



Unlocking The Future: Navigating The Legal Maze Of Smart Contracts And Blockchain In Real Estate – An Exploration Of Opportunities And Challenges

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Abstract

In the ever-evolving landscape of real estate, the integration of smart contracts and blockchain technology presents a paradigm shift that promises to revolutionize traditional practices. This research paper delves into the legal intricacies surrounding these technological advancements, dissecting both the challenges and opportunities they bring to the forefront. From the potential for transparent and efficient transactions to the complexities of regulatory compliance, the exploration aims to provide a comprehensive understanding of the multifaceted implications.

This paper aims to explore the prospective opportunities, challenges, enablers and inhibitors in using blockchain in the real estate sector and the need for a regulatory framework. In the dynamic landscape of technology, Blockchain-enabled Smart Contracts continue to achieve breakthroughs regularly. Despite this progress, significant issues related to their validity and legality remain unresolved, impeding further development. These complexities are attributed to the legal system's reluctance to regulate and surpass the boundaries of traditional contracts. Recognizing the immense potential and functions of this technology from a legal standpoint is crucial, and effective regulation is pivotal for promoting its widespread adoption. The paper delves into this unexplored territory to unveil innovative solutions and necessary legal frameworks for unlocking the true potential of smart contracts and blockchain in the real estate sector.

KEYWORDS: Blockchain Technology, Smart Contracts, Immutability, Real Estate, Intermediary, Security and Data Privacy.

1. Introduction

In the era of contemporary technology and creativity, we are progressing toward a highly digitized environment where automation takes centre stage. Groundbreaking concepts related to blockchain, artificial intelligence, and big data are on the horizon, poised to revolutionize the functioning of businesses and human infrastructure. Globally, the real estate industry is undergoing a significant transformation as it moves towards the creation and advancement of smart cities. These smart cities are in the process of being created, incorporating a multitude of networks, services and transactions into both the initial planning and daily operations of urban spaces¹. Traditionally, investors have relied on reliable third parties for the registration and transfer of land and real estate property ownership. However, this conventional approach presents several challenges. Notably, it is time-intensive, requiring months to finalize the transfer of land titles. The prolonged process involves verifying property titles, estimating values, submitting registration documents, and other intricate steps, indicating a cumbersome and problematic registration process. This inefficiency is indicative of governance weaknesses and susceptibility to corruption. Additionally, the transfer procedure is both expensive and intricate, with various parties seeking fees and commissions. Furthermore, there is a lack of procedural consistency across different states in India. Owing to excessive scrutiny of documents and fraudulent activities in data entry, approximately two-thirds of civil cases in India's district courts are associated with land and property disputes. The lack of transparency and potential data tampering contribute to a noticeable lack of trust in the government-maintained RoR.²

Documents are often in non-digitized formats, challenging to access, even more difficult to update, and occasionally susceptible to being lost over time. Blockchain technology offers an innovative solution for digital record-keeping. It seeks to mitigate the risks of corruption and fraud associated with records by implementing decentralization. In a decentralized system, records are stored within the blockchain without reliance on a central authority. The growing list of blocks is interconnected using cryptography, ensuring security and resistance to tampering. Each block contains transaction data, a timestamp, and the hash of the previous block³. The blockchain structure can be likened to a train, where each coach is linked to its preceding and succeeding coaches, except for the first and last ones. In simpler terms, the information stored in the blockchain is distributed among all participants, making it nearly impossible to falsify.

Blockchain has the potential to facilitate Real Estate Transactions through the implementation of Smart Contracts. These contracts are self-executing and contain coded terms directly embedded in lines of code. Their ability to automate and validate processes, remove intermediaries, and bolster security represents a significant shift beyond traditional real estate practices. Nevertheless, the journey toward widespread acceptance encounters obstacles in the shape of legal complexities that demand meticulous examination.

¹ Karamitsos I, Papadaki M and Barghuthi N, 'Design of the Blockchain Smart Contract: A Use Case for Real Estate' (2018) 09 Journal of Information Security 177.

² Punit Shukla, 'How India's Government can build better contracts with Blockchain' World Economic Forum (4 October 2019) (taken from The Adaptability of Smart Contracts in the Real-Estate Sector RASHNEEL KAUR SAYAL1)

³ Karamitsos I, Papadaki M and Barghuthi N, 'Design of the Blockchain Smart Contract: A Use Case for Real Estate' (2018) 09 Journal of Information Security 177.

This paper suggests an innovative departure from conventional contracts by introducing Smart Contracts through blockchain technology. It delves into the legal realm to examine the advantages associated with these digitized contracts and transactions. Additionally, the document delves into the legal obstacles that need to be tackled to guarantee the efficient deployment and functioning of blockchain technology in real estate dealings.

2. Demystifying Smart Contracts and Blockchain

2.1 Blockchain Technology

Blockchain serves as a collective and unalterable ledger that streamlines the recording of transactions and monitoring of assets within a business network. The Blockchain network has the capability to track and facilitate the trade of anything valuable. Operating as a decentralized database, Blockchain is distributed across a network of computers. It electronically stores information in a digital format through the use of **Distributed Ledger Technology (DLT)**, organizing data into interconnected blocks. These blocks are inherently secure and resistant to hacking⁴. They enable users to securely store and transfer data or currency directly, eliminating the necessity for intermediaries. Transactions can take place without the involvement of third parties, such as banks, to facilitate them. Furthermore, any data or transactions documented on the blockchain are tamper-proof. The **immutability** of the blockchain ensures that once something is recorded, it remains unchanged⁵.

An illustrative comparison can be drawn between Blockchain technology and Google Docs. In the case of Google Docs, when a document is created and shared with a group, it is distributed rather than copied or transferred. However, Blockchain operates on a more intricate level than Google Docs. Essentially, Blockchain is acknowledged as Distributed Ledger Technology, assuring the immutability and transparency of any digital asset by incorporating decentralization⁶.

2.2 Smart Contracts

Smart contracts are a type of digital contract which are deployed on a blockchain as part of its transactions⁷. These self-executing and self-verifying contracts, once composed, become tamper-resistant. They are automatically generated upon meeting predefined conditions, and they become irreversible and traceable once executed. All transaction-specific details are encapsulated within a smart contract, ensuring thorough record-

⁴ 'Blockchain Technology: Ministry of Electronics and Information Technology, Government of India' (*Blockchain Technology | Ministry of Electronics and Information Technology, Government of India*) <<https://www.meity.gov.in/blockchain-technology>> accessed 4 December 2023.

⁵ Zheng Z and others, 'An Overview of Blockchain Technology: Architecture, Consensus, and Future Trends' [2017] 2017 IEEE International Congress on Big Data (BigData Congress)

⁶ 'Blockchain Technology: Ministry of Electronics and Information Technology, Government of India' (*Blockchain Technology | Ministry of Electronics and Information Technology, Government of India*) <<https://www.meity.gov.in/blockchain-technology>> accessed 4 December 2023.

⁷ Alharby M, Aldweesh A and Moorsel A van, 'Blockchain-Based Smart Contracts: A Systematic Mapping Study of Academic Research (2018)' [2018] 2018 International Conference on Cloud Computing, Big Data and Blockchain (ICCBB)

keeping⁸. Smart contracts will eliminate the need for third-party involvement in transactions, such as document writers. This reduction in intermediaries will, in turn, lead to a decrease in transaction costs⁹.

In simple terms, a smart contract is an autonomous and self-executing contract activated by specific pre-defined events. The concept of a smart contract may be traced back to a paper authored by American computer scientist Nick Szabo in 1996, titled "*Smart Contracts: Building Blocks for Digital Markets.*"¹⁰, in the paper, Szabo explores the idea of integrating particular types of contractual clauses into the hardware and software of a computer program. These clauses are structured in a manner where a breach of contract would be, potentially even prohibitively, costly for the party breaching the contract. Szabo illustrates this idea using the analogy of a vending machine, where smart contracts function similarly to the machine in dispensing the desired product. Operating a vending machine requires inputting a command (offer), providing a certain amount of money (consideration), and then the machine dispenses the product (acceptance). Fundamentally, the consistent use of identical inputs to operate the machine yields identical outputs each time. In its essence, vending machines operate automatically, and smart contracts symbolize the automation of their software.

3. Revolutionizing Real Estate Transactions with Blockchain and Smart Contract

The conventional process of purchasing a house, involving numerous sequential steps, can be revolutionized through the implementation of blockchain technology. Blockchain offers a streamlined solution to the extended procedure by bringing all involved parties onto a unified platform. To begin, a potential buyer interested in a property can utilize blockchain-enabled Multiple Listing Services (MLS) to access real-time information about listed properties. This information is generated by the agent based on details provided by the seller. Following property inspection, negotiations between the buyer and seller take place, leading to a subsequent due diligence phase. The digital identity, represented by the property's hash, is permanently documented in a global ledger, enabling verification by involved entities such as financial institutions. With blockchain linking all participants, the buyer establishes direct connectivity with lending institutions, ensuring complete transparency and a real-time overview of the transaction history, so that the lending decision can be made easy and more straightforward. This could be done by means of consensus which will run an algorithm to check the credentials of the buyer.

Handling the lending workflow in the existing process is time-consuming, but in this streamlined approach, it can be efficiently managed. The digital identity, encompassing property information, undergoes thorough verification within the network. After the fulfilment of all validations, the agreement is formalized as a smart contract on the blockchain. When both the buyer and seller reach an agreement on terms and conditions, and the buyer decides to proceed with the transaction, a smart contract is generated. This smart contract serves as

⁸ Mohanta BK, Panda SS and Jena D, 'An Overview of Smart Contract and Use Cases in Blockchain Technology' [2018] 2018 9th International Conference on Computing, Communication and Networking Technologies (ICCCNT)

⁹ Mohanta BK, Panda SS and Jena D, 'An Overview of Smart Contract and Use Cases in Blockchain Technology' [2018] 2018 9th International Conference on Computing, Communication and Networking Technologies (ICCCNT)

¹⁰ Szabo, Nick, "*Smart Contracts: Building Blocks for Digital Markets*" 1996.

<https://www.fon.hum.uva.nl/rob/Courses/InformationInSpeech/CDROM/Literature/LOTwinterschool2006/szabo.best.vwh.net/smart_contracts_2.html>

a verifiable proof of the transaction¹¹. Money will be transferred from the buyer to the seller, and the registrar digitally facilitates the transfer of the title from the seller to the buyer. The update of the title transfer is reflected in the app, making it visible to all involved parties.

In utilizing a smart contract, individuals have the capability not only to buy or sell property but also to leverage this technology for renting out properties. In this situation, the tenant and landlord have the option to digitally sign a smart contract that reflects their mutually agreed-upon terms and conditions. These terms and conditions may include rental fees, lease duration, payment frequency, and specific details about each party involved¹². Following the pre-established terms and conditions, a smart contract will be automatically generated between the landlord and the tenant. Subsequently, these smart contracts can independently initiate lease payments from the tenant to the landlord and facilitate the return of the security deposit to the tenant upon the termination of agreement.

3.1 Legal Validity of Smart Contracts

The Indian Contract Act, 1872 (ICA) governs all contracts in India. Section 10 of the Indian Contract Act, 1872¹³ outlines the components of a valid contract, and for a smart contract in India to be considered valid and enforceable, it must adhere to these criteria. Although the Indian Contract Act specifically pertains to physical contracts, the validity of contracts established through electronic means can be inferred from Section 10-A of the Information Technology Act, 2000¹⁴. Accordingly, a contract is not invalid merely because it is entered into in electronic form. In other words, the validity of a contract is independent of whether it is executed in physical or electronic form. It also gives legal recognition to electronic records¹⁵ and contracts finalized through electronic means.

Using blockchain technology, smart contracts are digitally signed by two or more parties. The Information Technology Act, 2000 allows the use of eSignatures¹⁶ in the signing of documents. In a court of law, electronic signatures are allowed to show support for the authenticity, acceptance and existence of a contract according to section 65B of the Evidence Act, 1872¹⁷. But, earlier e-contracts under IT Act, 2000 could not be executed for sale or conveyance of immovable property. This position has now changed, the ministry of electronics and information technology had issued a gazette notification amending Schedule 1 to the Information Technology Act, 2000. It unequivocally eliminated all restrictions on the application of the IT Act to smart contracts, allowing for the digital execution of agreements related to the conveyance of any right or title to immovable property. This futuristic amendment will have a significant impact on the real estate sector. With this amendment, agreements concerning the transfer of rights and title to immovable property will now bear

¹¹ Mohanta BK, Panda SS and Jena D, 'An Overview of Smart Contract and Use Cases in Blockchain Technology' [2018] 2018 9th International Conference on Computing, Communication and Networking Technologies (ICCCNT)

¹² Latifi S, Zhang Y and Cheng L-C, 'Blockchain-Based Real Estate Market: One Method for Applying Blockchain Technology in Commercial Real Estate Market' [2019] 2019 IEEE International Conference on Blockchain (Blockchain)

¹³ Indian Contract Act 1872, s 10 (India)

¹⁴ Information Technology Act 2000, s 10-A (India)

¹⁵ Information Technology Act 2000, s 4 (India)

¹⁶ Information Technology Act 2000, s 5 (India)

¹⁷ Indian Evidence Act 1872, s 65B (India)

legal enforceability even if executed in digital formats. This groundbreaking development not only reflects the modernization of legal processes but also creates a new path for the integration of smart contracts, heralding a new era of efficiency and innovation in real estate transactions.

4. Opportunities

4.1 Trust and Transparency

Blockchain offers an indisputable and censorship-resistant solution for data sharing. It furnishes databases that are both shareable and tamper-resistant. All the involved parties in the blockchain consensus can access and update the block, ensuring a transparent process. By design, blockchain minimizes the reliance on third parties or intermediaries. All participants in a transaction share the same digital ledger, fostering trust among them without the need for any intermediary. Consequently, this helps in reducing or preventing extra costs and countering fraud activities.

4.2 Security

Open blockchains are overseen by an extensive network of entities, preventing any single entity from submitting inaccurate data or recording a fraudulent transaction. Since each transaction is encrypted and linked to the previous transaction, the likelihood of hacking is significantly reduced.

4.3 Integrity

Blockchain serves as a deterrent against hacker attacks and unauthorized access, thereby upholding the integrity of information¹⁸. The processing integrity relies on cryptographic proof, enabling peer-to-peer transactions and minimizing the risks associated with counterparty corruption, fraud, and scams¹⁹. “No-one can tamper with the transactions without the knowledge and consent of the stakeholders.” and automated transactions decrease the likelihood of errors made by humans²⁰. It ensures that documentation will not be overlooked.

4.4 Immutability

Immutability literally means that a transaction cannot be reversed or changed. After a transaction has been processed, it becomes tamper-proof, and any attempt to modify it requires the recalculation of the hash for every block. This makes alterations nearly impossible to carry out without detection. Immutability eliminates the possibility of fraud and establishes an unchangeable history of records. These unalterable records define the authenticity and security of data within the system²¹. “On a blockchain, it is practically impossible to “go

¹⁸ Sladić G and others, ‘A Blockchain Solution for Securing Real Property Transactions: A Case Study for Serbia’ (2021) 10 ISPRS International Journal of Geo-Information 35.

¹⁹ Krupa KS and Akhil MS, ‘Reshaping the Real Estate Industry Using Blockchain’ [2019] Lecture Notes in Electrical Engineering 255.

²⁰ Shuaib M and others, ‘Blockchain-Based Framework for Secure and Reliable Land Registry System’ (2020) 18 TELKOMNIKA (Telecommunication Computing Electronics and Control) 2560.

²¹ Mukne H and others, ‘Land Record Management Using Hyperledger Fabric and Ipfs’ [2019] 2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT)

back in time” and make a change in the block of transactions.” and transactions are securely and permanently stored²².

4.5 Disintermediation

“The disintermediation of the conveyancing services market can be achieved by rethinking the role of the middlemen in the sector (e.g., determining what will be the added value to the automatised system), and thus allowing a direct technology-supported interaction between the transacting parties.”²³. Blockchain removes third parties such as the brokers, lawyers, banks etc. “Anyone is able to record and access information without the involvement of Third party’s authority.”²⁴. The transfer of ownership is streamlined, expedited, and more secure without the necessity of involving third parties making it a cheap alternative to the traditional method.

4.6 Cost saving and efficiency

The innovation of blockchain can be extensively tailored to align with the distinct requirements of organizations or individuals employing it. Platforms can either be open to the public or restricted to a predefined group of participants who can access records through a specified protocol or administrator approval. Regardless of the chosen approach, every computer linked to the blockchain maintains a copy (or at least a portion) of the record, and any information added to the blockchain is authenticated by participants through a specific consensus mechanism applicable to the network.

The validation process determines what participants deem necessary for remote transactions without the involvement of a third-party intermediary. Utilizing blockchain technology can lead to reduced costs, increased confidence, and a significant reduction in counter-party risk. Additionally, it can facilitate faster execution and verification of information. In real estate context, it has the potential to diminish reliance on various third parties, such as brokers, title companies, and notaries. The implementation of such a consensus tool can also substantially decrease the occurrence of fraud and errors that may arise from manual documentation. Transactions can be executed promptly and without additional costs, thanks to the automation facilitated by blockchain. Using a single digital ledger, shared among entities, enhances the speed of processes.

5. Legal Challenges

5.1 Data Privacy and Security

Privacy challenges and the potential disclosure of sensitive information pose concerns. The immutability characteristics of blockchain make it challenging to uphold data subject rights, particularly “the right to be forgotten”²⁵. The issue of privacy is regarded as a central concern. Ensuring the privacy of sensitive information within a ledger that is accessible to all is crucial. Addressing the proof of identity becomes

²² Stefanovic M and others, ‘Possible Applications of Smart Contracts in Land Administration’ [2018] 2018 26th Telecommunications Forum (TELFOR)

²³ Nasarre-Aznar S, ‘Collaborative Housing and Blockchain’ (2018) 66 Administration 59.

²⁴ Nasarre-Aznar S, ‘Collaborative Housing and Blockchain’ (2018) 66 Administration 59.

²⁵ Konashevych O, ‘Cross-Blockchain Protocol for Public Registries’ (2020) 16 International Journal of Web Information Systems 571.

intricate when dealing with blockchain solutions that maintain anonymity or pseudo-anonymity, particularly in compliance with Know Your Customer (KYC) requirements²⁶. This has the potential to undermine the ability of the central bank to trace their identities.

5.2 Immutability

The challenge that arises in immutable records is how to determine the reliability of digitized information that is stored on a blockchain network. Blockchain operates on a “Garbage in, garbage out” principle, meaning that if inaccurate data is uploaded to the blockchain, it will persist as inaccurate. Prior to deploying blockchain, the information related to the land must be authentic, and stakeholders must ensure the accuracy of that data registered on the blockchain. Implementing blockchain in this context would necessitate a substantial shift from traditional processes²⁷.

While immutability is one of the key characteristics which makes blockchain useful, it acts as a double-edged sword. Since, data once recorded on the ledger, cannot be easily deleted or altered, the blockchain inherently becomes non-compliant with data protection laws. The European Union's General Data Protection Regulation includes provisions for the “right to be forgotten”²⁸ and the California Consumer Protection Act grants consumers the right to request alterations or deletions of their data²⁹.

But in India, the digital data protection Act, 2023 does not provide “right to be forgotten” to the data principal. The Srikrishna Committee in 2018 recommended the said right, it observed that the “right to be forgotten” is an idea that attempts to instil the limitation of memory into an otherwise limitless digital sphere³⁰.

5.3 Pseudonymous Data

The term ‘personal data’ in Section 7(a) of the DPDP Act, 2023³¹ signifies that ‘pseudonymization’ as a practice will be resorted to in the Indian framework. The process includes delinking personal identifiers from personal data and keeping these identifiers separate from the remaining data. It is important to note that pseudonymized data is considered personal data under the European framework, and for that reason processing pseudonymized data attracts the provisions of GDPR. The rationale behind such classification is that the process of pseudonymization is generally reversible, i.e., the data principal can be identified through pseudonymized data by reverse engineering (linking it to the missing variables of the original data set).

Data can be retained in a pseudonymized form even after account deletion, and consequently, such retention could be done by processors after providing a monetary consideration to data fiduciaries/controllers as a quid

²⁶ Garcia-Teruel RM, ‘Legal Challenges and Opportunities of Blockchain Technology in the Real Estate Sector’ (2020) 12 Journal of Property, Planning and Environmental Law 129.

²⁷(Draft discussion paper - niti aayog) <https://www.niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf> accessed 5 December 2023.

²⁸ General Data Protection Regulation 2018, A 17 (EU)

²⁹ California Consumer Privacy Act 2018, s 1798.105 (US)

³⁰ (Draft discussion report – B.N Srikrishna Committee)

<https://www.meity.gov.in/writereaddata/files/Data_Protection_Committee_Report.pdf> accessed July 2018.

³¹ Digital Personal Data Protection Act 2023, s 7(a) (India)

pro quo for such agreements irrespective of the obligation of a data fiduciary to cause its data processors to delete personal data after its purpose is fulfilled as stipulated in Section 7(b) of the Act³². It is to be noted that once a set of data is pseudonymized, it is no longer categorized as personal data, at least in the Act, which potentially creates an arrangement to transfer data across countries without following the requisite compliance. The said data can later be converted to its original form. When the data is associated with an individual, the entire history of their pseudonymous transactions throughout their lifetime becomes susceptible to exposure. This risk is anticipated to increase over time due to the enduring nature of transaction history on the blockchain.

5.4 Enforcement and Jurisdiction Issues

The integration of blockchain technology presents the challenge of determining jurisdiction in case of a dispute over a transaction, particularly when the validation process is conducted by a node located in a different jurisdiction. Nodes, essentially participants in a blockchain network, connect to it through various computer/electronic software. The location of nodes or the nature of transactions may play a pivotal role in establishing a court's jurisdiction over a blockchain dispute and the subsequent enforcement of any rendered judgment.

Creating a secure digital environment for efficient, speedy, and cost-effective document exchange across multiple entities can be achieved by uniting all the parties involved in litigation—such as lawyers, experts, investigative agencies—on a single blockchain platform. This approach guarantees the security and immutability of information accessed on the blockchain network. Miners are assigned the responsibility of verifying the reliability of these data blocks, serving as participants who validate the authenticity of new blocks. This streamlined process saves the court significant time, enabling a focus solely on case adjudication rather than getting bogged down by minor procedural concerns.

Also, since blockchain has the ability to cross all jurisdictional boundaries, ensuring compliance with all relevant legal and regulatory frameworks becomes essential. Therefore, the enforcement of smart contracts may pose a number of complex jurisdictional issues which will require careful consideration. Additionally, this decentralization makes it challenging to determine the specific location of a transaction in cases where it proves to be fraudulent or erroneous in nature.

6. Recommendation

The introduction of blockchain in real estate gives rise to legal questions and challenges, with one of the foremost issues being property rights. The real estate sector is subject to stringent regulations, and the transfer of property rights must adhere to various legal prerequisites. Often, the transfer of property necessitates the participation of government agencies, such as the recording of deeds at local courthouses. For blockchain

³² Digital Personal Data Protection Act 2023, s 7(b) (India)

technology to be effective, it must align with these legal requirements, and there needs to be established legal frameworks to guarantee its utilization in a manner consistent with existing property laws.

The integration of blockchain technology in real estate introduces concerns related to data privacy and security. Blockchain relies on a decentralized ledger accessible to anyone on the network. While this enhances transparency and accountability, it also raises privacy concerns, especially in real estate transactions where sensitive personal information such as social security numbers, bank account details, and credit scores is often exchanged. Additionally, laws and regulations vary across jurisdictions, encompassing fundamental principles of contracts and rightful title. Establishing an agreeable mode of dispute resolution would also be beneficial for all involved parties.

Furthermore, it is the states, who have to do the groundwork on setting in place the legislative framework. Under Entry No. 18 and 45 of List II (State List) in Schedule 7 of the Constitution, matters related to land, including the maintenance of land records and surveys, fall within the jurisdiction of states. Therefore, the enactment of legislation on land titling is in the domain of state legislatures.

As of now, blockchain, on its own, cannot independently verify the legal requirements for real estate transactions³³. The utilization of smart contracts continues to pose legal and regulatory challenges³⁴. Four legal challenges have been identified in Land Administration Systems: “control of IDs; the legality of contracts; registration of co-ownership; and amendment of the ledger.”³⁵. The representation of property rights in the form of tokens, especially title rights, must comply with legal requirements as per the applicable jurisdiction. Therefore, the implementation of a legal framework is essential³⁶. Additionally, The Registration Act requires the parties and witnesses to be present at the registrar’s office³⁷. Amending these laws will help solve the problem of mistrust and regulatory uncertainty surrounding blockchain.

In December 2021, the Ministry of Electronics & Information Technology of India released an updated version of the *National Strategy on Blockchain*³⁸. This strategy advocates for the establishment of a national blockchain infrastructure distributed geographically across the country, with the aim of creating infrastructure for providing “blockchain as a service”. The strategy emphasizes the need for a National Blockchain Framework.

According to the Ministry, this framework would be capable of hosting multiple smart contracts and ledgers, addressing the broader requirements of the country. It is designed to facilitate basic process automation

³³ Garcia-Teruel RM, ‘Legal Challenges and Opportunities of Blockchain Technology in the Real Estate Sector’ (2020) 12 Journal of Property, Planning and Environmental Law 129.

³⁴ Sladić G and others, ‘A Blockchain Solution for Securing Real Property Transactions: A Case Study for Serbia’ (2021) 10 ISPRS International Journal of Geo-Information 35.

³⁵ Stefanovic M and others, ‘Possible Applications of Smart Contracts in Land Administration’ [2018] 2018 26th Telecommunications Forum (TELFOR)

³⁶ Konashevych O, ‘Cross-Blockchain Protocol for Public Registries’ (2020) 16 International Journal of Web Information Systems 571.

³⁷ The Registration Act 1908, s 32 (India)

³⁸ (*National strategy on Blockchain - Ministry of Electronics and Information Technology*)

<https://www.meity.gov.in/writereaddata/files/National_BCT_Strategy.pdf> accessed 5 December 2023.

functional aspects related to assets, including asset creation, linking assets to users, and tracking asset transfers, through user-friendly and standardized APIs using the National Blockchain API. The strategy further suggests that applications can integrate with existing national services such as e-Pramaan, Aadhaar, eSign, Digilocker, etc., within the blockchain framework, ensuring compliance, security and privacy across the layers of the blockchain framework.

7. Future Outlook

The central and state governments in India have been actively working to enhance land record management systems and provide citizens with clean title records. Numerous initiatives in this direction have primarily concentrated on digitizing land records and have been initiated under the Digital India Land Record Modernisation Programme (DILRMP)³⁹, previously known as the National Land Records Modernisation Program. A significant step in this direction involves the integration of blockchain into land record management as part of the Indian government's Digital India Land Records Modernization Programme (DILRMP).

Rajasthan has taken a pioneering role in the digitization of land titles, with a focus on implementing blockchain technology. This initiative aligns with the applicability of the Rajasthan Urban Land (Certification of Titles) Act, 2016 ("Rajasthan Act")⁴⁰. According to this legislation, the state government will establish an 'Urban Land Title Certification Authority'. This authority will collect all relevant documents from landowners, cross-verify them against state records, and issue a provisional certificate of the title for a two-year period without guarantee. Subsequently, a permanent certificate of title will be issued with the state government acting as a guarantor. In the event of defective titles, the state government will assume responsibility and compensate those adversely affected. The assurance is based on a certificate provided by the Urban Land Title Certification Authority after verifying the property's ownership.

In a significant move, Maharashtra has initiated e-registration for newly constructed properties. The state government, declared the development of a blockchain technology specifically designed to store e-registration data. This data can be efficiently shared with pertinent stakeholders, encompassing property buyers, financial institutions and government agencies engaged in funding property purchases⁴¹. The Maharashtra government introduced a software tool that allows developers to electronically register new property sales at their respective offices.

The Andhra Pradesh government has implemented a blockchain-based land record management system with the aim of enhancing transparency and efficiency in land-related transactions within the state. The software,

³⁹ 'MIS: Digital India Land Records Modernization Programme' (DILRMP) <<https://dilrmp.gov.in/>> accessed 5 December 2023.

⁴⁰ Rajasthan Urban Land (Certification of Titles) Act, 2016 (India)

⁴¹ 'Maharashtra Govt Develops Blockchain Technology to Store Property Buyers' e-Registration Data' (*Moneycontrol*, 6 September 2022) <<https://www.moneycontrol.com/news/business/real-estate/maharashtra-authority-develops-blockchain-technology-to-store-property-buyers-e-registration-data-9140201.html>> accessed 5 December 2023.

known as “Bhoomi”⁴² has been developed by the state government in collaboration with the blockchain firm, ChromaWay⁴³. Bhoomi stores land records and ownership information on a decentralized ledger, ensuring their tamper-proof nature and reducing the risk of fraud. The platform is designed for online verification of property titles, minimizing the need for physical inspections and documentation. Additionally, the system enables instant access to land records, eliminating the necessity for manual record-keeping and thereby reducing the likelihood of errors. This development can be considered a significant breakthrough in the real estate sector facilitated by the adoption of blockchain technology.

While states like Maharashtra, Rajasthan, and Andhra Pradesh have commenced the integration of land records into blockchain, a complete transition of the real estate sector to blockchain may take a considerable amount of time. In a densely populated country such as India, digital property registration is currently mainly prevalent in metros and tier-2 cities. Technology adoption in several villages started in the late 2000s, gradually introducing the use of computers.

To facilitate a smooth transition, starting with a pilot implementation in selected registration offices could pave the way for broader adoption, contingent on the success and acceptance among stakeholders. Land transactions using blockchain could be implemented on a public blockchain, allowing any citizen to view the data stored without the risk of tampering. Moreover, blockchain could potentially enable cross-border land transactions, subject to the establishment of necessary legal frameworks. Eventually, the vision is to streamline land transactions, making them as accessible and straightforward as online shopping.

The goal of 'The Digital India Land Records Modernization Programme' (DILRMP) is to replace the manual presumptive land-title system with a digital conclusive land-titling system. The program aims to create a unique identification similar to Aadhar for every land parcel in India⁴⁴. A decentralized land registry has the potential to enable parties to trace ownership records, transaction history, and facilitate the verification of data. Moreover, it could encourage the seamless payment of stamp duty and utilities, while also automating the mutation of property. Recognizing the transformative impact of blockchain in this context, NITI Aayog, in its discussion paper on ‘Blockchain: The India Strategy,’⁴⁵ has underscored the necessity of amending existing laws on land transactions to promote the adoption of this technology.

8. Conclusion

The convergence of blockchain, virtual reality, and smart contracts within the Indian real estate sector presents a profound potential for enhanced efficiency and transparency. However, successfully navigating the legal complexities is imperative. Real estate professionals and technology developers need to remain vigilant regarding the evolving landscape of data privacy and security regulations in India. Adhering to these laws is

⁴² ‘National Government Services Portal Find Government Services Faster’ (*Meebhoomi - Online Viewing of Land Records in Andhra Pradesh | National Government Services Portal*) <<https://services.india.gov.in/service/detail/meebhoomi-online-viewing-of-land-records-in-andhra-pradesh>> accessed 5 December 2023.

⁴³ ‘Chromaway’ (*ChromaWay*) <<https://chromaway.com/>> accessed 5 December 2023.

⁴⁴ ‘MIS: Digital India Land Records Modernization Programme’ (*DILRMP*) <<https://dilrmp.gov.in/>> accessed 5 December 2023.

⁴⁵ *Draft discussion paper - niti aayog* <https://www.niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf> accessed 5 December 2023.

paramount to harness the advantages of emerging technologies while preserving individuals' personal data and establishing a legally robust real estate ecosystem in the country. The Indian legal framework is adapting to accommodate these transformations, underscoring the significance of aligning technology and law to foster innovation and drive growth in the real estate sector. Numerous challenges remain to be addressed before realizing the complete potential of technologies connected to blockchain. These challenges encompass issues concerning privacy and cybersecurity. In addition to guaranteeing the technology's strength and scalability, it is crucial to examine the ethical and social consequences of its diverse potential applications, while also assessing the financial costs and benefits associated with its adoption.

Considering the regulatory ambiguity within this domain, it is crucial for stakeholders in both the public and private sectors to work together. Their collaboration is essential to raise awareness about the potential benefits and applications of blockchain, and to advocate for a comprehensive legal and regulatory framework that embraces this technology. Despite potential risks, the advantages of blockchain technology far outweigh them, and companies embracing this technology now may reap substantial benefits in the future. While blockchain holds a promising future in tech-based development, its distinctive features might pose challenges for legal enforcement, particularly given that a minority of legal professionals and judges are proficient in technology.

The technology is currently undergoing development, and legislators must grapple with various legal and practical challenges, including coding errors and a lack of cryptographic knowledge. While these issues hold true in the realm of legal enforcement, it is essential to recognize that blockchain technology has introduced a straightforward yet potent system based on trust among anonymous users and cryptography. In this era of digital technology, a meticulous and well-defined legislative framework for the implementation of this technology will, over time, enhance efficiency by reducing errors and expanding access to legal processes.

The seamless integration of smart contracts and blockchain in land-related applications encounters various challenges that demand resolution, including the need for regulatory amendments and restructuring existing administrative authorities responsible for land records. Nonetheless, government initiatives like the Digital India Land Records Modernization Programme (DILRMP) and proposed strategies by organizations such as NITI Aayog signify a move toward incorporating blockchain systems in India. Despite being in its early stages, the implementation of this technology could potentially happen without causing significant disruption to the existing system, and its potential merits acknowledgment and exploration. By undertaking these measures, it is possible to establish a robust and efficient blockchain technology in the real estate sector.