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Blockchain in Human Resources

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ABSTRACT

Blockchain is basically a decentralized digital ledger. Instead of storing information in one company's server, data lives on a distributed network of computers. That means once information is recorded, it's secure, transparent, and verifiable. From verifying resumes to running payroll, blockchain has the potential to make human resources faster, more transparent, and more secure. Blockchain makes HR more human by cutting out bureaucracy and focusing on real relationships. This innovative technology is a trustless system that eliminates the need for intermediaries, reducing costs, increasing transparency, and enhancing security. It directly tackles many of the longstanding inefficiencies in HR. This paper examines the applications of blockchain technology in human resources.

KEYWORDS: *blockchain, distributed digital ledger, logistics, human resources, HR, human resource management, HRM, automation.*

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INTRODUCTION

As the business world becomes increasingly digital, innovative technologies are constantly emerging to revolutionize traditional practices. One of such emerging technologies has been blockchain. Blockchain technology has the potential to transform many industries, including human resource management. It is poised to be a game-changer for HR professionals and businesses alike [1]. Traditional HR systems are usually centralized databases. They are prone to hacks, errors, and manipulation. Unlike traditional systems that rely on central authorities such as banks or governments, blockchain uses a decentralized network of computers to verify and store data.

Blockchain technology is rapidly changing the landscape of various industries, and human resources (HR) is no exception. Blockchain technology operates as a decentralized ledger where transactions are recorded in real time. This approach offers a stark contrast to traditional centralized databases, where companies maintain sole custody of data. Blockchain offers a unique set of features that have the potential to revolutionize HR processes, from recruitment and payroll to data security and employee empowerment. By fostering trust, transparency, and efficiency, blockchain has the potential to revolutionize not only HR processes but also the overall workplace culture [2].

WHAT IS BLOCKCHAIN?

Blockchain, a type of distributed digital ledger technology (DLT), is a relatively new and exciting way of recording transactions in the digital age. It is a decentralized and distributed digital ledger technology that securely records and verifies transactions across multiple computers or nodes in a network. Basically, it is a chain of blocks in which each block contains a list of transactions. The symbol of a blockchain is depicted in Figure 1 [3]. The blockchain technology was created as the foundational basis for Bitcoin – a digital currency in which secure peer-to-peer transactions occur over the Internet. It is expected that the spending on blockchain solutions worldwide would grow from 4.5 billion USD (2020) to an estimated value of 19 billion USD by 2024 [4].

Originally developed as the accounting method for the virtual currency Bitcoin, Blockchains are appearing in a variety of commercial applications today. Blockchain technology is a type of distributed digital ledger that uses encryption to make entries permanent and tamper-proof and can be programmed to record financial transactions. It is used for secure transfer of money, assets, and information via a computer network such as the Internet without requiring a third-party intermediary. It is now being adopted across financial and non-financial sectors. As a catalyst for change, the Blockchain technology is going to change the business world and financial matters in major ways.

The first Blockchain was conceived in 2008 by an anonymous person or group known as Satoshi Nakamoto, who published a white paper introducing the concept of a peer-to-peer electronic cash system he called Bitcoin [5,6]. Bitcoin and Ethereum are the first two mainstream blockchains. Other modern blockchains include Namecoin, Peercoin, Ether, and Litecoin. Figure 2 shows different components of blockchain [7].

Blockchain combines existing technologies such as distributed digital ledgers, encryption, immutable records management, asset tokenization and decentralized governance to capture and record information that participants in a network need to interact and transact. As illustrated in Figure 3, a complete blockchain incorporates all the following five elements [8]:

- *Distribution:* Digital assets are distributed, not copied or transferred. A protocol establishes a set of rules in the form of distributed mathematical computations that ensures the integrity of the data exchanged among a large number of computing devises without going though a trusted third party. A centralized architecture presents several issues including a single point of failure and problems of scalability.
- *Encryption:* BC uses technologies such as public and private keys to record data securely and semi-anonymously. Completed transactions are cryptographically signed, time-stamped, and sequentially added to the ledger.
- *Immutability:* The blockchain was designed so these transactions are immutable, i.e. they cannot be deleted. No entity can modify the transaction records. Thus, Blockchains are secure and meddle-free by design. Data can be distributed, but not copied.
- *Tokenization:* Value is exchanged in the form of tokens, which can represent a wide variety of asset types, including monetary assets, units of data or user identities.
- *Decentralization*: No single entity controls a majority of the nodes or dictates the rules. A consensus mechanism verifies and approves transactions, eliminating the need for a central intermediary to govern the network.

Bitcoin and its underlying blockchain technology increasingly impact all facets of society. Bitcoin's status as digital gold is merely the tip of this technology. Figure 4 shows Bitcoin [9], while Figure 5 shows how blockchain works [10]. Although blockchain technology will for all time be associated with Bitcoin due to their common genesis, it has broader applications. Cryptocurrency will increasingly become a factor in family law issues as well.

A blockchain is a tamper-proof, distributed database that stores blocks of information for cryptographically bound transactions via peer-to-peer networks. At the heart of blockchain's functionality is cryptographic hashing. Each block in a blockchain contains a cryptographic hash of the previous block, creating an immutable chain of blocks. If anyone attempts to tamper with the data in a block, it would alter the block's hash. This would disrupt the entire chain, making it virtually impossible to manipulate. The security feature ensures data integrity and prevents unauthorized changes [11].

In a nutshell, blockchain technology involves three basic concepts [12]: (1) It is a system for recording a series of data items (such as transactions between parties); (2) It uses cryptography to make it difficult to tamper with past entries; (3) It has an agreed process for storing copies of the ledger and adding new entries (also called a consensus protocol).

Blockchain is a novel decentralized infrastructure and distributed computing paradigm that uses a chained data structure for verification, storage, and distributed consensus algorithms to generate and update data. Decentralization is a key feature of blockchain technology, which refers to the distribution of power and decision-making across a network of nodes or participants rather than being controlled by a central authority or system. It provides robustness while eliminating many-to-one traffic flows to avoid delays and single points of failure. Figure 6 shows the decentralized property of blockchain [10]. The advantages of decentralized property of blockchain network include the following [10]:

- The decentralized property of blockchain makes it less prone to failure and more expensive for hackers to attack the network.

- There is no third-party involvement; therefore, there is no added risk.
- Every change made in the network is traceable and concrete.
- Users maintain full autonomy of their properties and are not dependent on third parties to maintain and manage their assets.
- It provides enhanced security.

BLOCKCHAIN IN HUMAN RESOURCES

The main objective of implementing blockchain technology in human resource management (HRM) is to enhance data security and privacy by creating a secure, immutable record of employee information. The scope of blockchain technology in HRM includes transforming recruitment processes by providing a secure, immutable platform for verifying candidate qualifications, which enhances trust and reduces hiring biases. Blockchain technology has the potential to radically transform the HR function, touching everything from benefits administration to control over sensitive employee data to the way that HR transactions are carried out. It offers vast potential applications that can simplify and secure human resource management. It can facilitate smoother, more reliable methods for contract negotiation, project management, and payment systems. By providing decentralized, transparent, and immutable systems, blockchain technology enhances trust, efficiency, and security within HR practices. Figure 7 shows a typical HR team [13].

Traditional human resource management (HRM) systems are criticized for lacking transparency, being inefficient, and offering ample opportunities for fraud because of their centralized design and reliance on manual processes. Traditional HRM systems are centralized, and that can potentially lead to a myriad of issues. The absence of procedural transparency in activities such as recruitment, performance appraisal, and payment processing can provide a breeding ground for inefficiency and corruption [14]. Blockchain technology is rapidly advancing within the HR sector, presenting itself as a transformative force ready to reshape conventional HR practices. As shown in Figure 8, blockchain will revolutionize HR forever [15].

Blockchain offers a robust alternative that could potentially revolutionize the field, affecting everything from hiring to compliance. By harnessing the power of blockchain, HR team can drive significant improvements in the accuracy, efficiency, and reliability of HR operations. However, HR departments will need to examine their existing HR information systems and possibly restructure them to accommodate blockchain technology effectively. In a blockchain-based HR systems, employee credentials, such as educational qualifications, past employment records, and professional certifications, are stored on a blockchain. Each record is encrypted and linked to a unique digital identifier, making it verifiable in real-time by HR professionals and other authorized parties without intermediaries [16]. Figure 9 shows blockchain in HRM [17].

APPLICATIONS OF BLOCKCHAIN IN HUMAN RESOURCES

In the HR sector, blockchain introduces several compelling use cases, such as in recruitment, employee records, payroll, smart contracts, fraud reduction, and auditing processes. Some promising use cases are depicted in Figure 10 [18]. Common applications of blockchain in HR include the following [16,19-22]:

- *Payroll:* This is perhaps the strongest use case, since payroll is closely tied to finance, and managing money is a strong point of blockchain. Payroll is one of HR's biggest headaches—especially when it comes to international employees or contractors. Blockchain can simplify all of that. Blockchain technology possesses distinct advantages in the realm of payroll management. Blockchain can streamline the payroll process by automating and securing payments to employees. It offers a more secure option for employees to be paid, and they can use it to pay other expenses. By leveraging blockchain, companies can improve the efficiency and security of their payroll systems. With cryptocurrency or stablecoin-based payroll systems, employees can get paid instantly, in any country, without expensive middlemen. Using blockchain technology, a multinational corporation can execute payroll seamlessly, ensuring timely and correct payments in multiple currencies without costly and time-consuming currency conversion services
- *Smart Contracts:* Smart contracts are essentially self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code. They offer a transformative approach to managing employment terms, benefits administration, and HR agreements within blockchain networks. They are self-executing contracts written into blockchain code. Once conditions are met, the contract triggers automatically. No paperwork, no chasing signatures, no delays. This makes them an ideal solution for HR processes, where contracts such as employment agreements, non-

disclosure agreements, and other legal documents are involved. Smart contracts can regulate employee contracts autonomously, ensuring that employment terms are strictly adhered to. These smart contracts could automate routine transactions such as reimbursements and holiday pay-outs, which consume a chunk of HR's time. In benefit administration, smart contracts simplify the management of employee benefits such as health insurance, retirement plans, and leave entitlements. Companies that can integrate smart contracts efficiently will likely see advantages in HR management: reduced errors, lower costs, enhanced speed of processes, improved transparency, and employee satisfaction.

- *Recruitment:* One of the ways that blockchain technology can impact human resource management is by streamlining recruitment processes. Blockchain technology offers an advantage in recruitment and verification by introducing a system of immutable records for verifying candidate credentials and employment history. Recruitment is fraught with inefficiencies and potential for deception, as candidates may present embellished qualifications or false employment histories. HR departments spend considerable resources on background checks, which involve manually verifying academic and professional credentials through third-party services. This delays the hiring process and adds significant costs. With blockchain, these credentials can be verifiably recorded on a decentralized ledger, ensuring they are tamper-proof and readily accessible. This verification process would reduce fraud.
- *Anonymous Feedback:* Employees are often reluctant to provide constructive feedback about their employer or manager for fear of reprisal. Despite companies promising confidential processes, someone is often able to see where the feedback originated. On the other hand, when feedback is provided anonymously on external sites, it is almost impossible for a company to confirm it was done by an actual employee. Blockchain can facilitate employment verification before anonymous feedback is provided. The feedback also stays anonymous and cannot be deciphered. Blockchain can provide a platform for employees, past or present, to rate their organization anonymously while maintaining credibility.
- *Employee Records:* The rapid advancement of technology has fundamentally transformed the way organizations manage and protect employee records. Traditional HR systems, which have long relied on centralized databases, are increasingly vulnerable to cyber-attacks and data breaches. Blockchain offers a revolutionary approach to storing and managing employee records securely and efficiently. Traditional record-keeping methods involve centralized databases vulnerable to hacking, fraud, and data corruption. Blockchain offers a solution to these challenges with its decentralized framework, distributing data across numerous nodes to prevent unauthorized alterations. Each employee's record on a blockchain is secured with cryptography and can include a wide range of data, from personal identification details to performance reviews and health records. Blockchain's immutable nature ensures that once an employee's record is established, it remains unchangeable without collective agreement.
- *Employee Performance:* Blockchain facilitates efficient tracking and monitoring of employee performance by providing real-time access to performance data. Through blockchain-based systems, HR professionals can maintain comprehensive records of employee performance, enabling timely interventions and feedback. By leveraging blockchain, organizations can establish trust-based performance management systems that promote fairness, accountability, and employee development. Blockchain enables decentralized performance evaluation systems, where performance assessments are conducted based on predefined criteria without the need for centralized oversight.
- *Fraud Reduction:* Credential fraud in the HR sector is a significant issue. Blockchain serves as an effective anti-fraud mechanism by offering a secure and unalterable repository for verifying credentials accurately. On blockchain, each credential is secured and linked to a distinct digital identifier that can be verified. HR professionals can then access these credentials to perform background checks without needing third-party verification services, significantly reducing the opportunity for fraudulent activities.

BENEFITS

Blockchain technology provides many benefits, such as decentralized transactions, transparency, immutable records, and security. It can simplify payroll systems by processing transactions seamlessly across borders without hefty fees or the need for banking infrastructure. It can significantly revamp talent acquisition processes. It promises improvement and transformation towards greater efficiency,

reliability, and transparency in recruitment. It reduces fraud, enhances transparency, and ensures compliance with legal and regulatory requirements. Other benefits of blockchain in HR include the following [2,20]:

- *Cost Reduction:* Companies looking to hire can also see a reduction in operational costs. Blockchain eliminates the need for intermediaries to verify academic and career credentials during the hiring process. Instead of paying these service providers, companies can directly access verified records via the blockchain. Blockchain can eliminate intermediaries and reduce transaction fees in payroll and recruitment, leading to significant cost savings for organizations. Integrating blockchain technology in finance leads to significant cost savings for organizations. Blockchain technology reduces transaction costs and operational expenses by eliminating intermediaries, reducing fraud, and streamlining processes.
- *Automation:* Blockchain streamlines financial processes by automating manual tasks, eliminating intermediaries, and reducing paperwork. It can streamline payroll and benefits management by automating processes. This automation eliminates delays, reduces errors, and enhances transparency in payroll processing. By automating routine tasks such as payroll processing and candidate verification, blockchain can free up HR professionals to focus on more strategic initiatives.
- *Data Security:* HR departments often deal with sensitive information such as employee personal data, salary information, and performance evaluations. Ensuring the privacy and security of this data is of utmost importance. Employee records are gold mines for hackers—social security numbers, bank details, health data, etc. Keeping this information safe is non-negotiable. Blockchain provides end-to-end security. Data stored on blockchain is encrypted and immutable, meaning no one can alter or delete it without leaving a trail. Blockchain also makes it easier to comply with data privacy regulations like GDPR. Blockchain's data integrity also translates well into managing employee data.
- *Employee Onboarding:* Blockchain technology can significantly streamline employee onboarding, making it more efficient, transparent, and user-friendly. Traditionally, onboarding involves numerous steps, including verifying documents, signing contracts, and integrating new hires into the company's systems and culture. Blockchain can be used to streamline the onboarding process for new hires. By combining identity verification software with blockchain technology, companies can instantly confirm the identity and credentials of new employees. Furthermore, smart contracts can automate onboarding tasks such as equipment allocation, training assignments, and initial payroll setup.
- *Employee Engagement*: Blockchain technology can be used to enhance employee engagement. By using blockchain-based reward systems, employers can offer incentives and bonuses to employees for achieving specific goals or milestones. These rewards can be stored in a digital wallet that is secured by blockchain, providing employees with a tangible and secure incentive for their achievements.
- *Employee Empowerment:* Blockchain can empower employees by giving them greater control over their data and promoting transparency in HR processes. However, organizations need to ensure that this empowerment is balanced with ethical considerations and responsible data management practices.

Figure 11 shows some benefits of blockchain [23].

CHALLENGES

Despite its promising applications, full blockchain integration in HR is not widespread. Initial setups and migration from existing databases to blockchain can be resource-intensive, and gaining operational and technical proficiency can take time. Organizations must address concerns related to interoperability with existing HR systems, data privacy laws, and potential resistance from stakeholders unaccustomed to blockchain technology. Cultural barriers, skepticism, and fears of job displacement contribute to reluctance in embracing new technologies such as blockchain. Other challenges include the following [2,19,22]:

- *Data Privacy:* There is the challenge of digital security and privacy. For HR, the biggest internal risk factor is the human component. HR data is among the most sensitive a company handles—ranging from personal identification to performance reviews. Employees might not yet feel it is safe to store personal information on a distributed ledger, and it can be difficult to explain the technology to some. While blockchain inherently offers improved security, the digitization and automation of contracts mean that vulnerabilities could be exploited if not adequately protected.
- *Interoperability*: Interoperability remains a prominent challenge, as existing HR systems and

new blockchain solutions must communicate seamlessly to ensure accurate data transfer and process alignment. The development of standards and protocols for blockchain interoperability will facilitate seamless data exchange between different platforms and organizations. Interoperability solutions are being developed to facilitate seamless communication and data exchange between different blockchain platforms and networks, enabling greater flexibility and integration across diverse applications and use cases within the blockchain ecosystem.

- *Integration:* Integrating blockchain solutions with existing HR systems and legacy software can be technically challenging. For example, a large corporation that implemented a new blockchain system for employee records found they had to create a custom bridge to connect it with their 20-year-old payroll software. Without that bridge, data could not flow between the systems, and the whole integration process became a major roadblock. As such, organizations need to carefully consider interoperability issues and ensure seamless data exchange between different platforms.
- *Regulatory Compliance:* Legal and regulatory compliance is another significant concern. The regulatory landscape for blockchain is still evolving, creating uncertainties for organizations looking to implement blockchain solutions in HR. Smart contracts must reflect a thorough understanding of employment laws and regulations, which can differ widely by jurisdiction. Blockchain still lacks regional regulatory standards, which exposes organizations to financial losses and legal penalties for failing to respect employee data rights and comply with legal frameworks, such as the European Union's GDPR.
- *Scalability:* This is a major challenge in implementing blockchain in HR. Scalability issues may arise when handling a large volume of transactions, impacting overall system performance. Ensuring blockchain networks in HR remain efficient and performant as organizations grow and data increases can be complex. That is the challenge of scalability. As organizations grow and the volume of data increases, ensuring the efficiency and performance of blockchain networks can be complex.
- *Collaboration:* Collaboration with blockchain technology providers and experts is essential to designing and deploying blockchain-based, rewarding solutions tailored to the organization's specific needs and objectives. It is essential to encourage interdisciplinary collaboration between HR experts, blockchain developers, and industry practitioners to co-create innovative solutions that address the evolving needs of the workforce. Collaboration among HR professionals, hiring managers, and third-party verification agencies is enhanced through a shared, immutable record of candidate information, fostering better communication and alignment throughout the recruitment process.

FUTURE OF BLOCKCHAIN IN HUMAN RESOURCES

By all accounts, blockchain is barely making a scratch in HR, but it still has the potential to play a role in the long-term future of work. As blockchain technology matures, its applications within human resources departments are set to become more diverse and integrated. The future of blockchain in HR is becoming increasingly vital as businesses and HR leaders embrace its capacity for enhancing data security, reducing fraud, and simplifying the complexity of managing global workforces. Some forward-thinking companies are already experimenting with blockchain HR solutions. In the near future, it will not just be tech startups—expect banks, healthcare providers, and even governments to adopt it. This technology can offer a seamless integration throughout all phases of the employee experience—from hiring to retirement [14]. Moving forward, the adoption of blockchain in rewarding practices holds the potential to revolutionize traditional approaches to compensation and innovation, driving organizational performance and employee retention.

Smart contracts in HR automation will become more complicated and responsive. Future HR blockchain solutions will combine augmented reality (AR) and virtual reality (VR) to create interactive training, recruitment, and employee engagement venues. Integrating with natural language processing (NLP) tools will ease interactions, allowing HR and workers to communicate with blockchain systems, thereby reducing technical barriers to adoption. Ethics and regulation will shape blockchain in HR [14].

CONCLUSION

The potential for blockchain to transform HR is vast, offering unmatched levels of security, efficiency, and transparency. From smarter hiring to instant payroll and bulletproof data security, blockchain is a practical tool that can make HR more trustworthy, efficient, and people-focused. Blockchain technology provides revolutionary capabilities in HR operational

processes, including recruiting, tracking payroll, training employees, and smart contracts. HR leaders who start experimenting now will be ahead of the curve when blockchain goes mainstream.

For HR departments to truly harness the power of blockchain, they must prepare, which encompasses education, investment in technology, and alignment with regulatory standards. HR professionals must stay informed about changes to ensure compliance and be ready to demonstrate how blockchain implementations enhance data accuracy and privacy. HR departments must navigate evolving regulatory landscapes to ensure adherence to relevant laws and regulations. More information on the integration of blockchain in human resources is available from the books in [24-27] and the following related journals:

- Blockchain
- IEEE Blockchain
- Human Resources Management and Services
- Global Journal of Human Resource Management
- International Journal of Human Resource Studies

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Figure 1 The symbol of blockchain [3].

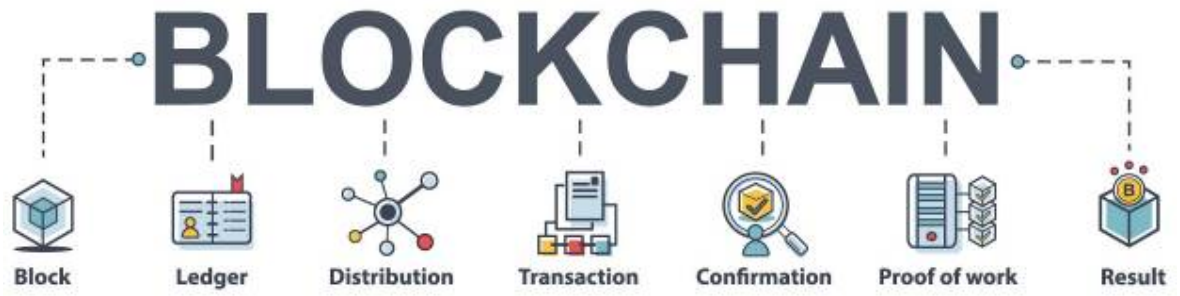

Figure 2 Different components of blockchain [7].

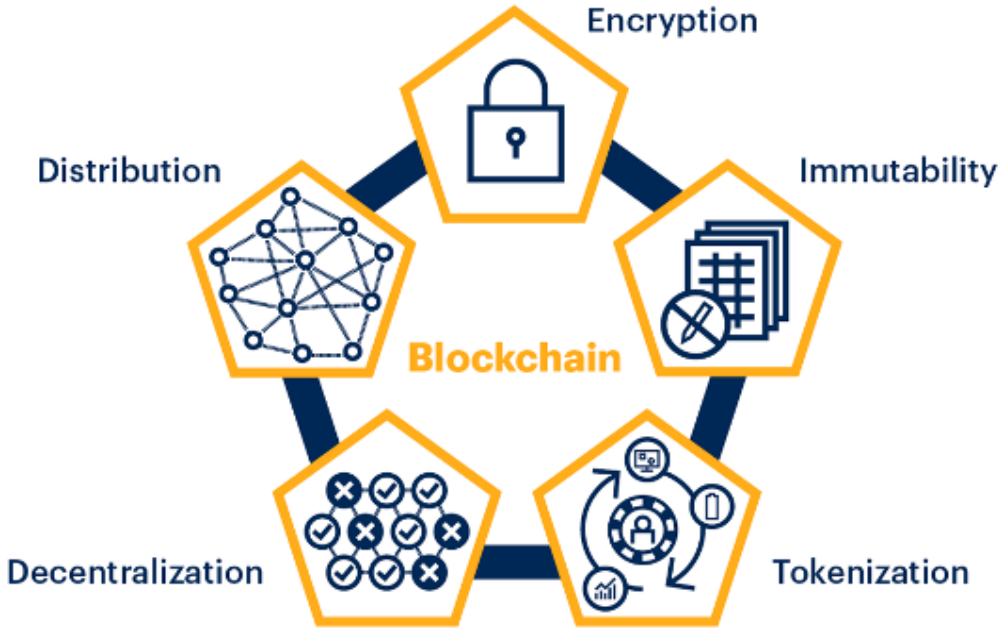

Figure 3 Five key elements of Blockchain [8].

Figure 4 Bitcoin [9].

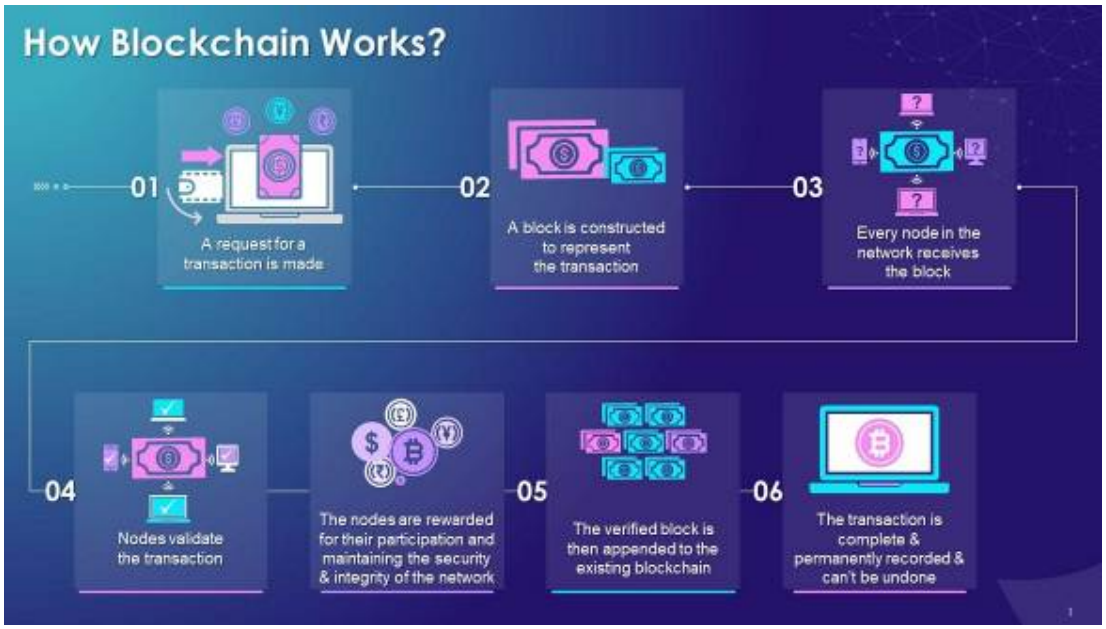

Figure 5 How blockchain works [10].

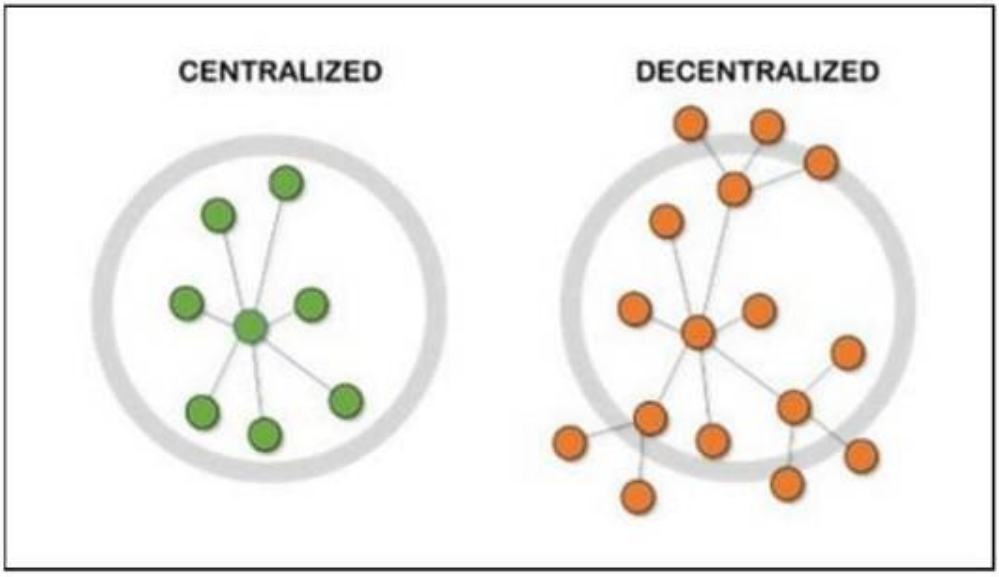

Figure 6 The decentralized property of blockchain [10].

Figure 7 A typical HR team [13].

Figure 8 Blockchain will revolutionize HR forever [15].

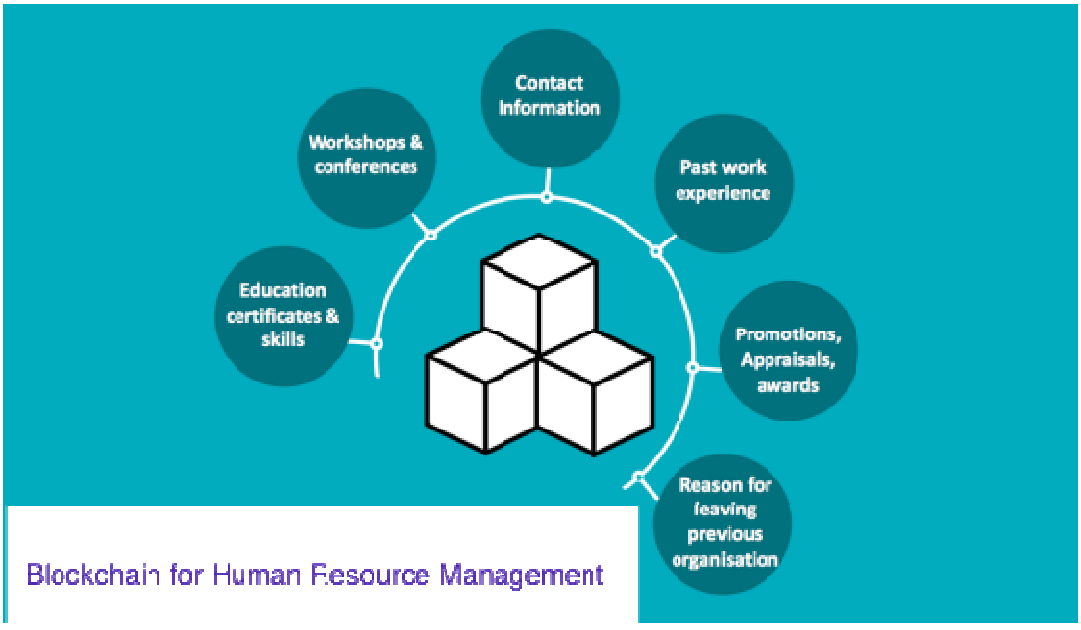

Figure 9 Blockchain in HRM [17].

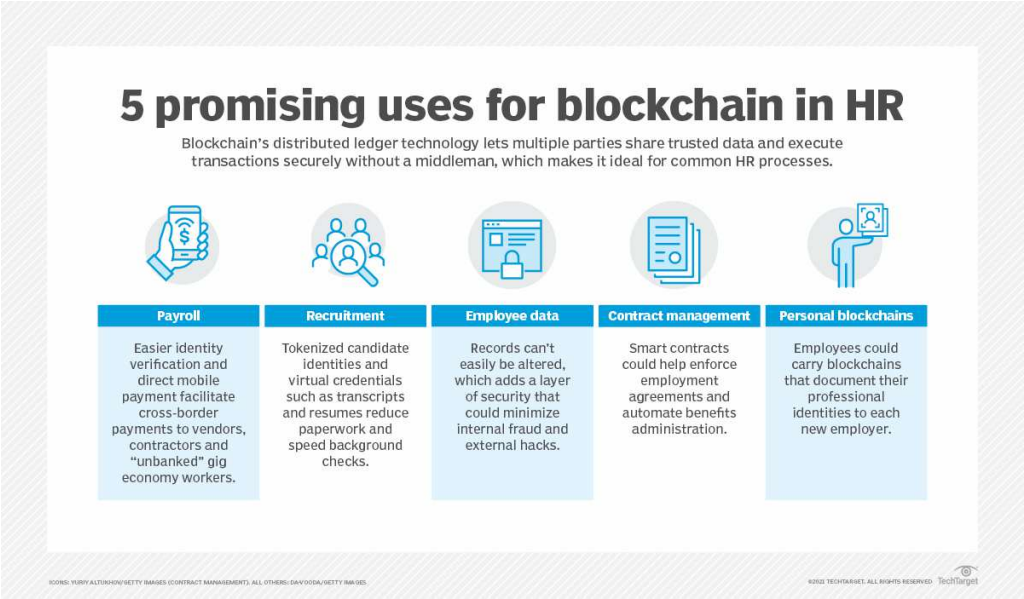

Figure 10 Some promising use cases of blockchain in HR [18].

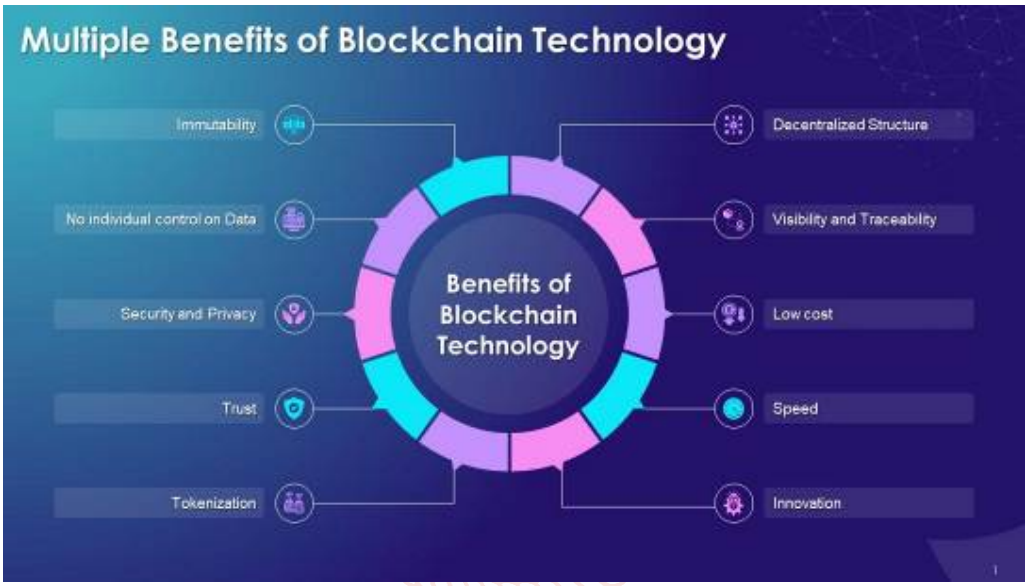

Figure 11 Some benefits of blockchain [23].