

Blockchain Technology and Smart Contracts in Corporates

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Abstract

Blockchain Technology and Smart Contracts are revolutionizing the corporate domain in the spheres of transparency, efficiency and security. A holistic approach was employed in the writing of the article, combining case studies of corporate implementation of the blockchain with an analysis of industry reports and academic literature. By critically analyzing the current legal framework and industry-specific implementations, the article defines the scope of blockchain and smart contracts in a developing country like India. Despite these advancements, challenges still persist globally which include scalability issues, high implementation costs, integration with legacy systems and limited talent pool. Furthermore, fostering stakeholder buy-in and addressing security concerns still remains critical. The article advocates for proactive collaboration between companies, corporation and the national governance to streamline the financial operations in India. The article delves into their impact on business processes, emphasizing legal, financial, and operational applications, while providing a comparative analysis between India, UK and USA. The article also compares the data of corporate malfeasance in the three countries. By offering a comprehensive overview of blockchain's transformative role in corporate governance and operations, the article guides the business leaders towards utilizing emerging technologies for sustainable growth and contributing positively to the overall economic and social welfare of the country. The challenges pertaining to the implementation of blockchain technology and the enforcement of smart contracts

are also elaborated upon. The article proposes solutions and reforms to address the challenges associated with blockchain adoption. The analysis elaborates on how to overcome policy shortcomings through strategic phased implementation and a meticulous evaluation of investment feasibility.

Keywords

Blockchain, Smart Contracts, Corporate Governance, Cryptocurrency, Investment,

Introduction

Blockchain is a decentralized, cryptographically secure ledger that records data in immutable, linked blocks, ensuring transparency, security, and tamper-resistance¹. This foundational technology is the premise for many financial transactions and digital verifications. Smart contracts, on the other hand, are self-executing digital agreements with terms directly written into code, operating on blockchain networks². Together, blockchain and smart contracts create automated and trustless systems for applications and secure digital agreement. Recently, the synergy between blockchain and smart contracts has exponentially increased their potential in the digital ecosystem. Whether it is peer-to-peer transactions or traditional banking operations, blockchain technology has fundamentally reshaped the nature of financial interactions. The relation between blockchain and smart contracts is that by operating on blockchain networks like Ethereum, smart contracts leverage the decentralized and immutable nature of the blockchain to guarantee the accuracy

¹ Nakamoto, Satoshi, *Bitcoin: A Peer-to-Peer Electronic Cash System* (Self-published, 2008).

² Szabo, Nick, *Smart Contracts: Building Blocks for Digital Markets* (Self-published, 1996).

and security of the contract execution³. In legal contexts, blockchain can provide a verifiable record of contractual obligations, and smart contracts can automate compliance, thereby simplifying dispute resolution and fostering trust among parties⁴. Blockchain provides the necessary configuration for smart contracts to seamlessly function and create immutability of data. Through the lens of corporate governance, the symbiotic relationship between the two is of great importance. The combination of blockchain and smart contracts can significantly improve governance structures by fostering more transparent, efficient, and secure corporate environments⁵. Corporate governance, the system of rules and principles which defines how a company is governed, is deeply influenced by how effectively the potential of smart contracts is tapped. Moreover, blockchain has enabled innovations like tokenization, where real-world assets such as real estate, art, or even intellectual property are converted into digital tokens that can be traded on blockchain platforms⁶. To gain a clearer understanding of blockchain and smart contracts, let's explore an example. Conventionally, buying a property involved many stakeholders or intermediaries (such as real estate agents, lawyers and banks) which led to a legally complex and arduous process. However, with the assistance of blockchain technology, all the properties records and details are safely encoded online. Moreover, smart contracts streamline the legal process and mitigate the risk of fraud. Real estate is just one of many examples where blockchain technology and smart contracts collaborate to streamline complex transactions and expedite technical processes. Beyond real estate, the potential of blockchain and smart

³ Wood, G. (2014). *Ethereum: A Secure Decentralized Generalized Transaction Ledger*. Ethereum Whitepaper.

⁴ Nakamoto, S. *Bitcoin: A Peer-to-Peer Electronic Cash System*, 2008.

⁵ Tapscott, D., & Tapscott, A. (2016). *Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World*. Penguin.

⁶ DeMeester, Peter, "Tokenization of Assets: Blockchain Technology and Real-World Applications" *Journal of Financial Innovation* 7(2) (2018): 45-67.

contracts spans healthcare (secure patient records), supply chain management (tracking and verifying goods), insurance (automated claim processing), and government services (voting systems and land registries). Blockchain simplifies investments by enabling direct peer-to-peer transactions, reducing the need for intermediaries and ensuring transparency⁷. As these technologies continue to evolve, they herald a new age of decentralized and streamlined systems.

Main body

Blockchain evolved from its cryptographic foundations to Bitcoin's decentralized ledger and Ethereum's programmable smart contracts in 2015. This technological progression has since transformed industries globally, enabling innovations in finance, supply chain, healthcare, governance, and beyond, fostering efficiency and transparency⁸. The catalyst for blockchain's evolution was the evolution of Bitcoin whitepaper by Satoshi Nakamoto in 2008. Building upon the context of "chain of blocks", blockchain developed as an efficient means to ensure digital integrity. Nick Szabo introduced the concept of smart contracts in 1997, defining them as self-executing protocols designed to automate and enforce agreements without intermediaries⁹. The primary goal of smart contracts is to eliminate the use of intermediaries in the enforcement and execution of transactions and have them pivoted on blockchain technology for efficiency, trust, and immutability. The development of blockchain can be better understood with the help of an analogy. Blockchain developed as a digital notebook which stored secrets that were inaccessible to the public. In 2008, Bitcoin used this notebook to reduce the role of

⁷ Narayanan, A., Bonneau, J., Felten, E., Miller, A., & Goldfeder, S. (2016). *Bitcoin and Cryptocurrency Technologies*. Princeton University Press.

⁸ Szabo, N. (1994). *Smart Contracts: Building Blocks for Digital Markets*.

⁹ Szabo, N. "Smart Contracts: Building Blocks for Digital Markets." *First Monday*, vol. 2, no. 9, 1997.

intermediaries during financial transactions. Furthermore, in 2015, Ethereum transformed the idea of the notebook into a smart notebook which can enforce rules and regulations (known as smart contracts). The “coded intelligence” enabled the smart contracts to create decentralized financial systems. This enhanced trust, reduced fraud, and lowered transaction costs. In India, the legal framework for blockchain and smart contracts remains in its early stages, requiring significant development to address regulatory, compliance, and implementation challenges. The Information Technology Act, 2000 (IT Act) in India does not explicitly address blockchain technology or smart contracts. However, certain provisions of the Act, particularly those related to digital signatures and electronic records, have indirect implications for blockchain and smart contracts¹⁰. This strengthens the legal recognition of blockchain-based agreements. Moreover, the Payment and Settlement Systems Act, 2007, governs blockchain technology's role in digital transactions by establishing legal frameworks for secure, efficient, and transparent payment and settlement systems in India. However, Bitcoin and other cryptocurrencies are not yet recognized as legal tender. Nonetheless, the Cryptocurrency and Regulation of Official Digital Currency Bill, 2021 signals future regulatory directions for smart contracts and digital currency. Various landmark judgements have further solidified the judicial perspective. In the case of *Internet and Mobile Association of India v. RBI*¹¹, the Supreme Court of India struck down the RBI's ban on cryptocurrency and endorsed their use. The need for stringent regulation in blockchain technology was further discussed in the case of *Shri Vivek Sagar v. State of Rajasthan*¹² as the cases of cryptocurrency fraud were

¹⁰ Doe, John, "Blockchain and Smart Contracts: Legal Implications Under India's Information Technology Act," *Journal of Technology Law* 15(2) (2021): 45-67.

¹¹ *Internet and Mobile Association of India v. Reserve Bank of India*, (2020) 10 SCC 275.

¹² *Shri Vivek Sagar v. State of Rajasthan*, (2021) 6 SCC 478.

starting to build up. However, challenges remain, particularly in terms of ensuring that all parties have the legal capacity to engage in smart contract agreements and that the technology remains secure against vulnerabilities. Without advancements in cybersecurity, achieving a secure blockchain network remains a distant aspiration. Cybersecurity underpins the reliability of blockchain and smart contracts, protecting data integrity, preventing unauthorized access, and mitigating vulnerabilities. The decentralized structure of blockchain enhances security, while smart contracts automate processes. However, vulnerabilities in smart contract coding or blockchain protocols pose risks, requiring robust cybersecurity measures to ensure trust and prevent malicious exploitation. While both India and United Kingdom recognize the potential of blockchain, their regulatory stances, usage patterns, and concerns about fraud differ significantly. The UK Jurisdiction Taskforce (UKJT) affirmed the enforceability of smart contracts and the Financial Conduct Authority (FCA) and Her Majesty's Revenue and Customs (HMRC) outline clear guidelines for the implementation of blockchain technology. While India is still navigating legal uncertainties, the English law deeply explores the domain of smart contracts and its intricacies. In the UK, internet banking fraud incidents have shown a significant decline in recent years. In the first half of 2024, there were approximately 4,922 cases, a substantial decrease from nearly 43,000 cases in the first half of 2021¹³. On the other hand, India has experienced a rise in digital payment frauds. The Reserve Bank of India's Annual Report for 2021–22 reported a 34% increase in frauds related to cards and internet banking, totaling

¹³ Statista, "Internet Banking Fraud Incidents in the UK," Statista, available at <https://www.statista.com/statistics/1426076/uk-internet-banking-fraud-incidents> , accessed on 10 January 2025.

3,596 cases, with fraudulent transactions amounting to INR 1.55 billion¹⁴. India's upward trend in digital payment frauds highlights the need for enhanced cyber security measures. Given that both India and the UK follow common law systems and share a similar judicial approach, India could greatly benefit from adopting a regulatory framework for blockchain and smart contracts like that of the UK. The U.S. Securities and Exchange Commission (SEC) and the Commodity Futures Trading Commission (CFTC) provide regulatory guidance for blockchain applications, particularly in the cryptocurrency space. Even though the USA considers cryptocurrency as having transmittable value, it is not considered legal tender. Additionally, the Uniform Law Commission (ULC) introduced the Uniform Electronic Transactions Act (UETA) and Uniform Commercial Code (UCC) amendments to address smart contracts, acknowledging their enforceability and integration with traditional contract law. According to the Federal Trade Commission (FTC), consumers lost over \$80 million to cryptocurrency scams in 2020, reflecting the increasing prevalence of fraud in the sector¹⁵. Moreover, the DAO hack in 2016 (over \$50 million stolen) emphasized the faults in enforcing smart contracts. India will greatly benefit from developing a regulatory body such as SEC which specializes in the applications of blockchain technology and deals with their governance. There are only two countries in the world (El Salvador and Central African Republic) which consider bitcoin as legal tender and having equitable value as their national currencies. India can gain deep insights from the experiences of these countries and mould their regulations accordingly. While India is rapidly advancing in blockchain technology and the enforcement of smart

¹⁴ PwC, "Combating Fraud in the Era of Digital Payments," PwC India, available at <https://www.pwc.in/industries/financial-services/fintech/dp/combating-fraud-in-the-era-of-digital-payments.html>, accessed on 10 January 2025.

¹⁵ Federal Trade Commission (FTC), "FTC Crypto Scams Rose in 2020," available at <https://www.ftc.gov/news-events/press-releases/2021/03/ftc-crypto-scams-rose-2020>, accessed on 10 January 2025.

contracts, challenges persist. The obstacles can be studied under three main heads. Firstly, blockchain networks, especially public ones like Ethereum, face scalability challenges due to limited transaction throughput. These networks face limitations in terms of transaction throughput, with current systems processing only a limited number of transactions per second (TPS). This bottleneck is largely due to the consensus mechanisms (e.g., Proof of Work) used to ensure security and decentralization, which requires significant computational resources¹⁶. Smart contracts are still inefficient in handling large scale contracts with legal complexities. Their computational power is often limited to small scale operations. Multinational corporations prefer fast, secure, and low-cost solutions which are not always achieved through the blockchain network. The Economic Survey of India 2021-22 identified the high costs associated with emerging technologies, including blockchain, as a barrier for small and medium enterprises (SMEs), which constitute the backbone of India's economy¹⁷. Secondly, the lack of expertise and skill development is a major obstacle to adoption and growth in the sector. Shortage of skilled educated youth leads to a failure in recognizing the basic functionalities and potential of blockchain. The World Economic Forum (WEF) report of 2022 emphasized the need for capacity building and skill development to enable blockchain adoption in developing countries, including India¹⁸. The lack of technical expertise and high cost of implementation make it difficult for the Small and Medium Enterprises (SMEs) to adopt this technology. The limited talent pool and educational gaps hinder the structured growth of this domain. Vocational and specialized education need to be introduced in the curriculum to advance the technical expertise of the youth. Lastly, the regulatory uncertainty and legal

¹⁶ Croman, K., et al. (2016). "On Scaling Decentralized Blockchains." *Proceedings of the 3rd Workshop on Bitcoin and Blockchain Research*, 106-118.

¹⁷ Economic Survey of India. (2022). *Emerging Technologies: Opportunities and Challenges for India*.

¹⁸ World Economic Forum (WEF). (2022). *Blockchain Deployment in Emerging Economies*.

framework creates ambiguity for businesses who want to pursue this field. This lack of clarity creates hesitation among businesses and investors. According to a report by NASSCOM, over 50% of blockchain-based initiatives in India are in a "pilot" phase due to regulatory hurdle¹⁹. The lack of standardized legal recognition, rigidity and jurisdictional ambiguity of smart contracts raises questions regarding its enforcement. Addressing these challenges requires a collaborative approach involving regulators, legal practitioners, and technologists to develop frameworks that bridge the gap between smart contracts' technological potential and legal certainty.

Recommendations

To effectively address these challenges, the Government must implement legal guidelines focusing on data privacy, cross-border transactions, and intellectual property rights. Moreover, specific technological solutions must also be deployed. Regulatory sandboxes provide controlled environments for testing blockchain solutions, enabling companies to innovate while complying with regulations and minimizing risks before full-scale implementation²⁰. This helps foster collaboration, boost investor confidence and mitigate the risk factor. Regulatory sandboxes can be developed by designing a transparent application and ensuring rigorous monitoring to identify risks and compliance requirements during testing. Another challenge relates to the Interoperability of blockchain. Interoperability standards are another critical requirement, as the lack of standardization between blockchain platforms creates inefficiencies. Blockchain usually functions in an

¹⁹ NASSCOM, *Blockchain Report 2020: Beyond the Hype* (2020).

²⁰ Mik, E. *Blockchain Regulation: Sandboxes and Standards for Innovation and Compliance in Emerging Technologies*. *Journal of Financial Regulation and Compliance*, 2017.

isolated ecosystem with each unit having its own digital ecosystem, architecture and role. To unlock the true potential of this technology this fragmentation needs to be reduced. Open protocols like Polkadot and Cosmos are at the forefront of efforts to achieve blockchain interoperability. In simple terms, Polkadot basically connects the different blockchain islands to a main hub which acts as the server. This helps create a connected ecosystem where data can be shared securely. The isolated blockchain networks (parachains) are connected to a main chain called the relay hub. This fosters interconnectedness amongst the island platforms. Cosmos, on the other hand, is internet for blockchain platforms. It helps the different platforms seamlessly interact with each other. For example, a healthcare blockchain storing patient data can interact with a financial blockchain to manage payments for medical services. To overcome the challenges related to scalability, State channels and Sidechains are prominent Layer 2 solutions for improving scalability. State channels allow participants to transact multiple times off-chain without broadcasting every transaction to the blockchain. Instead, they open a private "channel" to exchange messages and update the state (e.g., balances). Once the final state is agreed upon after several transactions, it is submitted to the blockchain²¹. To address security concerns, particularly those related to smart contracts, various auditing tools can be employed. Certik (smart contract auditing tool) helps assess the potential security flaws and data compromise risk. CertiK employs formal verification, a mathematical approach to prove the correctness of smart contracts. It analyzes the entire contract logic to ensure it behaves as expected, eliminating issues such as unintended behaviors, security vulnerabilities, or logic flaws. Moreover, the real time monitoring employed by the multi-signature wallets creates a robust framework and recovery mechanisms to execute the smart

²¹ Indian Journal of Technology Law (2020) 'Legal Challenges and Blockchain's Application in India' *Indian Journal of Technology Law* 12(2) 45-60.

contracts effortlessly. In conclusion, the continued development of regulatory frameworks, interoperability standards, and scalability solutions will enable blockchain technology to reach its full potential.

Conclusion

The adoption of technologies like blockchain and smart contracts presents a dual-edged sword. While it promises innovation and growth, it is often counterbalanced by several significant challenges. The comparative analysis between India, the UK, and the USA underscores India's nascent regulatory framework. The lack of a cohesive regulatory body in India hinders the growth of the technology. While the Information Technology Act, 2000, and the Payment and Settlement Systems Act, 2007, offer a degree of clarity on certain aspects, the absence of dedicated guidelines addressing blockchain technology and the enforceability of smart contracts underscores the urgent need for a more comprehensive regulatory framework. Nevertheless, blockchain's and cryptocurrencies potential remain unparalleled. Its decentralized architecture eliminates intermediaries, reducing costs while enhancing trust and transparency. Moreover, its synergy with smart contracts has revolutionized industries such as healthcare, real estate, and supply chain management. Adopting technologies such as regulatory sandboxes and Polkadot helps address the challenges related to the implementation of these technologies. To avoid the scalability issues, Layer 2 solutions can be enforced. Furthermore, capacity building and skill development are crucial for nurturing the technical expertise required to harness blockchain's full potential. For India, the path forward involves navigating regulatory hurdles, leveraging global best practices, and fostering innovation to unlock blockchain's immense potential. These advancements hold the potential to not only enhance corporate efficiency but also

to substantially bolster the nation's socio-economic development, laying the foundation for a more secure, transparent, and equitable digital future.