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Integrating blockchain in HR and finance: A conceptual review and future directions

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Abstract

This review paper explores the integration of blockchain technology in human resources (HR) and finance sectors, examining its potential applications, benefits, challenges, and future directions. Beginning with an overview of blockchain technology, it delves into the challenges faced by traditional HR and finance systems, including data security concerns and inefficiencies. The paper discusses the transformative impact of blockchain on recruitment, employee records management, payroll, smart contracts, payments, and auditing processes. Key benefits of blockchain integration, such as enhanced security, transparency, efficiency, and potential barriers to adoption, are highlighted. The paper discusses emerging trends and innovations in blockchain technology. It offers recommendations for organizations to leverage their full potential in HR and finance. It emphasizes embracing blockchain technology to drive innovation, efficiency, and value creation in the HR and finance sectors.

Keywords: Blockchain; Human resources; Finance; Integration; Challenges; Opportunities

1. Introduction

Blockchain technology has emerged as a disruptive force reshaping various industries in recent years (Martino, 2021). Originally conceived as the underlying technology for cryptocurrencies like Bitcoin, blockchain has transcended its initial application, finding relevance in diverse sectors, including finance and human resources (HR). Its distributed ledger architecture, cryptographic security, and decentralized nature offer unprecedented opportunities for transforming traditional processes ensuring trust, transparency, and efficiency (Ajayi & Udeh, 2024b; Igbinenikaro & Adewusi, 2024c; Ross, 2016; Sharma & Kumar, 2020).

Integrating blockchain technology in the HR and finance sectors represents a paradigm shift in how organizations manage their operations, data, and transactions. In HR, blockchain promises to revolutionize recruitment, talent management, and payroll processes by providing secure, immutable employee credentials and performance records (Chillakuri & Attili, 2022; Dash, 2023). Similarly, blockchain facilitates real-time, peer-to-peer transactions in finance, eliminates intermediaries, and automates complex financial operations through smart contracts. The significance of this integration cannot be overstated. In HR, it addresses longstanding challenges related to data security, trustworthiness of credentials, and cumbersome administrative tasks. In finance, it addresses issues such as fraud, inefficiency, and lack of transparency that have plagued traditional systems. Moreover, the adoption of blockchain in these sectors enhances operational efficiency and fosters innovation, enabling organizations to stay competitive in an increasingly digital world (Holotiuk & Moormann, 2018; Javaid, Haleem, Singh, Khan, & Suman, 2021).

Against this backdrop, this paper aims to provide a conceptual review of the integration of blockchain technology in HR and finance. By synthesizing existing literature, identifying key trends, and exploring future directions, this paper aims to elucidate the transformative potential of blockchain in these domains. Through a comprehensive examination of its applications, benefits, challenges, and implications, this paper seeks to contribute to a deeper understanding of how

blockchain can reshape the landscape of HR and finance, offering insights for researchers, practitioners, and policymakers alike.

2. Understanding Blockchain Technology

2.1. Definition and Basic Concepts of Blockchain

At its core, blockchain is a decentralized and distributed digital ledger technology that records transactions across multiple computers to ensure the integrity and security of the data exchanged. Each transaction, or "block" transaction, is cryptographically linked to the previous one, forming a chronological chain of blocks. This chain is continuously updated and synchronized across all nodes in the network, creating a tamper-resistant and transparent record of transactions.

2.1.1. Key Features and Characteristics of Blockchain Technology

- Decentralization: Unlike traditional centralized systems where a single authority controls the database, blockchain operates on a decentralized network of nodes. This decentralization eliminates the need for intermediaries, reducing the risk of manipulation or censorship (Yassein, Shatnawi, Rawashdeh, & Mardin, 2019).
- Transparency: All transactions recorded on the blockchain are visible to all participants in the network. This transparency ensures accountability and trust among users, as the consensus mechanism can easily detect any attempt to tamper with the data (Kim, 2020).
- Immutability: Once a transaction is recorded on the blockchain, it becomes immutable, meaning it cannot be altered or deleted. This immutability is achieved through cryptographic hashing and consensus mechanisms, ensuring the integrity and permanence of the data (Ajayi & Udeh, 2024c; Igbinenikaro & Adewusi, 2024b; Priyadarshini, 2019).
- Security: Blockchain employs advanced cryptographic techniques to secure transactions and protect data from unauthorized access or tampering. Each block is cryptographically linked to the previous one, forming a chain resistant to tampering. Additionally, consensus mechanisms such as Proof of Work (PoW) or Proof of Stake (PoS) ensure the network validates all transactions before being added to the blockchain (Viriyasitavat & Hoonsopon, 2019).

2.1.2. Types of Blockchains

Blockchain can be classified into several types based on their accessibility and permissions (Buterin, 2016; Metcalfe, 2020; Rankhambe & Khanuja, 2019; Scherer, 2017).

- Public Blockchain: Public blockchains, such as Bitcoin and Ethereum, are open networks that allow anyone to participate, read, and write transactions. These blockchains are decentralized and permissionless, offering high levels of transparency and security.
- Private Blockchain: Private blockchains are permissioned networks that restrict access and participation to authorized users. Enterprises often use these blockchains for internal processes, offering greater control over data privacy and governance.
- Consortium Blockchain: Consortium blockchains are semi-decentralized networks governed by pre-selected participants. These blockchains combine the features of public and private blockchains, allowing for shared control among trusted entities while maintaining a degree of decentralization (Ajayi & Udeh, 2024c).

Blockchain ensures security, transparency, and immutability through several key mechanisms. Firstly, cryptographic hashing assigns a unique cryptographic hash to each block in the blockchain, serving as a digital fingerprint of the block's data. Any attempt to alter the data would change the hash, immediately alerting the network to potential tampering. Secondly, blockchain employs consensus mechanisms such as Proof of Work (PoW) or Proof of Stake (PoS) to validate transactions and achieve agreement among nodes in the network. These mechanisms ensure that only valid transactions are added to the blockchain, enhancing security and integrity by preventing unauthorized changes (Aggarwal & Kumar, 2021; Akbar, Muneer, ElHakim, & Fati, 2021).

Additionally, the distributed ledger nature of blockchain eliminates the risk of a single point of failure. Transactions are stored across multiple nodes in the network, making it virtually impossible for malicious actors to alter the data without consensus from the majority of the network. This decentralized approach to data storage and validation enhances security. It ensures the integrity of the blockchain, making it resistant to tampering and fraud. These mechanisms

establish trust, transparency, and immutability in blockchain transactions, making it a robust and secure technology for various applications (B. Rawat, Chaudhary, & Doku, 2020; Zhang et al., 2019).

In summary, blockchain technology offers a revolutionary approach to data management and transaction processing, with its decentralized, transparent, and immutable nature providing significant advantages in terms of security, efficiency, and trust. By understanding blockchain's fundamental concepts and mechanisms, organizations can harness its potential to innovate and transform various sectors, including HR and finance.

3. Integration of Blockchain in Human Resources

3.1. Challenges Faced by HR Departments in Traditional Systems

HR departments grapple with various challenges within traditional systems, spanning employee data management, recruitment, payroll, and compliance. Data security is a paramount concern, given traditional HR systems' reliance on centralized databases. This vulnerability leaves sensitive employee information susceptible to breaches and unauthorized access, necessitating robust security measures.

Fraud and identity verification pose significant hurdles, particularly in recruitment processes. Verifying credentials such as educational qualifications and work experience is time-consuming and error-prone, exposing organizations to fraudulent claims and identity theft risks. Consequently, maintaining the integrity of recruitment procedures becomes imperative. Manual processes entrenched in traditional HR systems contribute to operational inefficiencies. Tasks such as employee onboarding, performance evaluations, and payroll administration often involve labor-intensive paperwork and administrative burdens. These manual processes are prone to errors, leading to delays and a lack of transparency in operations (Ajayi & Udeh, 2024d; Igbinenikaro & Adewusi, 2024b; Trompeter, Carpenter, Desai, Jones, & Riley, 2013).

Navigating regulatory compliance adds complexity for HR departments, requiring adherence to data privacy regulations, equal employment opportunity laws, and labor regulations. Compliance mandates meticulous record-keeping and adherence to strict guidelines, posing a challenge for HR professionals amidst the intricacies of traditional systems.

Addressing these challenges is critical for HR departments to streamline operations, enhance security, and ensure compliance in today's business landscape. Transitioning to modern HR solutions, such as cloud-based systems or integrating emerging technologies like blockchain, holds the potential to mitigate these challenges and empower HR departments to operate more efficiently and effectively.

3.2. Potential Applications of Blockchain in HR Processes

Blockchain technology presents many potential applications that effectively address HR departments' challenges. Firstly, blockchain offers a streamlined process in recruitment by establishing a secure and transparent platform for verifying candidate credentials, encompassing educational qualifications, certifications, and work experience. Utilizing blockchain-based identity verification systems enhances trust and mitigates the risk of fraudulent claims (Kontzinos et al., 2020; Ramasamy & Khan, 2024).

Secondly, in employee records management, blockchain facilitates the creation of secure and tamper-proof digital records encompassing comprehensive employee information, ranging from personal details to performance evaluations and training certifications. These records are accessible and updatable securely by authorized parties, thereby reducing administrative burden and ensuring data integrity (Ajayi & Udeh, 2024a; Olawale, Ajayi, Udeh, & Odejide, 2024c; Ramachandran, Babu, & Murugesan, 2023). Lastly, blockchain-based smart contracts revolutionize payroll and benefits administration by automating processes, guaranteeing accurate and timely employee payments while minimizing the likelihood of errors and fraud. Furthermore, smart contracts extend to employee benefits administration, including insurance coverage and retirement plans, seamlessly enforcing predefined rules and conditions. Blockchain's integration in HR operations streamlines processes and enhances security, transparency, and efficiency, offering substantial benefits to organizations and employees (Alshahrani, Beloff, & White, 2021; Chillakuri & Attili, 2022).

3.3. Benefits of Integrating Blockchain in HR

The integration of blockchain technology in HR offers several compelling benefits. Enhancing data security is one such advantage, as blockchain's decentralized and cryptographic features ensure a high level of protection for employee data, guarding against unauthorized access, tampering, and data breaches. Additionally, blockchain streamlines HR processes

by automating and digitizing tasks, thereby reducing paperwork, manual interventions, and administrative overhead, ultimately leading to faster decision-making and an improved employee experience.

Furthermore, blockchain's transparent and immutable ledger fosters transparency and trust in HR operations, with all transactions and changes to employee records securely recorded and auditable, enhancing trust among stakeholders such as employees, employers, regulators, and auditors. Lastly, adopting blockchain in HR can lead to significant cost savings by eliminating intermediaries, reducing administrative costs, and minimizing the risk of fraud and errors, thus offering the potential for substantial cost reductions for HR departments. Integrating blockchain technology in HR promises to enhance data security, efficiency, transparency, and cost-effectiveness in HR operations (Michailidis, 2021; Pipino, Rocco, Pagano, & Cipriano, 2024; Sharif & Ghodoosi, 2022).

3.4. Potential Barriers to Adoption and Implementation

Despite its potential benefits, the adoption and implementation of blockchain in HR encounter several significant challenges. Blockchain technology's complexity requires specialized knowledge and expertise for development, integration, and maintenance, often surpassing the technical capabilities of HR departments. Regulatory uncertainty surrounding blockchain, including data privacy, security, and compliance concerns, poses formidable hurdles. HR departments must navigate evolving regulatory landscapes to ensure adherence to relevant laws and regulations. Integrating blockchain with existing HR systems presents challenges, requiring interoperability and data migration strategies. Legacy systems may prove incompatible, necessitating costly upgrades or replacements. Moreover, resistance to change from employees, managers, and other stakeholders can impede blockchain adoption in HR. Cultural barriers, skepticism, and fears of job displacement contribute to reluctance in embracing new technologies (Aggarwal & Kumar, 2021; Chhetri, 2022; Okatta, Ajayi, & Olawale, 2024; Olawale, Ajayi, Udeh, & Odejide, 2024a; Warren, 2012).

In conclusion, while integrating blockchain technology in HR processes holds promise for addressing longstanding challenges related to data security, transparency, and efficiency, several barriers must be overcome. By leveraging blockchain's decentralized, transparent, and immutable features, HR departments can streamline recruitment, employee records management, payroll, and compliance processes, fostering enhanced trust, security, and cost savings. However, overcoming technology complexity, regulatory uncertainty, integration obstacles, and resistance to change is crucial to fully realizing blockchain's transformative potential in revolutionizing HR practices.

4. Integration of Blockchain in Finance

4.1. Challenges Faced by Finance Departments in Traditional Systems

Finance departments grapple with various challenges within traditional systems, creating obstacles to efficiency and security. Foremost among these challenges is the susceptibility to fraud and security risks. Malicious actors often target traditional financial systems, exposing organizations to financial losses and reputational harm. Moreover, these systems lack transparency, complicating efforts to track transactions, verify ownership, and ensure regulatory compliance. Manual processes, paperwork, and reliance on intermediaries exacerbate inefficiencies, leading to delays and increased operational costs.

Additionally, the complexity of reconciling transactions, accounts, and records across disparate systems and parties presents a significant challenge. This process is labor-intensive, time-consuming, and prone to errors and discrepancies, further hindering the smooth operation of finance departments. These challenges underscore the need for modernization and innovation within finance departments to address vulnerabilities and streamline processes in an increasingly complex and dynamic financial landscape.

4.2. Potential Applications of Blockchain in Finance

Blockchain technology presents numerous opportunities for innovation and efficiency within the finance sector, with several potential applications poised to revolutionize traditional processes. Smart contracts, built on blockchain platforms, offer a groundbreaking solution for automating and enforcing predefined agreements or transactions. These self-executing contracts eliminate the need for intermediaries, enabling various financial transactions such as loans, insurance claims, and supply chain financing to be executed seamlessly and securely. Smart contracts operate based on predefined conditions, ensuring automatic execution according to established rules, thereby streamlining processes and reducing the risk of errors or disputes (Flood & Robb, 2018; Rane & Narvel, 2022).

Additionally, blockchain technology facilitates fast, secure, and low-cost peer-to-peer payments and remittances across borders. By leveraging blockchain's decentralized nature, cryptocurrencies and stablecoins offer alternatives to

traditional payment systems, reducing reliance on intermediaries and lowering transaction costs. This innovation enables individuals and businesses to conduct transactions swiftly and efficiently, regardless of geographical boundaries, while maintaining security and transparency (Igbinenikaro & Adewusi, 2024a; Naderi, 2021; Okatta et al., 2024; Olawale, Ajayi, Udeh, & Odejide, 2024b).

Moreover, blockchain's transparent and immutable ledger provides a robust solution for auditing and compliance within the finance sector. By recording transactions in real-time on a tamper-proof ledger, blockchain enables auditors to access transaction records securely and verify the accuracy and integrity of financial data without relying on manual processes or third-party intermediaries. This real-time auditing capability enhances transparency, reduces the risk of fraud, and ensures compliance with regulatory requirements, thereby bolstering trust and accountability in financial transactions (Ajayi & Udeh, 2024a; Deng, 2020).

4.3. Benefits of Integrating Blockchain in Finance

The integration of blockchain technology in finance yields several significant benefits. It reduces the risk of fraud and unauthorized transactions by leveraging the blockchain's transparent and immutable ledger. This tamper-proof record of transactions enables transparent and traceable transactions, facilitating the detection and prevention of fraudulent activities. Moreover, blockchain enhances transparency in financial transactions by providing a decentralized and transparent ledger accessible to participants in real time. This transparency fosters trust and accountability among stakeholders, bolstering the integrity of financial transactions.

Additionally, blockchain streamlines financial processes by automating manual tasks, eliminating intermediaries, and reducing paperwork. Smart contracts, operating based on predefined conditions, execute transactions automatically, minimizing the need for manual intervention and expediting the settlement process. Finally, 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. It enhances overall efficiency in the finance sector. These benefits collectively contribute to improved financial operations, enhanced security, and cost-effectiveness, positioning blockchain as a transformative force in the finance industry.

4.4. Regulatory Considerations and Compliance Challenges

The integration of blockchain in finance brings forth regulatory considerations and compliance challenges that organizations must address. Regulatory uncertainty pervades the landscape of blockchain and cryptocurrencies, with regulators grappling with issues like consumer protection, investor risk, money laundering, and tax evasion. This uncertainty surrounding regulations and compliance requirements poses challenges for organizations adopting blockchain in finance. Additionally, blockchain's transparency and immutability raise data privacy and confidentiality concerns. Organizations must ensure compliance with data protection regulations, such as the General Data Protection Regulation (GDPR), when storing and processing personal or sensitive information on the blockchain.

Moreover, Know Your Customer (KYC) and Anti-Money Laundering (AML) regulations mandate financial institutions to verify customer identities and monitor transactions for suspicious activities. Implementing KYC and AML compliance measures on blockchain platforms presents technical and regulatory challenges, such as ensuring privacy and confidentiality while complying with regulatory requirements. Furthermore, blockchain-based financial transactions often traverse international borders, giving rise to jurisdictional and regulatory challenges. When conducting blockchain-based transactions, organizations must navigate cross-border regulations and compliance requirements, such as foreign exchange controls and international sanctions. In summary, addressing these regulatory considerations and compliance challenges is imperative for organizations integrating blockchain in finance to ensure adherence to legal requirements and mitigate regulatory risks.

In conclusion, integrating blockchain technology into finance holds significant potential for transforming traditional financial systems and addressing fraud-related challenges, transparency, efficiency, and compliance. By leveraging blockchain's decentralized, transparent, and immutable features, organizations can streamline financial processes, reduce costs, and enhance trust and security in financial transactions. However, adopting blockchain in finance also presents regulatory considerations and compliance challenges, which require careful navigation and collaboration between industry stakeholders and regulators to ensure a regulatory framework that fosters innovation while safeguarding consumer protection and financial stability.

5. Future Directions and Implications

5.1. Emerging Trends and Innovations in Blockchain Technology

Blockchain technology is evolving rapidly, with several emerging trends and innovations shaping its future trajectory. 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. Scalability solutions, such as sharding, layer 2 protocols, and sidechains, are being explored to address the scalability limitations of blockchain networks. These solutions aim to increase transaction throughput and reduce congestion on blockchain networks, making them capable of supporting a broader range of applications and accommodating more users.

Additionally, privacy-enhancing technologies including zero-knowledge proofs and confidential transactions are being integrated into blockchain platforms to enhance privacy and confidentiality while maintaining transparency and auditability. These technologies enable selective disclosure of information and protect sensitive data from unauthorized access, thereby addressing privacy concerns in blockchain transactions. In summary, these emerging trends and innovations hold the potential to significantly enhance the capabilities and functionality of blockchain technology, paving the way for its wider adoption and application across various industries and sectors.

5.2. Potential Future Developments in Integrating Blockchain in HR and Finance

Future developments in integrating blockchain in HR and finance are poised to revolutionize these sectors in several ways. Tokenization of assets is expected to gain prominence, allowing real-world assets like property, securities, and intellectual property to be represented as digital tokens on blockchain networks. This facilitates fractional ownership, increases liquidity, and broadens access to assets traditionally inaccessible to retail investors. The rise of decentralized finance (DeFi) platforms leveraging blockchain technology promises to reshape financial services. DeFi platforms offer decentralized financial services such as lending, borrowing, trading, and asset management without intermediaries. DeFi has the potential to democratize access to financial services, reduce costs, and enhance financial inclusion globally.

Lastly, blockchain-based digital identity solutions are emerging to provide individuals with self-sovereign control over their identity and personal data. These solutions enable secure and verifiable identity verification, authentication, and access management, enhancing privacy and reducing reliance on centralized identity providers. Overall, these potential future developments underscore the transformative impact of blockchain technology on HR and finance, paving the way for increased efficiency, accessibility, and security in these sectors.

5.3. Opportunities and Challenges for Organizations Adopting Blockchain in HR and Finance

The adoption of blockchain in HR and finance presents both opportunities and challenges for organizations.

5.3.1. Opportunities

Opportunities arise with integrating blockchain technology in HR and finance, offering numerous benefits and avenues for growth. Enhanced security features such as cryptographic hashing and consensus mechanisms bolster data protection, safeguarding sensitive information from unauthorized access and tampering. Additionally, blockchain's capacity to streamline processes, automate tasks, and reduce paperwork translates into increased efficiency, quicker transactions, and diminished operational costs. The transparent and immutable ledger provided by blockchain enhances transparency, fostering trust and accountability among stakeholders. Moreover, blockchain opens doors to new markets, assets, and financial services, paving the way for innovation and expansion opportunities for organizations willing to embrace its transformative potential. Overall, integrating blockchain technology presents many opportunities for HR and finance sectors to enhance security, efficiency, transparency, and market access, driving growth and competitiveness in today's dynamic business landscape.

5.3.2. Challenges

Integrating blockchain technology into HR and finance sectors presents a promising avenue for improving processes and enhancing efficiency, transparency, and security. However, this integration is not without its challenges. One significant hurdle is the complexity of blockchain technology, which demands specialized knowledge and expertise for development, integration, and maintenance. Additionally, blockchain and cryptocurrencies' regulatory landscape is evolving, leading to uncertainty regarding compliance requirements and legal frameworks.

Another obstacle is the integration of blockchain with legacy systems, which can be challenging due to interoperability issues and the need for data migration strategies. Furthermore, resistance to change from employees, managers, and other stakeholders may hinder the adoption of blockchain technology in HR and finance. Overcoming these challenges will require concerted efforts from organizations, including investment in research and development, collaboration with industry partners, education and training of employees, and engagement with regulators to navigate regulatory complexities. By addressing these challenges and leveraging the potential of blockchain technology, organizations can drive innovation, efficiency, and value creation in HR and finance sectors.

5.4. Recommendations for Future Research and Practical Implications for Businesses

Moving forward, organizations aiming to integrate blockchain technology into their HR and finance sectors can benefit from several strategic recommendations. Prioritizing investment in research and development is crucial. By allocating resources to explore the diverse applications of blockchain technology in HR and finance, organizations can uncover innovative solutions tailored to their unique needs and requirements. Collaboration with industry partners, technology providers, and regulatory authorities is essential. Such partnerships facilitate knowledge sharing, best practices dissemination, and standards development, thereby expediting the adoption and implementation of blockchain in HR and finance. Investing in employee education and training is imperative. By equipping staff with comprehensive knowledge of blockchain technology and its potential applications, organizations foster a culture of innovation and empower employees to embrace change, ensuring the successful integration of blockchain into HR and finance operations.

Lastly, proactive engagement with regulators and policymakers is vital. Organizations can mitigate regulatory uncertainty and navigate compliance requirements effectively by advocating for clear and favourable regulatory frameworks, fostering a conducive environment for blockchain adoption in HR and finance. When implemented thoughtfully, these strategic recommendations can position organizations to leverage the transformative potential of blockchain technology, driving innovation, efficiency, and value creation in HR and finance sectors.

6. Conclusion

In conclusion, this paper has provided a comprehensive examination of the integration of blockchain technology in human resources (HR) and finance sectors. We began by discussing the foundational aspects of blockchain technology, including its definition, key features, types, and mechanisms ensuring security, transparency, and immutability. Subsequently, we explored the challenges HR and finance departments face in traditional systems, such as data security concerns, inefficiencies, and regulatory compliance issues.

The potential applications of blockchain in HR and finance were then examined, highlighting its transformative impact on recruitment, employee records management, payroll, smart contracts, payments, and auditing processes. By leveraging blockchain's decentralized, transparent, and immutable features, organizations can enhance data security, streamline processes, increase transparency, and reduce fraud in HR and finance operations. The benefits of integrating blockchain in HR and finance range from enhanced security and efficiency to increased transparency and trust among stakeholders. However, adopting blockchain in these sectors also presents challenges, including technological complexity, regulatory uncertainty, and resistance to change, which must be addressed to realize its full potential.

The future of blockchain integration in HR and finance appears promising. Emerging trends and innovations in blockchain technology, such as interoperability, scalability, privacy-enhancing technologies, and decentralized finance (DeFi), offer new opportunities for organizations to innovate and transform traditional processes. By investing in research and development, collaborating with industry partners, educating and training employees, and engaging with regulators, organizations can navigate challenges and leverage opportunities to harness the full potential of blockchain technology in HR and finance, driving innovation, efficiency, and value creation in the years to come.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest exists among the Authors.

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