POTENTIAL USES OF BLOCKCHAINS IN HUMAN RESOURCES

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Abstract: Blockchain technology offers businesses many opportunities for more efficient operation and safer data management. It also becomes easy to store and share employee data, while the blockchain guarantees that it does not fall into unauthorized hands. The management of financial transactions and the automation of the payment process are also a great advantage for businesses, which can manage the payment of wages and benefits more efficiently. Another area of application of blockchain technology is the creation of more efficient workflows that can improve productivity and reduce costs. The management of work schedules and optimized work processes will also be easier with the help of the blockchain, so businesses can become more efficient and effective. In this article, the relationship between HR and blockchains was explored through a meta-analysis based on available related publications.

Keywords: *Blockchain, Enterprise, HRM,, Human Resources*
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INTRODUCTION

Industrial revolutions increase significantly advance human life (Tuegeh et al. 2021). Explosive changes in technology are having a significant impact on all industries. Robotics, artificial intelligence, cyber physics systems, cloud computing, IoT and blockchain technology, 5G, nanotechnology, 3D printing are all defining elements of Industry 4.0. The integrated use of these methods enables the perception and display of the external environment, which significantly enables improvements in each industry. Nagy et al. (2022) expect in the future a fusion of physical, digital, and biological technologies, which will provide new opportunities for innovative solutions. In their study, the Kovács et al. (2021) point out that the demand-side, platform-based, collaborative economy is spreading rapidly, and its various forms have been part of everyday life for more than a decade. They can be further developed using AI and Blockchain technology.

It is necessary to foster and strengthen micro, small, and medium enterprises (MSMEs) to enhance their

growth and develop them as strong, resilient, efficient, and independent contributors to the national economy (Tumiwa and Nagy, 2021). Bittner et al. (2020) underline the importance of strategic planning and its relationship with traditional planning, as well as its differences. Significant changes in the economic, social and natural environment require a more responsible mentality and force companies to make more responsible decisions.

The present and future role of blockchain technology in business has several interfaces with HR and management organization to increase its effectiveness. Blockchain technology enables businesses to manage data more efficiently and securely, which is an important aspect of HR. The technology allows businesses to easilystore and share employee data and ensure that it does not fall into the wrong hands. Another important application is the management of financial transactions and the automation ofpayment processes. Businesses can use this technology to more efficiently manage the payment of wages and benefits and ensure that employees receive their salaries accurately andon time. In addition, blockchain technology also enables more efficient workflows. It allows businesses to easily manage employee schedules and optimise workflows, which can improve productivity and reduce costs (Abu-Md, 2022).

MATERIALS AND METHODS

In the preparation of this manuscript, a meticulous approach utilizing qualitative research methodologies was undertaken to facilitate an in-depth analysis of pertinent materials and to distill substantial conclusions therefrom. To achieve this, I leveraged methods including, but not limited to, comprehensive document analysis, which played a pivotal role in the scrutiny and evaluation of a wide spectrum of materials such as scholarly articles, research studies, and industry reports. To ensure the incorporation of a robust body of work in this analysis, a methodological review of substantial databases, notably Google Scholar and Web of Science, was conducted. This endeavor was further complemented by a careful examination of various reports alongside an extensive array of documents comprising both studies and reputable publications within the respective field of inquiry. The synthesis of the available evidence, facilitated through an analytical lens, has culminated in a set of informed conclusions that not only underscore the significant findings of this research but also pave the way for further scholarly discourse. Moreover, this intricate process of data assimilation and analysis has laid a foundational pathway, steering us towards the formulation of targeted recommendations. These recommendations are envisioned to serve as a valuable resource for stakeholders within the sector, propelling forward-thinking strategies that align with the evolving landscape delineated through this research.

RESULTS AND DISCUSSION

1. Blockchain phenomenon

A centralised network as shown in Figure 1 is managed by a central unit, while in decentralised networks several units contain the entire general ledger and both networks have subordinate and superordinate roles. When using the Internet, our request is sent to a server, which manages and verifies the data and then sends us the requested information with the appropriate privileges. In distributed networks, there are no subordinate and superordinate roles, all nodes are connected to each other, which increases security and reduces the risk of outages do not cause a complete system shutdown. In a centralised banking system, a hacker attack cancompromise the entire system, making it difficult for people to access money and banking services (Györfi et al. 2019).

Figure 1: Hierarchical and organic systems
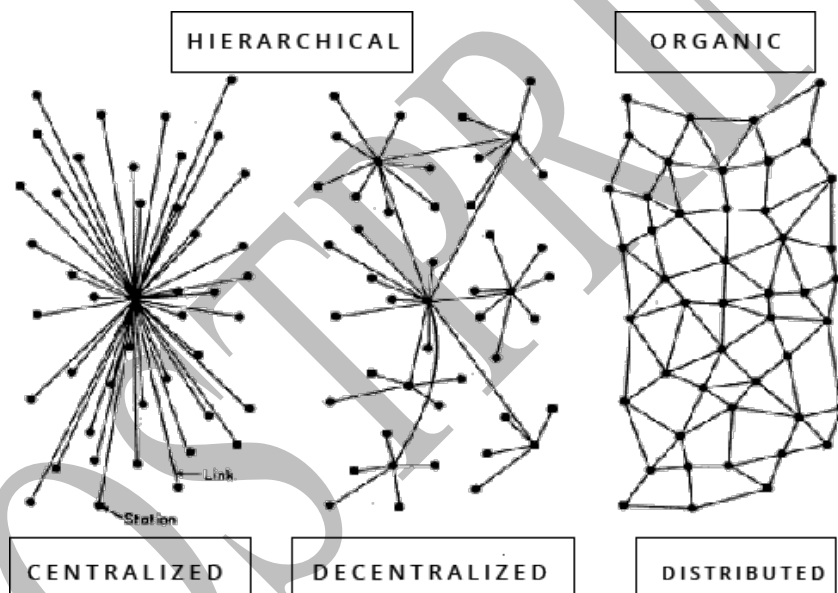
Source: Barabási (2003)

A blockchain is a decentralised, large open-book database that varies in size according to traffic and the number of users. A blockchain is composed of blocks that are used to store dataand are highly secure because each unit has a unique, tamper-proof identifier (Gábor and Kiss, 2019). A blockchain is essentially a distributed database of digital records, transactions and events shared between participants. All transactions are entered into the public ledger, whichis controlled by the majority of the participants in the system. Authenticated information inthe data blocks cannot be deleted (Michael et al. 2015). A blockchain is a digital system built from intelligent algorithms and data to execute and record transactions. The system is protected by encryption and is used by various industries and governments to gain market advantage (Justinia, 2019). Blockchain is built on trust, which allows us to avoid the third- party trust issues currently provided by banks, lawyers, and other organizations. The blockchain has a distributed network that allows for secure and transparent data

management and makes transactions more efficient for industries. In recent years, blockchain has been ranked among the top 10 strategic technology trends (Panetta, 2018).

2. Presence of a blockchain

Blockchain technology can be applied in many areas and can have a significant impact on businesses. Table 1 shows a summary of these areas globally, based on the Forbes (2020) blockchain-50 report, which includes companies with annual revenues of $1 billion using blockchain technology. In the report there are big companies from the US, Europe and Asia, but the technology is led by the United States.

Table 1: Applications of blockchain technology in large companies

Territory	Process, activity	Company
Financial sector	Payment solutions, authentication, data storage	Citigroup, JPMorgan
Trade	Supply chain, authentication	Amazon, Royal Dutch Shell
Automotive industry	Supply chain, payment solutions	BMW, Daimler
Food industry	Supply chain	Dole Foods, Cargill
Computing	Supply chain, authentication, data storage	IBM, Samsung
Insurance	Authentication, data storage	Anthem, Aon

Source: own edits based on Forbes (2022)

The benefits of using blockchain technology in different areas:

Its use in different areas has many advantages. In the case of supply chains, blockchain enables full traceability of products and services, making the process more transparent and secure, and reducing costs and risks. In the area of data management, blockchain-basedsystems enable secure and efficient data management by sharing data between the appropriateparties, while ensuring data security and real-time tracking. In financial services, blockchain enables secure, reliable and fast transactions without the need to transfer data, and reduces thecost and time of transactions. In healthcare, blockchain technology enables the secure storage and sharing of healthcare data, improving the quality of patient care. In public services, blockchain enables the registration and accessibility of important documents such as birth and marriage certificates, simplifying administration (William M, 2016). For businesses, private blockchain solutions can be important, making internal transactions and data management more secure and efficient. Private blockchains operate with a limited number of participants, ensuring the security of transactions and data and enabling faster processes. However, building and maintaining the system can be costly and requires considerable expertise. In addition, the legal framework is not yet fully developed and can pose legal

risks for businesses (Jai et al. 2019).

Nakamoto (2009) delineates blockchain as a decentralized ledger that aggregates transactions verified through cryptographic digital signatures and consolidated into blocks. The primary merits of blockchain (BC) encompass:

- Decentralization: Within the blockchain framework, transactions are ratified by a distributed network functioning through consensus algorithms, obviating the requirement for a central authority to uphold data coherence.

- Durability: The system undertakes the validation of transactions while concurrently seeking to affirm those that deviate, promptly identifying the outcomes of the transactions.

- Anonymity: Users within the network are endowed with a generated address (hash) granting them the authorization to facilitate transactions.

- Auditability: Every transaction maintains a relational attribute to preceding transactions, thereby facilitating the scrutiny of the data manipulated.

- Transparency: In the context of public networks, transactions stemming from any registered address within the network remain accessible for user perusal.

- Security: The blockchain architecture is constructed as shared and resistant to falsification.

- Immutability: Alterations to the data contained within the BC remain unfeasible; each ledger entry necessitates network endorsement. Moreover, every block retains the hash of its predecessor, ensuring any modification attempts are met with rejection.

By offering such a detailed representation of blockchain's attributes, Nakamoto underscores the transformative potential this technology holds, characterized by its secure, transparent, and immutable nature.

3. Data management

Blockchain technology is revolutionising the way businesses operate, enabling more efficient and secure data management, which is key to HR. Retrieved from managing and sharing employees' personal data with enormous responsibility. A blockchain isa decentralised database that operates across a network of computers. The data stored in the blockchain is divided into several blocks, each containing information related to the previous block. The blocks are linked organically and together form the blockchain, allowing data to bestored and shared securely. The stored data is encrypted so that only those with access to the appropriate keys can access it. In addition, the technology allows transactions to be tracked and authenticated, thus minimising the possibility of fraud (Candice, 2022).

Businesses can easily store and share employee data, including personal information, job performance and benefits. Employee data can be block chained and only those with the right access can access this data. Another benefit is that it minimizes the number of intermediaries. In traditional HR systems, communication between businesses and employees often requires intermediaries to access the data. Technology allows the elimination of intermediaries, so that businesses and employees can communicate directly (Sakho et al. 2019).

Effective data management allows you to monitor the work of your employees and evaluate their performance. It also enables automatic tracking and payment of employee performance and benefits, minimising the potential for errors in workforce management. It can also help automate complex processes. For example, companies can store employee data sheets in the blockchain and employees can use this information to automatically apply for new positionsor training. Another benefit of blockchain technology is that it helps businesses improve their communication with customers. Through blockchain technology, businesses will be able to manage customer data more efficiently and securely, improving the customer experience and contributing to the long-term success of the business (Mishra and Venkatesan, 2021).

In summary, blockchain technology offers businesses greater security and efficiency in the area of HR. Employee data can be securely stored and shared on blockchain, minimising the potential for fraud and reducing the number of intermediaries. Blockchain technology enables the automation of complex processes, improves the customer experience and contributes tothe long-term success of the business. The use of blockchain technology in HR could be the key to business success in the future.

4. Financial transactions

The technology can be used not only for storing and sharing data, but also in many otherareas, such as managing financial transactions and automating the payment process. Financial transaction management and payment automation play a key role in the lives of businesses. Traditional payment systems can be time-consuming and expensive, while the use of blockchain technology can make the management of such transactions much more efficient and cost-effective (Tucker and Catalini, 2018).

Allows data to be stored and shared securely, as data is stored in multiple independent blocks that are not linked through a single central point can be traced back simply to. This prevents data manipulation and unauthorised modification of transactions. For businesses, it also means more efficient management of employee wages and benefits. With blockchain technology, businesses can easily manage the payment ofwages and benefits as the payment process is fully automated. For employees, this means that they receive their salaries accurately and on time. Using technology to manage financial transactions and payments can also bring additional benefits. Technology allows

for the fast and efficient handling of transactions between different currencies, as well as the automation of complex financial transactions. In addition, blockchain technology can also help manage taxation and financial reporting, which can help businesses meet their tax and accounting obligations (William, 2016).

5. Workflows

Blockchain technology is revolutionising the world of business. Originally behind cryptocurrencies, the technology can now be used in many areas, including business processes. Blockchain enables businesses to create more efficient workflows that can improveproductivity and reduce costs (Jai et al, 2019).

The benefits of the technology also include more efficient management and optimisation of workflows. Businesses can easily manage employee schedules and track their work. Employees' activities can be recorded in blocks and these blocks can be added to the blockchain along with time stamps. This approach makes it easier to track data and monitor employee work. In addition to managing employee schedules, blockchain technology can alsohelp businesses optimise workflow. Through blockchain, it is easy to track the production process, parts procurement and sales. By analysing data faster and more efficiently, businesses can identify problem areas and react to problems in a timely manner. Its use not only leads to more efficient workflows and increased productivity, but also helps to reduce costs. The transparency and reliability of the data reduces administrative costs, as businesses can easily access the data without the need for multiple checks and adjustments. In addition, blockchain technology helps businesses to reduce transaction fees as the role of centralauthorities and intermediaries is minimised. The benefits of blockchain technology also include data security. The data stored by blockchain cannot be modified or falsified, as all transactions must be confirmed by consensus of the participants. This prevents phishing, forgery and fraud (Fachrunnisa and Hussain, 2020).

6. Most popular uses in Human Resources

The use of blockchain technology is gaining momentum in various fields. Blockchain technology offers significant benefits to businesses in the areas of HR, management and organisation. The technology helps in more efficient data management, financial transaction management and workflow optimisation, all of which contribute to increasing business efficiency (Mishra and Venkatesan, 2021).

1. Payroll: Payroll is one area where blockchain can simplify and secure the payment of employees, contractors and suppliers. This is particularly useful for cross-border payments where traditional electronic payment methods may not work due to local regulations and IT security systems. Large payroll providers, such as ADP, are also developing blockchain

applications for this purpose (Dina et al. 2020).

2. Recruitment: Candidates can tokenise their identity and provide virtual credentials such as transcripts, training certificates, CVs and work histories that recruiters and HR managers can trust have not been manipulated. This can significantly reduce the workload associated with retrieving and securely transmitting documentation. Blockchain verification can also reduce the cost of background checks and verification (Koncheva et al. 2019).

3. Employee decentralized data management: Personal data can also be encrypted and securely stored on the blockchain, providing immutability and a secure management system. However, experts suggest that it is more realistic to use the blockchain as a database to capture data on future employees, rather than asa trusted repository of past information (Damle and Kulkarni, 2023).

4. Smart contract: Finally, smart contracts enabled by blockchain can transform paper contracts into immutable, transparent digital contracts. Employers can use them to enforce the terms and penalties setout in agreements with employees and contractors (Pinna and Ibba, 2019).

   - Automated Agreements: Smart contracts facilitate automatic execution of contracts once predetermined conditions are met, saving time and reducing disputes.
   - Performance-Based Rewards: Smart contracts can be used to automate performance-based rewards and incentives (Coita et al. 2019).

5. Verification of Employee Credentials

   - Swift Verification: Blockchain allows for the quicker and more secure verification of potential employee credentials, including their education and work experience.
   - Fraud Prevention: By securing data on a decentralized ledger, it reduces the possibilities of fraud and misrepresentation.
   - Transparency: Employees can have a clear and immutable record of their compensation, including bonuses and other incentives (Mukherjee et al. 2022).

Overall, blockchain technology enables businesses to create more efficient workflows that can improve productivity and reduce costs. By managing employee schedules and analysing data more effectively, businesses can more easily identify problem areas and respond to issues in a timely manner. Data security and transparency are additional benefits that blockchain technology offers businesses. As a result, more and more businesses - primarily large enterprises (Forbes, 2020) - are choosing blockchain technology to better manage their workflows and increase efficiency.

7. Limitations

Implementing blockchain technology in Human Resources Management (HRM) can bring about

several advantages, such as increased security and transparency. Nevertheless, some constraints have to be taken into account. Herein are a few possible drawbacks of employing blockchain in HRM:

1. Technical Challenges: Blockchains are complex technologies that require deep understanding for effective implementation. Privacy concerns and legal and regulatory hurdles remain critical barriers to the effective use of blockchain technology. Integrating these technologies with existing HR systems presents significant challenges due to technical hurdles and compatibility issues (Abu and MD, 2022).

2. Privacy concerns: Legal and regulatory hurdles remain critical barriers to the effective use of blockchain technology. Storing employee data on a blockchain may result in privacy issues as it is unchangeable once recorded. In terms of compliance with data protection laws, legal and regulatory hurdles can arise (Fachrunnisa and Hussain, 2020).

3. Energy issues: Additionally, the high energy consumption required for blockchain technology may prove to be resource intensive. Blockchain networks, particularly those employing proof-of-work algorithms, consume a noteworthy amount of energy. The establishment and maintenance of a blockchain infrastructure can prove to be expensive, requiring investments in technology and expertise (Wang et al. 2017).

4. Adoption concern: There may exist cultural and adoption resistance. Employees and stakeholders may be hesitant to embrace a new technology owing to unfamiliarity or scepticism. Companies need to allocate resources to training employees to operate the new system, which could be time-consuming. Additionally, procuring the appropriate expertise poses a significant challenge due to the scarcity of skilled professionals required for implementing and managing blockchain systems (Mishra and Venkatesan, 2021).

5. Scalability: The limited scalability of blockchain networks can hinder their widespread adoption. Transaction speed limitations can be observed on blockchain networks, which can impede large organizations. Furthermore, blockchain demands substantial data storage capacity, causing a challenge for HR databases with significant size (Kartik, 2018).

Table 2: Comparison: Centralized HRM and Decentralized HRM

	Centralized	Blockchain Based
Data	is hosted in a centralized server.	is hosted on a decentralized blockchain.
Signatures	Digital signatures are necessary.	Private key is needed to access database.
Compatibility	Incompatible to work various modules simultaneously.	Large number of modules can cross-talk.
Monetization	Not possible	Monetization of data can be

		monetized (cryptocurrency).
Tampering	Possible	Almost impossible, in case of successful, will be know by the blockchain.

Source: Based on Kartik (2018) and Candy (2020).

CONCLUSION

In conclusion, blockchain technology is increasingly being adopted in the field of human resources, where it shows great potential in optimizing and securing various HR processes, including payroll management, recruitment, and employee data management. Leveraging the immutability and transparency features of blockchain can streamline workflows, enhance data security, and reduce fraudulent activities, potentially revolutionizing the HR landscape. Moreover, smart contracts, a byproduct of blockchain, can transform traditional contracts into digital agreements, automating various aspects and enhancing efficiency in enforcing terms and agreements. However, this emerging technology brings forth considerable challenges such as integration complexities, privacy concerns, high energy consumption, and scalability issues, which require thoughtful consideration and strategic planning before implementation. As businesses, predominantly large enterprises, are navigating these challenges to incorporate blockchain technology, it is pertinent to equip HR professionals with the necessary knowledge and skills to adapt to this evolving landscape effectively. While promising, it demands a careful approach to integration, balancing the remarkable benefits with the existing hurdles to foster a more efficient, secure, and transparent HR environment.

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