Marilou Ioakimidis*

THE PROMISE OF BLOCKCHAIN FOR HRM:
A TRANSACTION COST THEORETICAL PERSPECTIVE

ABSTRACT

Previous research has shown that implementing blockchain technology in businesses can lead to more secure and efficient processes in various organizational areas, including human resource management. This review paper examines the use of blockchain in human resources departments from the perspective of transaction cost economics theory, which identifies several fundamental variables that increase transaction costs for firms. These variables include bounded rationality, the pervasive possibility of opportunistic behavior, and uncertainty. The paper explores how blockchain implementation, including blockchain-enabled smart contracts, can mitigate these challenges. The paper also identifies some limitations to using blockchain and smart contracts that may increase transaction costs and thus reduce transaction cost savings.

KEYWORDS: *blockchain, smart contracts, HRM, transaction cost economics, bounded rationality, opportunism, uncertainty.*

1. INTRODUCTION

The new, disruptive forms of production, consumption, and communication we are experiencing today, referred to as the Fourth Industrial Revolution (Schwab, 2016), are largely due to the increasing digitization of processes. Blockchain technology is at the forefront of these changes (hereafter, "blockchain"). Blockchain is expected to improve organizational processes, including strengthening the accuracy of supply chain tracking (Subramanian et al., 2020), securing contractual agreements (Fauziah et al., 2020), and combating fraud (Sarda et al., 2018). Human resource management (HRM) is one area where blockchain is expected to significantly impact traditional HR functions such as recruitment, contract management, training, and compensation (Li et al., 2021; Pal et al., 2021).

This paper examines how blockchain may provide advantages to HR departments from the perspective of transaction cost economics (TCE) theory, especially as set forth by Coase (1937, 1960) and Williamson (1979, 1989). The paper addresses the research question of how, from the TCE perspective, blockchain implementation may reduce the costs of HR department transactions. In particular, the paper focuses on the key TCE issues of bounded rationality, opportunism, and uncertainty. The analysis shows that blockchain implementation can lead to transaction cost savings for HR departments by addressing these three challenges.

The paper's originality lies in its examination of blockchain implementation for HRM from the perspective of the fundamental elements of TCE theory. Several researchers have argued that blockchain holds

*   Marilou Ioakimidis, Associate Professor, National and Kapodistrian University of Athens, Department of Business Administration, Greece; Phone: +302103689824, Email: mioakeim@ba.uoa.gr

promise for HR departments. However, it appears that no one has yet analyzed the benefits of blockchain for HRM from the perspective of TCE and its central assumptions that bounded rationality, opportunistic behavior, and uncertainty increase transaction costs.

After this introduction, the paper is divided into several sections. Section 2 reviews the literature on blockchain and TCE theory. Section 3 explains the research methods. Section 4 presents the analysis. Section 5 provides a discussion, while Section 6 concludes. The last section provides a list of references.

2. LITERATURE REVIEW

2.1. The nature of blockchain

Blockchain originated as a platform for the cryptocurrency bitcoin but has been adopted by many companies, including IBM, Amazon, Google, and a Chinese consortium led by Tencent and Huawei, as well as various government organizations (CBInsights, 2019). Blockchain is a distributed peer-to-peer network that serves as a digital ledger where individuals can keep ownership records and conduct transactions securely and semi-anonymously (Atay & Tong, 2022). It can be used to certify and manage ownership of any asset that can be digitally recorded (Drescher, 2017). It can also manage and record other digitized information, such as supply chain history, health records, and claims and payment information (Li et al., 2021). Blockchain maintains an encrypted table of transactions, where each block in the chain consists of transactions that occurred during a specific period. The ledger is replicated exactly on each node of the network, and a consensus mechanism involving the network members is used to verify and approve the validity of the transactions (Drescher, 2017). A blockchain is decentralized because no central authority controls the network or the devices on which it runs (Babu & Babu, 2020). Records are immutable because each block is cryptographically linked to the previous block, making it impossible for a single party to change transactions that have been made (Zheng et al., 2018). Records of transactions can only be changed if the network members decide to do so through a consensus process. In addition, a blockchain can use tokens to represent monetary or other types of assets. When this is the case, the blockchain may include a method for creating tokens that provide a native currency that can be traded by network participants (Drescher, 2017).

Blockchain enables the creation and implementation of smart contracts. First described by Szabo (1996), smart contracts are agreements written in computer code that automatically execute the contract terms (Muneeb et al., 2021). Contactless card payments for services such as bus travel are an example of the use of smart contracts (Vigliotti, 2021). When implemented on a blockchain, smart contracts allow parties to make secure agreements that cannot be tampered with or eliminated (Schmitz & Leoni, 2019).

The unique strengths of a blockchain are its security and immutability, which prevent hackers or other unauthorized parties from altering the records in the chain. This is very important in today's world, where secure storage of data is a challenge (Ahmed et al., 2018). The security and immutability of the technology are enabled by its decentralized and distributed nature and the cryptographic linking of the blocks of recorded transactions (Drescher, 2017).

As with the Bitcoin platform, a blockchain can be public or private (Limata, 2019). Public blockchains are open to anyone who wants to participate (Casino et al., 2019). Private and consortial blockchains are managed by a single organization or consortium of organizations and are limited in membership to those deemed to have a legitimate interest in participating. Private and consortial blockchains are thus not purely decentralized systems. Although they are distributed systems to some degree, they are ultimately under the control of one or more organizations that decide on the basic architecture and rules of the blockchain (Drescher, 2017).

2.2. Transaction cost theory

For their separate work in economics, Ronald Coase and Oliver Williamson -each won the highest accolade achievable by an economist, the Nobel Prize-are most closely associated with TCE theory. Coase is the father of TCE theory, founded in 1937 with his seminal article "The Nature of the Firm" (Rindfleisch, 2020). In this article, Coase distinguishes between the cost of conducting transactions and producing a good or service. Coase (1960) points out numerous time and other costs involved in conducting transactions. These include the costs of obtaining information about sources of supply for the required good, negotiating, establishing the terms of the transaction, drafting a contract, and ensuring compliance with the contract terms. These costs are in addition to the costs of raw materials and production. The costs of the steps required to sell a good or service (e.g., the transaction costs of advertising, marketing, and customer relations) are also added to the cost of production. Coase (1937) argues that markets alone would be sufficient for efficiently exchanging goods and services without transaction costs. However, because of the costs associated with the exchange, firms are

formed because they can manage transaction costs more efficiently. Optimal organizational structures minimize transaction costs (Young, 2013).

Oliver Williamson further expanded TCE and made it a major force in economics, organizational theory, and marketing theory (Rindfleisch, 2020). According to Williamson (1979, p. 234), the transaction is the primary unit for analyzing economic phenomena. He asserts that three crucial dimensions distinguish transactions of all types: the uncertainty associated with the transaction, the repetition frequency, and the transaction object's specificity. Market control is sufficient for standardized goods and services; for more specialized, non-standardized services and transactions, more elaborate control is usually required to ensure that the parties can "work things out" (Williamson, 1979. p. 254).

Aside from these three variables, Williamson assumes that transactions between parties are subject to two other conditions: bounded rationality and opportunism. Bounded rationality is the fact that people are not perfectly rational. For example, when negotiating contracts, they cannot know what events might occur in the future that are relevant to the terms of the contract and require revision (Williamson, 1989). The presence of bounded rationality can lead to increased uncertainty associated with a transaction. The concept of opportunism refers to the fact that people often tend to act primarily in their self-interest and take advantage of others without concern for ethical principles. This is not to say that people are always opportunistic, but opportunism is a pervasive possibility that companies must guard against in their internal and external transactions. Given the limits of human rationality and the pervasive possibility of opportunism, the efficient organization of economic activities requires the application of an appropriate governance structure. Williamson, therefore, seeks to determine the most economical institutional framework, which can be markets, hierarchies, or anything in between, to govern transactions of various kinds.

Williamson (1979) addresses transactions between organizations and employees that are particularly relevant to human resource management functions. He divides transactions between employers and employees into nonspecific labor market transactions, highly idiosyncratic transactions, and mixed transactions. Nonspecific transactions are those in which the labor market includes individuals capable of doing a particular type of work that requires little specialized skill. He cites agricultural workers as an example. Highly idiosyncratic transactions involve employees with unique value to a company because of their experience, inside knowledge, or special value as a team member. These transactions may result

in long-term contracts that tie the employee to the company, with both parties facing penalties for unilateral exit from the contract, and may involve the development of long-term compensation plans for the employee. Mixed transactions are those in which employees have acquired skills useful to the company but not uniquely valuable (Williamson, 1979). Examples include transactions in which computer operators, software specialists, and electricians are hired.

3. METHODS

For this conceptual paper, a literature search was conducted using blockchain for HR activities. The search terms "blockchain" and "smart contracts" were combined with some other terms, including HRM, human relations, verification, hiring, training, pay, labor, employees, contractors, and outsourcing. The literature addressing how implementing blockchain and smart contracts for HRM can improve HR processes was particularly interesting.

A second search was conducted that focused on TCE theory. This search led to the seminal articles by Coase and Williamson and commentaries on these articles. These articles were closely examined to identify the basic assumptions of TCE theory and the key concepts that underlie this theory.

Based on the results of the two literature reviews, a two-part analysis was conducted. The first part of the analysis focused on answering several questions. Is there widespread agreement among researchers on which particular HR processes could benefit from blockchain adoption? If so, which HR processes are these? To what extent would blockchain implementation benefit these processes? In other words: What specific features of the blockchain could improve typical HR processes?

The analysis's second and more specific part focused on how basic elements of TCE theory can contribute to our understanding of how blockchain implementation can improve HR processes. This part of the analysis focused on which of the five key variables identified by TCE theory as influencing transaction costs could improve our understanding of how blockchain can improve HR processes. The variables examined were bounded rationality, opportunism, uncertainty, frequency, and specificity.

The two parts of the analysis were combined to provide a more comprehensive look at how blockchain implementation can improve several typical HR processes. The analysis illustrates how mitigating fundamental business challenges identified in TCE theory is important in achieving these benefits of blockchain implementation for HR departments.

3.1. Benefits of blockchain for HRM in the light of TCE theory

The costs incurred by HR departments are not production costs but the costs for entering into, administering, and monitoring certain time-consuming transactions. According to TCE theory, reducing such transaction costs should be a key economic concern for organizations (Williamson, 1979, 1989). The literature reviewed focuses on four typical HR functions (Ahmed, 2018; Jain et al., 2021; Patrick & Mazhar, 2019; Thite, 2019; Yi et al., 2020):

- Reviewing applications and hiring the right people for open positions in the company
- Ensuring correctly worded employment contracts for full-time, part-time, and temporary employees, as well as for all outside individuals providing services
- Ensuring timely and accurate distribution of compensation to employees and outside contractors
- Ensuring all training is relevant, current, and completed for each position.

3.2. Verification, opportunism, and blockchain

An important function of HR, which incurs transaction costs, is to find, authenticate, and hire the best-qualified people for the organization's needs-a function filled with labor-intensive, time-consuming segments (Thite, 2019). One segment is the verification of applicant credentials, which has traditionally involved time-consuming efforts to contact third parties to ensure that the qualifications provided by applicants are true. These third parties may be previous employers, educational and training institutions, personal references, or law enforcement agencies. HR may also spend time inspecting recruitment platforms that purport to provide accurate information about job seekers. However, these platforms may not verify the authenticity of the credentials provided by their users, as it is in the interest of the platform operators to encourage both job seekers and employers to use their service, which calls into question the authenticity of the information (Lai, 2020). These verification activities require significant time and effort from HR personnel, resulting in significant costs. Authenticating applicants' qualifications can be so demanding that small and medium size companies may want to avoid the costly process (Sarda et al., 2018).

HR departments must verify the authenticity of the information provided by applicants to reduce the risk of applicants submitting false resumés or educational credentials or providing other misleading information about their qualifications for a position. When reviewing the credentials submitted by applicants, there is always the possibility that they may not be entirely truthful in presenting themselves and their background (Wang et al., 2017).

Looking at the problem of job applicants' dishonest presentation of qualifications from a TCE perspective, it becomes clear that this is a type of self-serving, opportunistic behavior that Williamson (1979) identifies as a fundamental danger to organizations. The pervasive risk of this opportunism can lead to excessive time being spent verifying the accuracy of the qualifications stated by applicants, which increases transaction costs and can lead to the organization hiring someone not qualified for the job offered. Misrepresentations that result in hiring an underperforming employee who is not qualified for their position are also costly to the company because they hinder teamwork, slow down processes, and may require excessive internal training. Suppose the company decides to lay off the individual. In that case, the HR department may undergo an additional costly hiring process to search for and vet a replacement for the laid-off employee (Trevor & Piyanontalee, 2020).

Blockchain implementation in HR can help reduce the risk of opportunistic behavior in the form of dishonest candidate representation. At the same time, it can streamline the time-consuming practice of third-party verification of candidate education and skills by enabling accurate, timely, and cost-effective background checks while preserving candidate privacy (Adel et al., 2021). Streamlining is achieved by allowing potential applicants to store their background information on a blockchain dedicated to verified credentials (Lai, 2020). This information, whose veracity and accuracy are guaranteed, can consist of a comprehensive, immutable record of an applicant's education, training, work experience, and other relevant qualifications they can share with potential employers (Rhemananda et al., 2021). Each aspect of the background history can be validated by an educational or training institution, a previous employer, a government agency, or another relevant organization. A potential employer's HR department can access the verified information in the blockchain. The technology can allow employees to view an already verified summary of an applicant's qualifications. This reduces the risk of inauthentic HR information and provides HR departments with an effective decision-making tool (Wang et al., 2017). Ownership of the information stored in the blockchain could remain with the individual applicant, with the person granting access to HR departments as needed. This confirmed information can be sent from an applicant to the department. Once received, HR staff only need to review the confirmed information, resulting in faster verification

CHALLANGE: Opportunism in the form of false information on applications
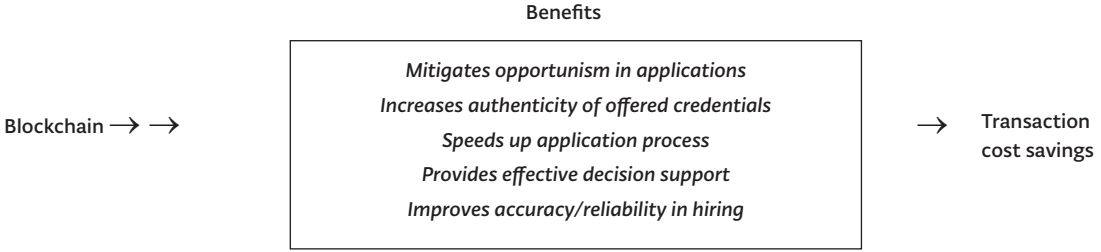MITIGATION: Implement blockchain to improve applicant verification

Benefits

Blockchain → →

Mitigates opportunism in applications
Increases authenticity of offered credentials
Speeds up application process
Provides effective decision support
Improves accuracy/reliability in hiring

→   Transaction
cost savings

FIGURE 1. Blockchain and the hiring process
SOURCE: Author.

of applicants' basic qualifications than by contacting education and training institutions, previous employers, and references (Li et al., 2021).

Because of its security and immutability, a blockchain-based listing of applicants' qualifications could virtually automate the routine, time-consuming third-party verification process, increasing productivity and freeing time for other tasks. This streamlining saves the transaction costs of verification by reducing the time spent on this function while freeing up staff for other HR tasks. The presence of prior certified verification would go beyond what is typically offered by job seeker websites, as a website can be lax in verifying the claimed qualifications of searchers. Blockchain records would have the same ironclad security and complete resistance to unauthorized modification as blockchain registries for real estate transactions.

In summary, using blockchain to verify applicants' qualifications can reduce the often high transaction costs HR departments must spend on verification (Atay & Tong, 2022). Perhaps most importantly, blockchain implementation can improve verification accuracy, increasing the percentage of qualified employees for their position and decreasing the percentage of those who perform poorly. This improved accuracy results in fewer unsatisfactory employees to lay off and fewer transaction costs to contact and vet applicants to replace laid-off employees.

As shown in Figure 1, implementing blockchain to support the hiring process can mitigate the problem of potential opportunistic behavior by applicants by providing several specific benefits. The overall result is transaction cost savings for HR departments.

A potential weakness in using blockchain to verify employees is the reliance on certifying organizations for the accuracy of the information. HR departments should ensure that such organizations are

legitimate and can be trusted. It is also important to ensure that organizations have strong security measures to prevent unauthorized access to their data. The steps required to ensure third-party legitimacy and the data's overall integrity and authenticity increase the transaction's overall cost. However, in an era where unauthorized access to confidential information and the provision of false information is a constant threat, such expenditures are necessary.

3.3. Contract management, limited rationality, and blockchain

Another transaction cost incurred by HR departments arises from preparing employment contracts for full-time, part-time, and temporary employees, as well as from preparing contracts with outside sources (McKeown & Cochrane, 2017; Neuberger et al., 2019). In doing so, they must ensure that contracts are clear and transparent, as unclear contracts can eventually lead to disputes or litigation. When contracts are digitized, it is also critical that they are completely secure and impervious to surreptitious changes. A pervasive danger in contract management is that the future is unknown. Thus, there is the possibility that future events will cause one party to demand changes to a previously agreed-upon contract while the other party disagrees. The fact that the future is unknown is an important aspect of the limited rationality condition that contributes to the cost of transactions according to the theory of TCE (Williamson, 1979, 1989). Limited rationality may also contribute to uncertainty, another key TCE variable that increases transaction costs.

The use of smart contracts on a blockchain by HR departments can help reduce contract management's limited rationality and uncertainty while improving transparency and security. One advantage of

CHALLANGE: Limited rationality, uncertainty, and vulnerability in contracting
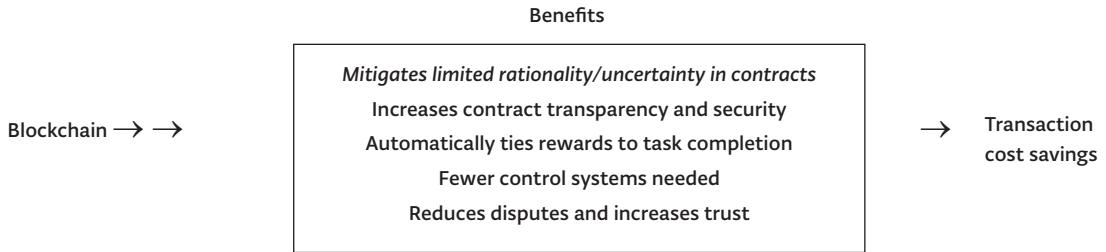MITIGATION: Use self-executing smart contract on blockchain

Benefits

Blockchain → →

Mitigates limited rationality/uncertainty in contracts
Increases contract transparency and security
Automatically ties rewards to task completion
Fewer control systems needed
Reduces disputes and increases trust

→ Transaction
cost savings

FIGURE 2. Blockchain and the limited rationality in contracts
SOURCE: Author.

smart contracts securely embedded in a blockchain is that contractual agreements can only be modified if the parties decide to enter into a new contract, which promotes transparency and clarity in employer-employee agreements (Tiwari et al., 2021). Blockchain protects the company and the employee from attempts to manipulate or breach the contract (Muneeb et al., 2021). Risks with traditional contract implementations, such as the loss of a paper contract or the covert modification of a digitally recorded contract, no longer exist. Disputes between the company and the employee or contractor over contract terms can be more easily resolved by referring to the original contract signed by both parties and then securely recorded in the blockchain (Lai, 2020).

Using smart contracts housed on a blockchain to clarify employment agreements can reduce the transaction costs of securing expected employee work performance. A key advantage of smart contracts is that they are programmed to specify terms and conditions clearly and be self-executing, i.e., to verify that an employee is fulfilling the contract by performing specific tasks (Halaburda et al., 2019). This self-fulfilling capability of smart contracts can reduce the transaction costs associated with monitoring, supervising, and disciplining employees. The use of smart contracts implemented on a blockchain to define, monitor, and ensure employee activities replaces the legal apparatus that governs the application of traditional contracts. Smart contracts increase trust that employees will not breach the contract and reduce transaction costs because control systems are less necessary for more trustworthy employees (Bromiley & Harris, 2006).

For similar reasons, smart contracts embedded in a blockchain are also valuable for encoding agreements with outside contractors for services to be provided (Oranburg & Palagashvili, 2018). The pres-ence of the smart contract in a blockchain guarantees security and makes the agreement virtually unassailable to unauthorized changes (Drescher, 2017), which protects both the organization and the outside party. Such an agreement strengthens trust between the organization and the service provider (Tiwari et al., 2021), reducing the transaction costs that the organization would otherwise incur to ensure that the service provider honors the contract. The clarity and immutability of the smart contract can also reduce transaction costs associated with potential disputes over the terms of the contract.

Figure 2 illustrates the specific benefits of using smart contracts on the blockchain to reduce transaction costs. The figure shows how these benefits mitigate the limited rationality and uncertainty accompanying contracts.

There are several limitations to consider when using smart contracts on a blockchain. One issue that HR managers considering the use of smart contracts should understand is that it can be difficult to translate legal terms in a natural language into the programming language used in a smart contract (Lamb, 2018). Legal issues can also arise from the difficulty of writing a smart contract to conform to another country's legal system (Khan et al., 2021). This problem can arise in cross-border contracts. Overall, it is important to realize that legal advice is required when formulating and drafting smart contracts and that dealing with legal ramifications can increase transaction costs.

Another limitation that can lead to transaction costs is that a contract may have programming errors that make it vulnerable to unlawful interference. Expert testing to ensure that a smart contract works as intended can be costly (Khan et al., 2021). Integrity may also be compromised if the data for a smart contract comes from an outside party, such as an online source that reports on a contractor's work (Hu et al., 2019).

CHALLANGE: Uncertainty in providing timely and accurate compensation
MITIGATION: Use self-executing contracts to immediately pay for services rendered

Benefits

Blockchain → →

Mitigates any uncertainty regarding compensation
Ties compensation to work completion
Provides immediate, accurate compensation
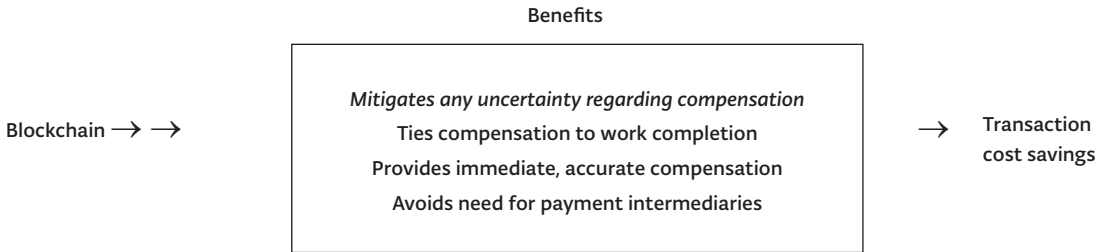Avoids need for payment intermediaries

→ Transaction
cost savings

FIGURE 3. Blockchain and compensations
SOURCE: Author.

The immutability of blockchain and smart contracts can also lead to unexpected transaction costs. Immutability makes it difficult to update smart contracts and limits renegotiations. Even if parties want to change an agreement, they may need to program a new contract (Hu et al., 2019), which increases transaction costs.

In addition, it should be noted that transaction automation is often not complete but requires the input of a person or oracle that provides information that a job or service has been completed. This need can increase transaction costs when using smart contracts.

3.4. Timely and accurate compensation, uncertainty, and blockchain

Smart contracts implemented on the blockchain can streamline another typical function of HR departments: managing compensation. Once the conditions of a self-executing smart contract are met, the agreed-upon compensation or other reward can be released immediately (Pinna & Ibba, 2018). Because smart contracts are self-executing, no intermediaries are needed to ensure fulfillment, eliminating potential costs for lawyers, negotiators, or other intermediaries. The smart contract can specify the deduction of applicable taxes, resulting in an accurate net payment. Payments attached to self-executing contracts reduce uncertainty about when employees or contractors will be paid for their work or services rendered.

In addition, the blockchain allows an organization to transfer funds directly to any location worldwide without going through a bank or other intermediary, thus avoiding all associated fees (Ahmed, 2018). Instant direct transfer of funds is particularly beneficial for instant, transparent cross-border payments for work performed by outside contractors in another country, reducing clearing and settlement time and avoiding all associated transaction fees charged by intermediary organizations to either the organization or the payee (Coita et al., 2019; Tiwari et al., 2021).

As illustrated by Figure 3, self-executing contracts can link compensation to the completion of tasks, enabling immediate, accurate payment for work performed. They can also reduce the need for payment intermediaries. These benefits reduce uncertainty about when employees or contractors are paid for work.

It is important to realize that using self-executing contracts to manage compensation does not eliminate the need for sufficient funds before compensation. This requires either that an organization's funds for compensation be frozen for some time or that there be a guarantor for those funds. In either case, there are transaction costs associated with compensation enabled by smart contracts.

3.5. Training, uncertainty, and blockchain

Managing employee training is a fourth typical HR function that can be improved using blockchain (Jain et al., 2021; Nurhasanah et al., 2021). Training incurs another set of transaction costs that companies must bear. Training programs must be effective to ensure that these costs are spent wisely. Blockchain can help reduce skills gaps in the workforce across industries by providing a single secure system where company training officers can provide input on what basic skills and competencies are needed. Participants then process this input until they reach a consensus on the industry's basic skills and competencies. The results can then be stored on the blockchain and made available to training centers to design and implement training programs (Fachrunnisa & Hussain, 2020). The blockchain can then be used to set competency standards

CHALLANGE: Make training more effective to reduce uncertainty of outcomes
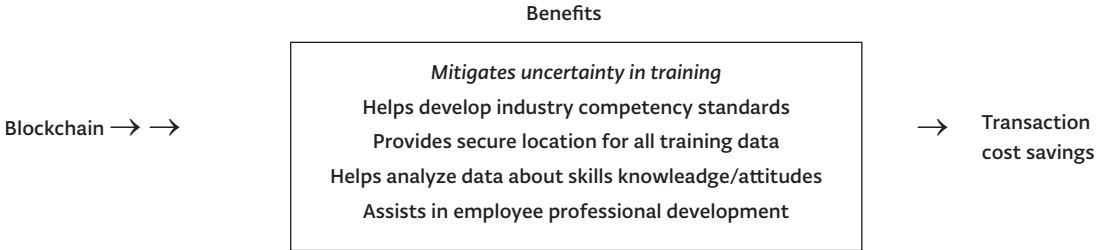MITIGATION: Use blockchain to enhance training and securely maintain records

Benefits

Blockchain → →

Mitigates uncertainty in training
Helps develop industry competency standards
Provides secure location for all training data
Helps analyze data about skills knowleadge/attitudes
Assists in employee professional development

→ Transaction
    cost savings

FIGURE 4. Blockchain and training
SOURCE: Author.

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for employees and create a single secure location to store their training records (Atay et al., 2022). This information can determine if employees are up to date and working effectively or need further training, reducing transaction costs that could result from ineffective or inadequate training. More effective training can also positively impact the business by increasing employee commitment (Alolayyan et al., 2021).

Blockchain can help achieve this goal by collecting and analyzing data about employee skills, knowledge, and attitudes. This information can help with employee professional development (Nurhasanah et al., 2021).

Looking at the benefits of blockchain for managing employee training from the perspective of TCE theory, it does not appear that the benefits mitigate opportunism or the inability to know the future. However, the benefits may be seen as reducing the negative effects of a third key variable identified by TCE, namely the uncertainty associated with some transactions. For example, more effective training through blockchain implementation can reduce uncertainty in deciding which workers are best qualified for a particular task. More generally, uncertainty is reduced by providing confidence that the company's training programs are achieving the right goals. Figure 4 summarizes the benefits of blockchain for reducing uncertainty in training.

One caveat to using blockchain to reach consensus on industry competencies is that the process requires the active participation of industry representatives. These representatives must be training experts whose views reflect the current competency needs of the industry. That is, ensuring the integrity of the training data collected and stored in the blockchain is critical, which can increase transaction costs.

4. DISCUSSION

Blockchain implementation promises significant transaction cost savings for typical HR functions. The discussion above shows how these benefits serve to mitigate the negative effects of several fundamental variables that, according to TCE theory, burden transactions and increase their costs. By mitigating the negative effects of these variables, blockchain can lead to savings that extend far beyond individual transactions. For example, improved verification processes can lead to transaction cost savings by speeding up the verification process and also helping to ensure that more capable workers are available. Similarly, improved contract management through smart contracts can lead to cost savings by mitigating limited rationality to create more transparent contracts and automating immediate rewards based on task completion; it can also lead to happier and more motivated employees. In addition, blockchain for training can lead to cost savings for certain training programs and a better-trained workforce that generates savings through increased knowledge, skills, and efficiency. In short, implementing blockchain for human resources can lead to cost savings for certain transactions and contribute to long-term savings for the company and its success.

While these benefits of blockchain and smart contracts are significant, it is important to recognize that blockchain has limitations that can lead to transaction costs. Some of the key disadvantages already mentioned are associated with the blockchain implementation of smart contracts. Among these limitations is the problem of ensuring that smart contracts capture the exact meaning of the agreement made. A legal expert may be required to verify the natural language wording of the contract. Correctly translat-

ing this natural language wording into computer code then presents another challenge that may require expert review to ensure that the smart contract accurately reflects what is intended and nothing more. These and several other issues mentioned above can increase transaction costs.

Despite the potential cost savings for many HR departments, the proliferation of blockchain use currently faces several challenges. One challenge is the need for technology experts who understand blockchain and its capabilities and can help companies implement blockchain solutions. One study found that the biggest challenge cited by blockchain experts was the lack of skills to use blockchain technology (Dolzhenko, 2021). A second challenge for blockchain is clarifying the legal status of smart contracts (Limata, 2019). A third challenge is that smart contracts are sometimes vulnerable to illegitimate interference, leading to security concerns (Chen et al., 2022; Khan et al., 2021). The remedy to this possibility appears to be careful programming of the contract, including testing for vulnerability (Giesen et al., 2022).

Even in the face of the challenges noted and examined above, companies are increasingly adopting blockchain and smart contracts because of their advantages. Not least among these benefits are those that benefit HR departments by reducing transaction costs.

5. CONCLUSION

This review paper uses transaction cost economics theory as the basis for analysis. The analysis shows how the blockchain, by providing several specific benefits to the common functions of HR, mitigates the three main reasons that transaction cost economics theory suggests increasing the cost of transactions. These are opportunistic behavior, rationality, and uncertainty. The functions of HR that have been studied are screening job applicants, awarding contracts to employees and outside contractors, and managing compensation and training. Blockchain can help mitigate the challenge of opportunism in the case of vetting by streamlining and improving the vetting of applicant qualifications. Blockchain can help mitigate the challenges of rationality and uncertainty in contracting and compensation by enabling self-executing smart contracts to clarify agreements, automatically indicate the completion of tasks, and provide immediate direct compensation without the involvement of an intermediary organization. Blockchain can help mitigate the challenge of uncertainty in the case of training by helping to develop and monitor effective internal and industry training programs. As block-

chain technology evolves and increases within organizations, HR departments will likely find additional uses for blockchain to reduce transaction costs.

While blockchain and smart contracts offer HR departments overall transaction cost savings, managers should know the limitations that may reduce those savings. In particular, issues related to smart contracts that require expert legal advice and thorough testing of smart contracts to ensure that computer code accurately reflects contract intent in natural language will likely result in transaction costs.

Future research on how much savings HR departments could realize from various blockchain implementations might be useful. Such research could focus on savings relevant to the four transaction types highlighted in this paper: verification, labor contracting, compensation, and training. In addition, further research on whether HR departments could realize savings through other applications of blockchain not mentioned here could be valuable.

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BLOCKCHAIN I UPRAVLJANJE LJUDSKIM RESURSIMA: TEORIJSKA PERSPEKTIVA

TRANSAKCIJSKIH TROŠKOVA

SAŽETAK

Prethodna istraživanja su pokazala da implementacija tehnologije blockchaina može dovesti do sigurnijih i učinkovitijih procesa u različitim organizacijskim područjima, uključujući upravljanje ljudskim resursima. Ovaj pregledni rad istražuje upotrebu blockchaina u odjelima ljudskih resursa s perspektive teorije transakcijskih troškova, koja identificira nekoliko temeljnih varijabli koje povećavaju troškove transakcija za tvrtke. Te varijable uključuju ograničenu racionalnost, sveprisutnu mogućnost oportunističkog ponašanja i neizvjesnost. Rad istražuje kako implementacija blockchaina, uključujući pametne ugovore zasnovane na blockchainu, može ublažiti ove izazove. Rad također identificira neka ograničenja u korištenju blockchaina i pametnih ugovora koja mogu povećati troškove transakcija i smanjiti uštede u transakcijskim troškovima.

KLJUČNE RIJEČI: *blockchain, pametni ugovori, upravljanje ljudskim resursima, teorija transakcijskih troškova, ograničena racionalnost, oportunizam, neizvjesnost.*

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