Technology

The concept of Blockchain originated as the underlying technology for the cryptocurrency Bitcoin. However, it has been embraced by numerous companies, including major players like IBM, Amazon, and Google, as well as a Chinese group led by Tencent and Huawei, along with several government entities (CBInsights, 2019). Blockchain functions as a decentralized peer-to-peer network, serving as a digital ledger for securely managing ownership records and conducting transactions with a certain level of anonymity (Atay & Tong, 2022). Its application extends to certifying and managing ownership of digitally recordable assets (Drescher, 2017). Additionally, Blockchain can effectively manage and document other digital data such as supply chain history, health records, and payment facts (Li et al., 2021).

The structure of blockchain consists of encrypted transaction records grouped into blocks, sequentially linked in a chain. This ledger is duplicated across all network nodes, and a consensus mechanism among network members validates and approves transactions' validity (Drescher, 2017). Because it is decentralized, no central authority governs the Blockchain network or its devices (Babu & Babu, 2020). The immutability of records is ensured by cryptographic links between blocks, preventing unauthorized tampering (Zheng et al., 2018). Changes to transaction records require consensus among network participants, reinforcing the reliability of the system.

Moreover, Blockchain can utilize tokens to represent various assets, potentially creating a native currency for trade within the network (Drescher, 2017). The technology enables the creation and execution of smart contracts, automated agreements coded into software that execute contract terms (Muneeb et al., 2021). These smart contracts are secure and unalterable when deployed on Blockchain, as seen in contactless card payments for services like bus travel (Vigliotti, 2021).

Blockchain's standout features lie in its security and immutability, guarding against unauthorized manipulation of records, which is especially crucial in today's data security landscape (Ahmed et al., 2018). These traits arise from its decentralized and distributed nature, as well as the cryptographic linkage of transaction blocks (Drescher, 2017). Similar to the Bitcoin platform, Blockchains can be either public or private (Limata, 2019). Community blockchains are open for anyone to participate, while private and consortial blockchains are managed by specific organizations, limiting membership to relevant stakeholders. Though these private systems possess some distribution, they ultimately remain under the control of organizing entities that define the system's architecture and rules (Drescher, 2017).

TCE Theory

Ronald Coase and Oliver Williamson, both Nobel Prize winners in economics, are most prominently associated with Transaction Cost Economics (TCE) theory. Mr. Coase is recognized as the pioneer of TCE, a concept introduced in 1937 through his seminal work titled "The Nature of the Firm" (Rindfleisch, 2020). In this article, Mr. Coase differentiates between the expenses involved in conducting transactions and those related to manufacturing goods or services. He later elaborated in 1960 on the various costs associated with transactions, including information acquisition, negotiation, contract drafting, compliance enforcement, and additional costs beyond raw materials and production.

Coase's 1937 argument proposes that while markets could potentially facilitate efficient exchanges of goods and services, the presence of transaction costs led to the formation of firms that could manage these expenses more effectively. Ideal organizational structures, as discussed by Young in 2013, aim to lessen transaction costs.

Mr. Oliver Williamson significantly prolonged TCE, turning it into a cornerstone of economics, organizational theory, and marketing theory (Rindfleisch, 2020). In Williamson's perspective, the transaction becomes the core entity for evaluating economic phenomena. He identifies three key dimensions differentiating transactions: uncertainty, repetition frequency, and specificity of the transaction object. While standardized goods and services can often rely on market control, more complex control mechanisms are required for specialized, non-standardized transactions to ensure successful collaboration.

Williamson introduces two important factors affecting transactions: bounded rationality and opportunism. Bounded rationality recognizes the limitations of human rationality, impacting future events and contractual revisions, ultimately increasing transaction uncertainty. Opportunism refers to self-interested behavior that can disregard ethical principles. While not ubiquitous, opportunism is a prevalent concern in both internal and external transactions.

To enhance efficient economic activities, Williamson seeks an optimal governance structure, which can range from markets to hierarchies and everything in between, depending on the nature of transactions. Williamson's work in 1979 also addresses employer-employee interactions relevant to human resource management. He categorizes these interactions into nonspecific labor market transactions (e.g., agricultural workers), highly idiosyncratic transactions (involving

unique employee value), and mixed transactions (involving employees with useful but not unique skills).

In summary, the combined efforts of Ronald Coase and Oliver Williamson have significantly shaped TCE theory, highlighting the impact of transaction costs, organizational structures, and governance mechanisms on economic activities and interactions between individuals and organizations.

RESEARCH METHODOLOGY

This conceptual research study undertook a search for literature to discover the application of blockchain technology in HR functions. The main terms "blockchain" and "smart contracts" were united with other relevant terms such as HRM, human relations, verification, hiring, training, pay, labor, employees, contractors, outsourcing, etc. The focus of the literature review was on inspecting how the acceptance of blockchain and smart contracts could enhance HR processes. Another search was conducted to delve into Transaction Cost Economics (TCE) theory, examining seminal works by Coase and Williamson along with related commentaries. This phase aimed to uncover the foundational assumptions and key principles of TCE theory.

Drawing insights from the literature reviews, a two-part analysis was carried out. The first segment aimed to address questions regarding consensus amongst researchers on HRM processes that could benefit from blockchain integration. It sought to identify specific HRM processes that could be improved through blockchain implementation and determine the extent of potential benefits. In essence, the goal was to pinpoint the distinctive features of blockchain technology that could enhance standard HRM procedures.

The second, more focused part of the analysis explored how fundamental features of TCE theory could contribute to our comprehension of how blockchain execution could enhance HRM processes. This aspect of the analysis concentrated on evaluating how the five critical variables outlined by TCE theory—bounded rationality, opportunism, uncertainty, frequency, and specificity—could enhance our grasp of how blockchain might enhance HR operations. By merging the findings of these two analytical segments, the paper provided a comprehensive overview of how blockchain integration could ameliorate various common HR processes. Ultimately, this analysis highlighted the significance of addressing vital business challenges outlined in TCE theory to unlock the potential advantages of blockchain execution for HR departments.

The Objectives of the Study

- How the adoption of blockchain and smart contracts could enhance HR processes?
- What is the impact of TCE on blockchain implementation?
- How do the five critical variables outlined by TCE theory impact the working of blockchain?
- To know the influence of blockchain on HRM.

ANALYSIS OF THE STUDY

This section contains a detailed study of the research paper according to the objectives of the study.

Advantages of Blockchain Technology for HRM

The expenses accrued by HR department is not related to production prices but rather pertain to the expenses associated with managing and overseeing time-consuming transactions. As per Transaction Cost Economics (TCE) theory by Williamson (1979, 1989), organizations should prioritize reducing these transaction costs. The literature of study concentrates on four typical functions of HR (Ahmed, 2018; Jain et al., 2021; Patrick & Mazhar, 2019; Thite, 2019; Yi et al., 2020):

- Go through the job applications and selecting suitable candidates for vacant positions within the company.
- Make sure accurately phrased employment contracts for various types of employees (full-time, part-time, and temporary) and external service providers.
- Guaranteeing prompt and precise disbursement of payment to personnel and external contractors.
- Make sure that all training is pertinent, up-to-date, and completed for each job role.

Blockchain and the Hiring Process

A crucial role of HR involves incurring transaction expenses to identify, validate, and recruit the most qualified individuals to meet the organization's requirements—a task marked by labor-intensive and time-consuming phases (Thite, 2019). One of these phases involves verifying applicant credentials, historically requiring extensive efforts to reach out to external parties to confirm the accuracy of applicants' qualifications. Additionally, HR might allocate time to review recruitment platforms that claim to offer reliable details about job hunters. Nonetheless, these stages might not authenticate users' credentials, as their interest lies in encouraging both job hunters and owners to use their service, casting doubt on the credibility of the evidence (Lai, 2020). These authentication actions impose substantial time and labor burdens on HR staff, leading to significant costs.

The verification of candidates' credentials is demanding to the extent that smaller companies may opt to escape this costly process (Sarda et al., 2018). HR units are obligated to validate applicants' provided information to minimize the risk of false resumes, misleading educational records, or other inaccurate qualifications. When assessing applicants' credentials, there is always the possibility of incomplete truthfulness in how they present themselves and their background (Wang et al., 2017). Viewing the issue of interviewees' dishonest representation of qualifications through the Transaction Cost Economics (TCE) lens underscores it as a form of self-serving, opportunistic conduct, a concern identified by Williamson (1979) as a fundamental threat to organizations. In the event of employee layoffs, HR departments might need to undergo costly replacement searches (Trevor & Piyanontalee, 2020).

The integration of the blockchain technology in HR can alleviate the threat of opportunistic behavior through deceitful candidate presentations. It can simultaneously simplify the

cumbersome process of third-party confirmation for the education of candidate and skills by facilitating exact, well-timed, and cost-effective background checks while protection of candidate privacy (Adel et al., 2021). This rationalization involves candidates storing their background information on a dedicated blockchain for tested credentials (Lai, 2020). This information, guaranteed for accuracy, encompasses a comprehensive, unchangeable record of education, work experience, training, etc. and other pertinent credentials that candidates can share with probable employers (Rhemananda et al., 2021). Every facet of the contextual history can be authenticated by educational institutions, previous employers, government agencies, or relevant organizations. Prospective employers' HR departments can access verified blockchain information, enabling them to sight an already confirmed summary of applicants' credentials. This lessens the risk of inaccurate HR data and empowers HR departments with an active decision-making tool (Wang et al., 2017).

The ownership of blockchain-stored information can remain with individual applicants, who grant the right to use it to HR departments as needed. This verified information can be transmitted from applicants to the department, requiring HR staff to review the confirmed details, and expediting the verification of basic qualifications compared to contacting educational institutions, previous employers, and references (Li et al., 2021). Due to its safekeeping and immutability, a blockchain-based listing of applicant credentials can effectively automate the routine, time-wasting third-party verification process, increasing efficiency and freeing up time for other responsibilities. This streamlining results in reduced verification-related transaction costs by minimizing the time invested, thus releasing the employees for other HR responsibilities. The presence of previously certified verification goes beyond the typical offerings of job hunter websites, as websites might be careless in validating claimed qualifications. Blockchain data ensure the same robust security and confrontation to unlawful changes as blockchain archives for real estate transactions.

In summary, leveraging blockchain for verifying applicants' credentials can mitigate the often high transaction costs that HR departments encounter during verification (Atay & Tong, 2022). Nonetheless, a potential drawback of utilizing blockchain for employee verification is reliance on certifying organizations for information accuracy. HR departments must ensure the legitimacy and trustworthiness of such organizations. It's also vital to confirm that these organizations have robust security measures to stop unlawful access to their data. The steps needed to verify third-party legality and ensure overall data integrity and validity add to the transaction's total cost. However, in an environment where unlawful access to personal data and the provision of false information pose constant threats, such expenses are essential.

Blockchain and the limited rationality in employment contracts

HR departments face various transaction costs related to the creation of employment contracts for different types of employees, both internal and external (McKeown & Cochrane, 2017; Neuberger et al., 2019). Ensuring these contracts are unblemished and transparent is crucial, as unclear terms could potentially lead to conflicts or legal disputes. The transition to digital contracts introduces the necessity for stringent security measures to prevent unauthorized alterations. An inherent challenge in contract management is the uncertainty of the future, which can lead to parties demanding contract changes, and this limited predictability contributes to transaction costs

according to the theory of Transaction Cost Economics (TCE) (Williamson, 1979, 1989). Limited rationality and uncertainty, key TCE factors, also amplify these costs. Integrating smart contracts on a blockchain within HR operations can alleviate these issues by enhancing clarity, security, and transparency in contractual agreements (Tiwari et al., 2021). Smart contracts within a blockchain framework are tamper-proof, safeguarding both the company and employees from manipulation or breaches (Muneeb et al., 2021). Traditional concerns such as lost paper contracts or unauthorized modifications to digital records are eliminated. Any disagreements between parties can be fixed by referring to the original blockchain-recorded contract (Lai, 2020).

Leveraging blockchain-based smart contracts to define employment terms can reduce the transaction costs associated with ensuring the performance of employees. Smart contracts offer the advantage of explicitly outlining terms and self-execution, thus automating the verification of employee tasks and diminishing the need for monitoring and discipline (Halaburda et al., 2019). This self-execution feature lessens the transaction costs linked with overseeing employee activities. These smart contracts replace the legal framework governing traditional contracts, fostering trust and reducing the need for control systems (Bromiley & Harris, 2006). For external service agreements, smart contracts within a blockchain establish secure and unalterable agreements, reducing transaction costs and enhancing trust (Oranburg & Palagashvili, 2018). However, limitations should be considered. Translating legal terms into smart contract programming language can be challenging, especially for cross-border contracts (Khan et al., 2021). Legal expertise is crucial to minimize transaction costs related to legal complexities. Programming errors can expose smart contracts to unauthorized access, necessitating costly expert testing (Khan et al., 2021). Additionally, reliance on external data sources for smart contracts can compromise integrity (Hu et al., 2019).

The immutability of blockchain and smart contracts can be main to unforeseen transaction costs, making updates and renegotiations challenging. Parties might need to create entirely new contracts, increasing costs (Hu et al., 2019). Moreover, transaction automation often requires human or oracle input, which can escalate costs in intelligent contract use cases.

Blockchain and Compensations

Smart contracts deployed on the blockchain can rationalize a common HR function: the management of compensation. Once predefined conditions are met within a self-executing smart contract, the agreed upon rewards can be promptly disbursed (Pinna & Ibba, 2018). Since these smart contracts are executed automatically, the involvement of intermediaries such as lawyers, negotiators, or other middlemen becomes unnecessary, leading to the elimination of potential costs. Additionally, the smart contract can stipulate the deduction of applicable tariffs, ensuring precise net payments. The utilization of self-executing contracts diminishes uncertainty regarding the timing of payments to employees or contractors for their services. Furthermore, the blockchain enables organizations to transfer funds directly worldwide without reliance on banks or intermediaries, effectively sidestepping related fees (Ahmed, 2018). This instantaneous uninterrupted fund transfer proves especially advantageous for transparent cross-border payments to external contractors in foreign countries, leading to reduced defrayal and settlement time and

the avoidance of transaction fees levied by transitional entities on either the organization or on the payee (Coita et al., 2019; Tiwari et al., 2021).

As discussed earlier, self-executing contracts can link compensation to task completion, enabling swift and accurate compensation for work carried out. They also diminish the requirement for payment mediators. These advantages alleviate uncertainty concerning payment timelines for employees or contractors. However, it's crucial to note that the adoption of self-executing contracts for compensation management does not obviate the necessity for adequate funds before disbursement. This entails either temporarily freezing an organization's compensation funds or enlisting a guarantor for these funds. In both scenarios, transaction costs are connected with compensation facilitated by smart contracts.

Blockchain and Training

Enhancing the management of employee training stands as a fourth customary responsibility within HR operations that can be enhanced through the application of blockchain technology (Jain et al., 2021; Nurhasanah et al., 2021). Training activities bring about additional costs that companies must bear, necessitating the need for these investments to yield value. Blockchain holds the potential to address skill gaps prevalent across industries by establishing a safe, unified platform where company training officials can contribute insights regarding fundamental proficiencies and capabilities required. Subsequently, participants collaboratively process this input until a consensus is reached on the foundational skills and competencies relevant to the industry. These outcomes can then be securely recorded on the blockchain and made accessible to training centers for the formulation and execution of training initiatives (Fachrunnisa & Hussain, 2020). Blockchain technology can also facilitate the establishment of competence benchmarks for employees and serve as a secure repository for their training histories (Atay et al., 2022). This information aids in evaluating the currency and effectiveness of employees' skills, minimizing the potential transaction costs that might arise from ineffective or insufficient training efforts. Furthermore, heightened efficacy in training endeavors can yield positive effects on the business, fostering stronger employee dedication (Alolayyan et al., 2021). Blockchain contributes to this objective by collecting and evaluating data about employee competencies, knowledge, and attitudes, thereby supporting the professional growth of employees (Nurhasanah et al., 2021).

Considering the advantages of employing blockchain for the management of employee training within the framework of TCE theory, it becomes evident that these benefits might not directly counteract opportunistic behavior or the challenge of uncertain foresight. Nonetheless, these benefits may be viewed as mechanisms for mitigating the adverse impacts of a distinct variable highlighted by TCE: the uncertainty linked with certain transactions. To illustrate, the implementation of blockchain-driven training solutions that are more effective can curtail uncertainty when determining the most qualified personnel for specific tasks. More broadly, the use of blockchain instills confidence in the achievement of desired goals within the company's training initiatives, thereby diminishing uncertainty. Figure 4 encapsulates the merits of blockchain in the context of decreasing training-related uncertainty.

An important caveat in utilizing blockchain to attain consensus on industry competencies is the imperative engagement of industry representatives. These representatives should be experts in training, possessing insights that accurately replicate the prevailing proficiency requirements of the industry. Ensuring the reliability of training-related data collected and deposited in the blockchain remains a critical concern, albeit one that could potentially escalate transaction costs.

RESULT OF STUDY

The application of blockchain technology holds the potential for substantial cost reductions in typical HR operations. The preceding discussion illustrates how these advantages counteract the adverse impacts of various underlying factors that, as per Transaction Cost Economics (TCE) theory, add complexity to transactions and escalate expenses. By alleviating the undesirable influences of these factors, blockchain can result in savings that prolong outside individual transactions.

For example, enhanced verification procedures can result in cost savings by expediting the verification process and ensuring a greater presence of highly skilled employees. Similarly, improved contract management facilitated by smart contracts can lead to savings by addressing cognitive limitations, establishing transparent contracts, and automating immediate rewards based on task completion. This can also enhance employee satisfaction and motivation. Additionally, the utilization of blockchain for training purposes can generate cost savings in specific training programs and result in a more proficient workforce, leading to savings through increased knowledge, skills, and efficiency.

In summary, the integration of blockchain into HR operations holds the potential to decrease costs in specific transactions, contributing to overall company savings and success. However, it's crucial to recognize that while the advantages of blockchain and smart contracts are significant, there are limitations that can result in transaction costs. Notably, implementing smart contracts on the blockchain may face challenges in accurately capturing the intended agreement, necessitating legal expertise and careful translation into code. These challenges, among others, can lead to increased transaction costs.

Despite these potential downsides, companies are increasingly adopting blockchain and smart contracts due to their benefits. However, the widespread adoption of blockchain encounters challenges, such as the requirement for skilled technology experts who understand the technology and can facilitate its implementation. Addressing the legal status of smart contracts and ensuring their security also present challenges. Nonetheless, the positive impact of blockchain and smart contracts, particularly in reducing transaction costs for HR departments, continues to drive their adoption.

CONCLUSION OF THE STUDY

This review paper employs the theory of transaction cost economics as the foundational framework for its analysis. The examination demonstrates how blockchain technology, by delivering specific advantages to fundamental HR functions, addresses the primary factors highlighted by transaction

cost economics theory that tend to escalate transaction expenses. These factors encompass opportunistic behavior, rationality, and uncertainty.

The HR functions that have undergone scrutiny encompass the assessment of job applicants, the allocation of contracts to both internal staff and external contractors, as well as the management of compensation and training. In the context of vetting, blockchain technology can alleviate the challenge of opportunism by streamlining and enhancing the evaluation of applicant qualifications.

Regarding contracting and compensation, blockchain can mitigate the hurdles posed by rationality and uncertainty by enabling self-executing smart contracts. These contracts serve to clarify agreements, automatically signal task completion, and promptly facilitate direct compensation, thereby bypassing the need for intermediaries. In the domain of training, blockchain can help alleviate uncertainty by facilitating the development and monitoring of effective internal and industry-specific training programs.

As the implementation of blockchain technology continues to evolve within organizations, HR departments are likely to uncover further blockchain applications that reduce transaction costs. While blockchain and smart contracts undoubtedly yield cost savings for HR departments, managers must recognize potential limitations that could curtail these savings. Notably, challenges tied to smart contracts, such as the requirement for expert legal guidance and meticulous testing to ensure that the underlying computer code accurately represents contractual intent in human language, may result in transaction costs.

SUGGESTIONS FOR FUTURE RESEARCH

In the future, research exploring the potential magnitude of savings achievable by HR departments through various blockchain implementations could prove valuable. This research could emphasis on savings pertinent to the four transaction categories emphasized in this paper: verification, labor contracting, compensation, and training. Furthermore, additional research that can investigate the feasibility of cost savings through alternative applications of blockchain, not covered in this study, could provide valuable insights. As this is a review paper to know the impact of blockchain on HRM, in the future a study can be done supported with real-time data.

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