PAPER • OPEN ACCESS

Role of Blockchain Technology in Digitization of Land Records in Indian Scenario

View the article online for updates and enhancements.

Role of Blockchain Technology in Digitization of Land Records in Indian Scenario

P Singh

Department of Civil Engineering, Amity School of Engineering & Technology, Amity University Uttar Pradesh, Noida, India

[*]Email: priyanka24978@gmail.com

Abstract. Blockchain is a way of passing data (such as records, events, or transactions) from one party to another in a very secure way. It is an electronic record of information that requires digital security. All data stored in the blockchain is immutable; once a piece of data enters into a blockchain, it is practically impossible to alter its value. The Blockchain has changed the model from a centralized way of traditional business to the decentralized model of the blockchain, that means there it can run without any central authority. It works on Peer to Peer Model rather than Peer-Mediator-Peer. The Blockchains makes the process easier, fastest, and trustworthy to deal with businesses as it follows Peer to Peer nature Blockchain. It has become the most used business model in different industries, such as construction industries, as it is the safest, fastest, transparent, and it also is more comfortable to implement. The critical feature of the blockchain that makes it today's most potential technologies are: decentralized, self-control, peer- to- peer relationship, fixed record and time stamping. Thus, this chapter focuses on the pivotal role and application of BlockChain technology on the digitization of land records of the Indian Scenario.

1. Introduction
The Record of Rights (RoR) of the Department of Revenue & Land Reforms is wisely exploring the benefits of blockchain technology in land registration because of transparent financial management and transactions. Blockchain in the land registry is utilized for secure transfer of property [1]. The concept of smart contracts enables updating of the record automatically; otherwise the ownership is transferred to the buyer through an application form. With the use of blockchain and smart contracts, the certainty about the ownership of property is assured [2]. This technology built the trust between parties in transactions as the agreement is implemented and imposed automatically. It also makes the business transactions faster and more organized. It ensures the originality of land records, built the customer's faith in the government, more convenient to the customer, improves the security of data [3].

2. Features of Blockchain Technology
In the blockchain, the nature of work built a trustworthy platform where users are the owner of the chain [4]. BlockChain occurs in three phases of the project - pre-construction, construction, and post-construction. In the first stage, the data is gathered and stored and protected. In the second phase the records and data collected is authenticated and secured to prevent breaching. In the third stage, all the

final changes are recorded in the blockchain model. This form the basis for further upgrades for the block and a more secure source of information and records for its protection [5].

The blockchain is a distributed ledger, every block in the network has an identical or almost identical copy of the ledger, this ensures that if a block is compromised or damaged, it can always be restored. Every block could receive a complete copy of the database from the system through the form of a sub-database [6].

The critical feature of Blockchain that makes it today's most potential technology are:

- Persistent: Data recorded cannot be deleted or altered and are saved permanently; hence it cannot be corrupted.
- Time-stamped records: Entire data entry in the Blockchain is recoded digitally at the time of occurrence.
- Approachable: Data records are easily accessible to the participants; they can view data or add data according to consent granted.
- Decentralized: The network is maintained by a group of blocks; therefore, there is no single governing authority. Any data can be stored securely, essential documents, contracts, etc. and can be directly controlled with the help of the private key.
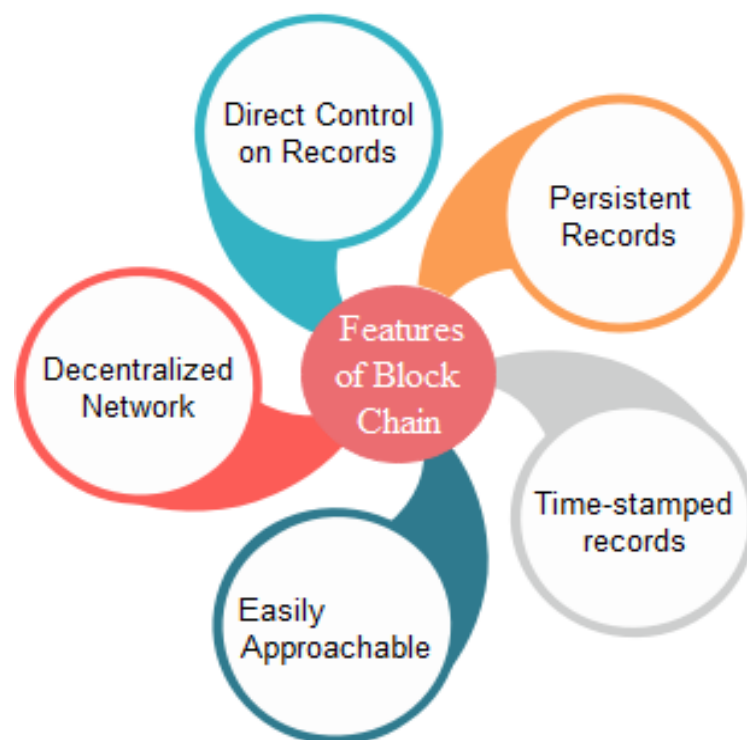

Figure 1: Features of BlockChain Technology

The other features of Blockchain are less likely to breakdown as a direct attack on the whole network of block is difficult for hackers, no involvement of any third-party, no chance of scams, transparent as every change in the Blockchain can be easily monitored, hence enhanced security [7, 8]. Figure 1 illustrates the features of Blockchain technology.

Blockchain is mainly divided into three main types; they are as follows:

1. Public Blockchain: It is fully decentralized and anyone can do the transactions. Any individual can join the network irrespective of location, nationality, etc.

2. Private Blockchain: It is also referred to as permissioned Blockchain, members need permission to join the network as transactions are private and are only accessible to the participants.
3. Consortium Blockchain: It is referred as Permissioned Blockchain, but the main difference is that, consortium blockchains are monitored by the group and not by any individual [9].

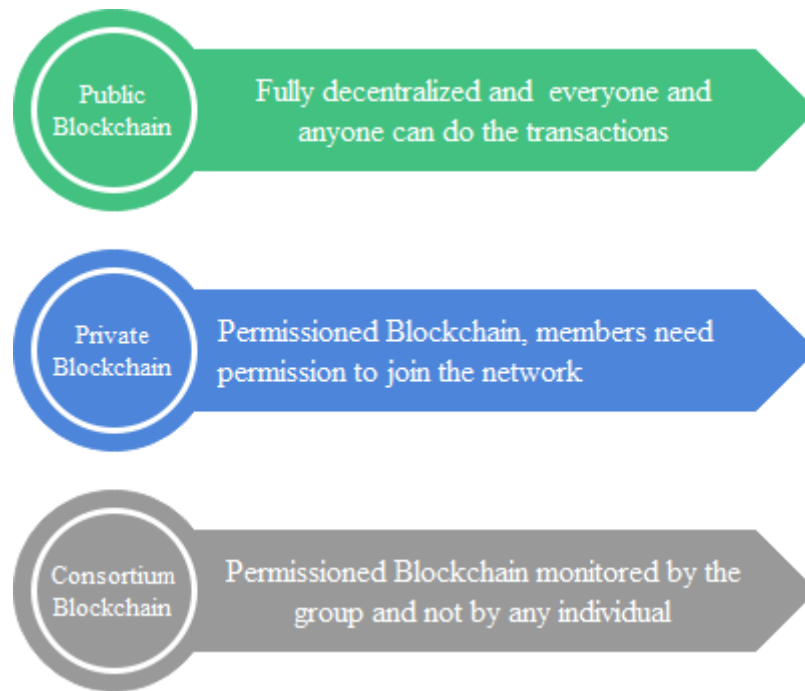Figure 2 demonstrates the different classification of blockchain technology with its features.

Figure 2. Classifications of Blockchain Technology

3. Application of Blockchain Technology in Land Records

The Blockchain in the land registry is used for secure transfer of land property. The transparent nature of Blockchain enables to track the changes made in land documents. Advent of Blockchain technology in the land registry is playing a very beneficial role in this developing era. It is helping in uplifting the poor, and marginalized section of the society in fighting illegal authorization of land [10,11]. The current system for land registration is full of duplicity and inefficiencies, due to which the land records are not protected, and citizens are the one those have to bear the most of it.

Similarly, there are thousands of people who face such a crisis [12]. With the help of Blockchain, all the records are preserved all the time, are easily accessible, none can ever doubt the originality of the records, records are fed in the system permanently. Therefore, no one can ever manipulate it, and the records can be seen by any participant anytime [13].

4. Concept of Smart Contracts

For the validation or proof of this blockchain technology in the land registry, the concept of the smart contract is followed. A smart contract is the legal proof of ownership and contain the history of the property. The buyer is confident for land bought, that it is original without any duplicity, and the seller is the lawful owner of the land, which abandons the probabilities for any disputes later [14, 15]. The use of smart contracts gears up the procedure of land titling by updating the record automatically. Figure 3 clearly depicts the applications of Blockchain technology in maintaining land records.
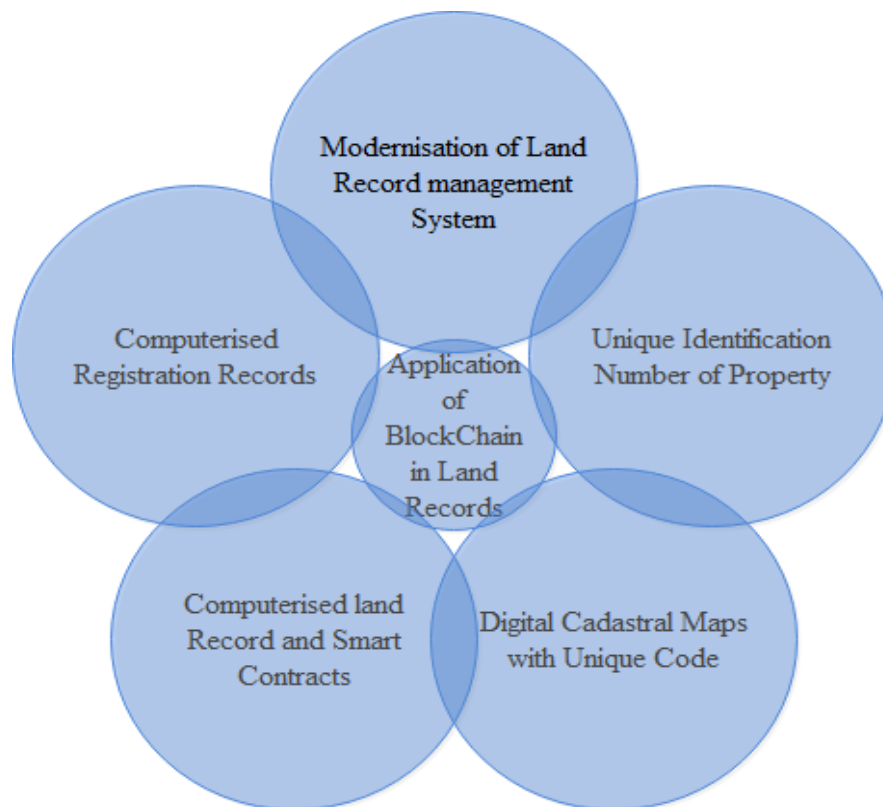
Figure 3. Applications of Blockchain Technology in maintaining land records
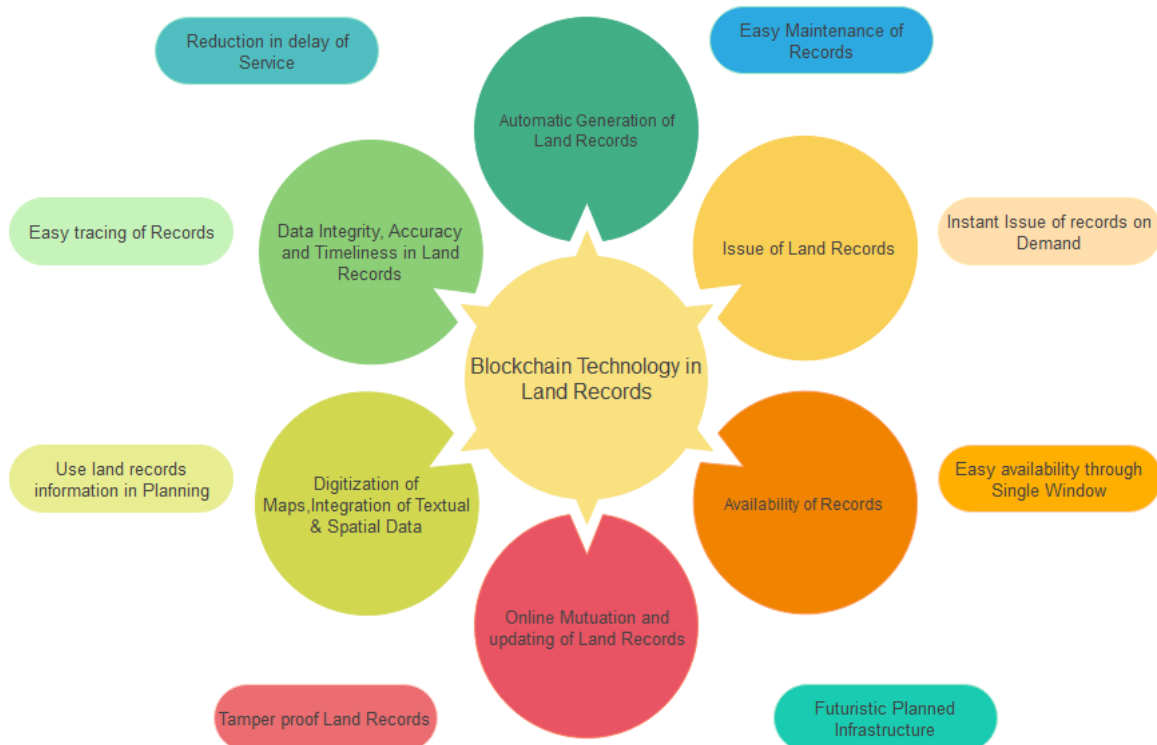

Figure 4. Role of Blockchain Technology in land Records

If the parties that are indulged in the purchase of the property have all the correct data at the required time, then decisions could be made faster, hence making the whole process smooth and transparent.

With the use of Blockchain and smart contract, the certainty about the ownership of property is assured. This technology built the trust between parties, as transactions is in the form of transparent contract. It makes the business faster and more organized [16]. It improves data security and ensures the originality of the land records [17]. Figure 4 clearly explains the role of Blockchain Technology in land Records.

The main merit of using public blockchain technology is the impossibility of making any changes in the blockchain. Thus, it helps in providing a level of trust to the buyers and the sellers.

In the hybrid land registration block chain process, only a limited number of entities are part of the blockchain [18]. When the current Land Registry system would be replaced by using a hybrid blockchain, used by the current stakeholders in the chain of real estate transfer, there could be a role for both the Registrar and the Notaries, bailiffs and other parties, who are sending official documents to be recorded in the Land Register [19].

5. Traditional Methods of Land Records in India

The traditional way of processing land registry prevailing in India is illustrated here (see Figure 5). Let us understand the traditional way of operating the transaction of the land registry.

There are three units of land registry.

1. Object: The spatial unit.
2. Right: The right associated with the property or power associated with a specific person.
3. Subject: The person or the titleholder of an asset.

Figure 5: Land management system in India

Land Registry Records term can be express as it is the legal records maintained and controlled by the govt. authorities, containing all the relevant information about the property, and one of the essential data is the current legal owner of the asset or the property [20]. It helps to get details back-dated history of ownership of that land with all the information about the past owners of the property. The Legal Rights of property gets changed from one hand to another hand. Figure 6 shows the land management system in India. The information stored as the legal records that can always get tampered [21].

It becomes challenging to understand who the legal owner of the asset or the property is. The land dispute between the legal owner and the claiming owner; the claiming owner can file a case against the legal owner to win the ownership of that property. In that case, the judiciary declared the property as disputed land or disputed property [22].

That cannot be bought or sold by anyone who claims to be an actual owner. In this case, the judiciary takes a hold on the property and decide who is the legal owner of the property which makes the inter-process difficult. Almost 66% court cases in the country are related to land disputes costing a whopping Rs.58,000 crore in litigation, both civil and criminal [23]. Land Records digitization can help accelerate India's GDP by as much as 1.3%.

6. Existing Problems in Land Registration in India

India has land disputes over all the levels of courts, comprising of discourse over a land of 2.5 million hectares involving 7.7 million people, which contains a total of 66% of all the pending court cases in India [24]. An average pendency extends from an average of 20 years, from the undertaking till the last hearing resolution. Authenticity in land registration is, therefore, posing as a significant challenge in the country. The critical process in land registration is the sale deed process, which involves five significant organizations, which include the government, two parties of interest, banks, registrar, witnesses and other minor organizations such as stamp vendors, agents, advocates, document writer.

These process affects the efficiency in transferring the ownership of land from one party to another, drastically as it can take almost 30 days in transferring total property, which poses a risk in the data loss or modification.

There is also an issue of not having an effective Land record management system to date [25,26]. Currently, in India, the transfer of records and collection of these data are what we refer to as land records. These are general labeling and comprises of multiple documents such as Record of Rights (ROR), sale deed, personal records [27, 28].Lack of maintenance and communication has resulted in the data being outdated, and no proper transaction details have been recorded. The solution proposed to the issue in land records collection and in maintaining the transactions required in the ownership of land is by blockchain [29-31].

Blockchain is a secured medium through which the operations, information is transferred without any infiltration of other parties. A World Economic Forum has reports estimating that 10% of global GDP shall rely on blockchain technology by the year 2027 [32-35]. Figure 10 exemplify the existing land administration in India.

7. Drawback of Existing method

The drawbacks of the existing way of transferring the ownership of land records are illustrated here (see Figure 6):

1. The Existing Process is very time-consuming.
2. This process is less secure as compared to the blockchain technology of land registration.
3. It has no transparency.
4. The process is less synchronized.
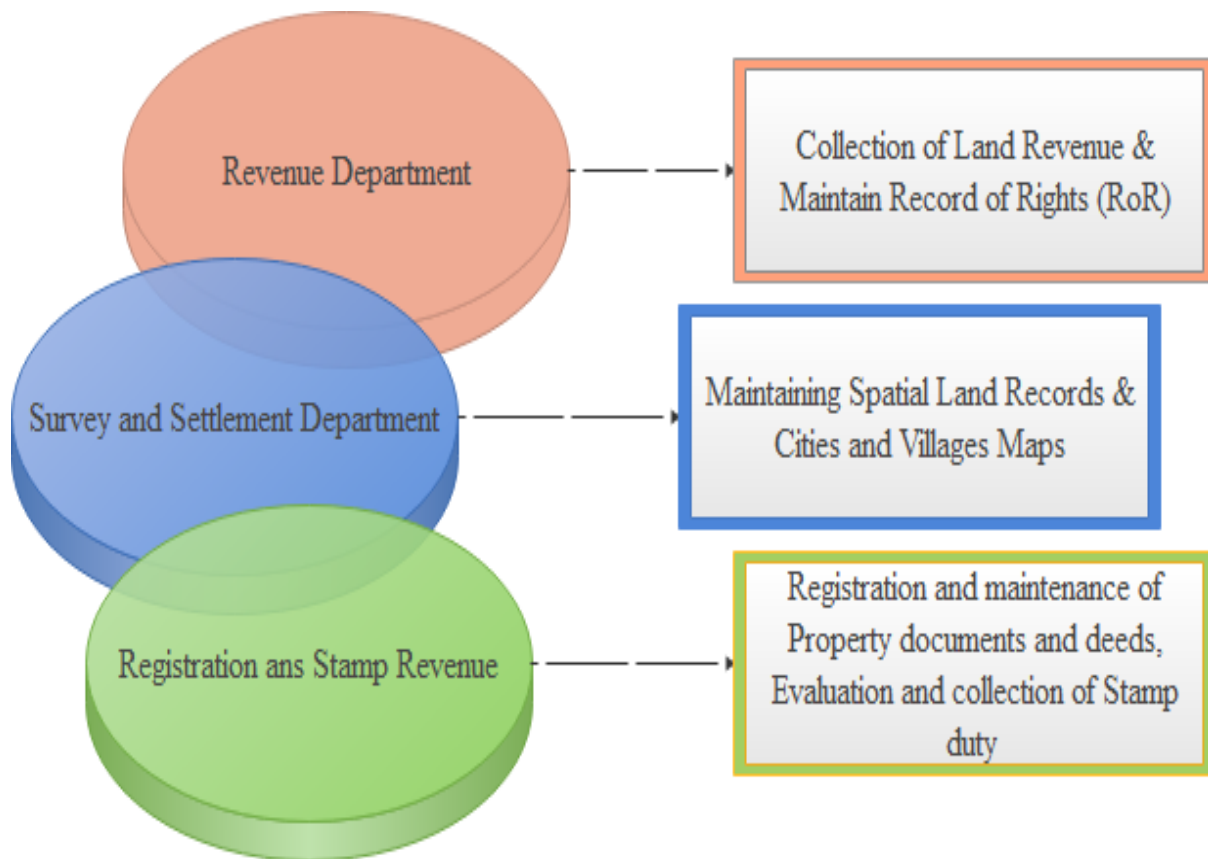5. The traditional way has very little data integrity.

Figure 6. Existing land administration in India

8. Application of Blockchain Technology for land records in India

India is rapidly developing in each sector and becoming economically stable, and the blockchain process assists in dealing with various public areas and some state govt. Authorities have initiated the progress of applying Blockchain in multiple sectors, as The Government of Andhra Pradesh has started an initiative to maintain the land registry records. The Govt. has partnered with a Sweden startup firm to work on maintaining the records of the land registry by Blockchain [36-38].

In India, Blockchain was first introduced in Andhra Pradesh, and they collaborated with Chromway, a Sweden based company, to build the software for improving the land registry process using blockchain technology. The blockchain land registry process in Andhra Pradesh will allow property deeds to be recorded on a Government Land Registry [39-40]. Using this software would enable transfer asset ownership from property seller to buyer, approved via the Land Department. It will also demonstrate the possible integration with the other Government entities, like the State Municipal Department and Water Department. In India, the Blockchain is in an evolving stage. There are a lot of disputes in India regarding land ownership because of poor maintenance of records, bribery, and cyberattacks [41-43]. The main problem is the collection of data as in the early years. Land records were recorded on paper because some documents are missing, or some lands have multi-owned property. Blockchain has made the complex structure of the land registry easier and faster. Table 1 shows the percentage of computerisation of land records of the states of India. In Figure 7, the computerized land record in all states of India has been shown graphically. In Figure 8 & 9 graphs are showing the ongoing computerized land record and computerized mutation record of all states of India.

Table 1: Details of computerized land records in different states of India [44]

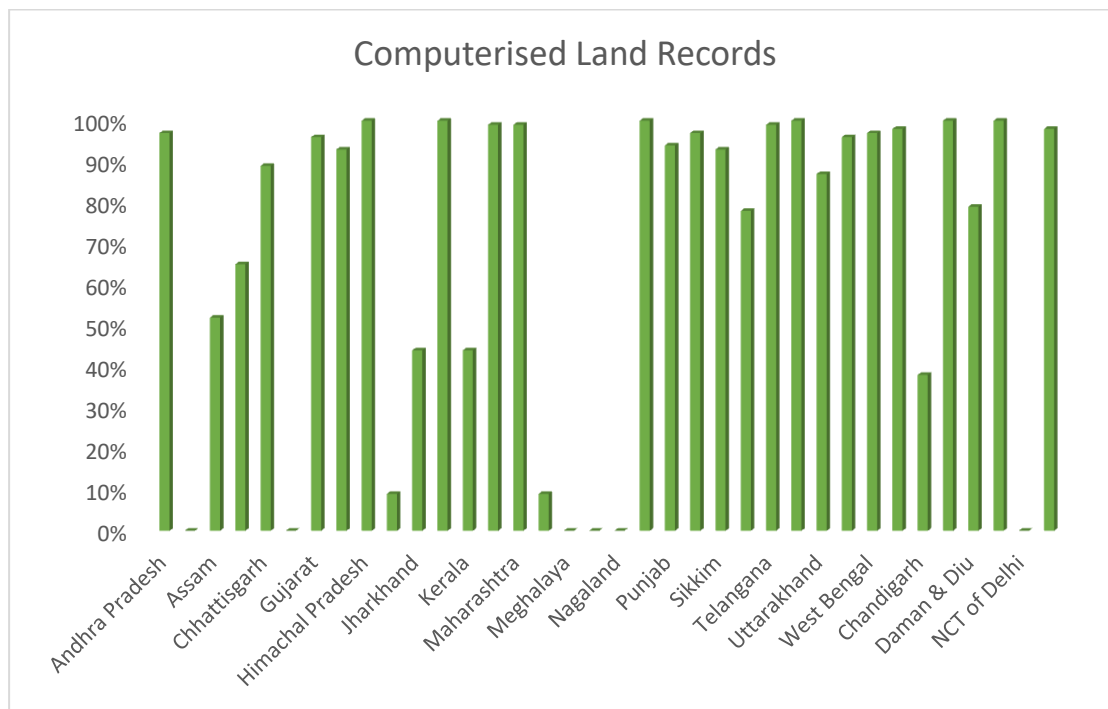| State	Number of villages	CLR Completed (%)	CLR Ongoing (%)	CLR not started (%)	Mutation computerised (%)
Andhra Pradesh	17.563	97%	1%	2%	98%
Arunachal Pradesh	5.590	0%	0%	100%	0%
Assam	26.777	52%	0%	48%	62%
Bihar	46.368	65%	19%	16%	2%
Chhattisgarh	20.401	89%	6%	5%	90%
Goa	425	0%	33%	66%	34%
Gujarat	18.531	96%	0%	4%	83%
Haryana	7.088	93%	4%	3%	93%
Himachal Pradesh	20.694	100%	0%	0%	2%
Jammu & Kashmir	5.733	9%	0%	91%	0%
Jharkhand	32.752	44%	24%	32%	32%
Karnataka	29.523	100%	0%	0%	0%
Kerala	1.674	44%	1%	55%	44%
Madhya Pradesh	55.070	99%	0%	1%	31%
Maharashtra	44.855	99%	1%	0%	99%
Manipur	2.743	9%	3%	88%	8%
Meghalaya	6.822	0%	0%	100%	0%
Mizoram	826	0%	0%	100%	0%
Nagaland	1.601	0%	0%	100%	0%
Odisha	51.681	100%	0%	0%	0%
Punjab	12.894	94%	0%	6%	30%
Rajasthan	47.921	97%	0%	3%	8%
Sikkim	417	93%	0%	7%	67%
Tamil Nadu	16.721	78%	0%	22%	74%
Telangana	10.829	99%	0%	1%	99%
Tripura	891	100%	0%	0%	100%
Uttarakhand	17.126	87%	0%	13%	37%
Uttar Pradesh	1.09.109	96%	0%	4%	73%
West Bengal	42.191	97%	1%	2%	96%
Andaman & Nicobar Islands	209	98%	2%	0%	98%
Chandigarh	16	38%	6%	56%	6%
Dadra & Nagar Haveli	72	100%	0%	0%	100%
Daman & Diu	28	79%	14%	7%	93%
Lakshadweep	24	100%	0%	0%	0%
NCT of Delhi	207	0%	0%	100%	0%
Puducherry	130	98%	0%	2%	98%
Total	6.55.502	86%	3%	11%	47%

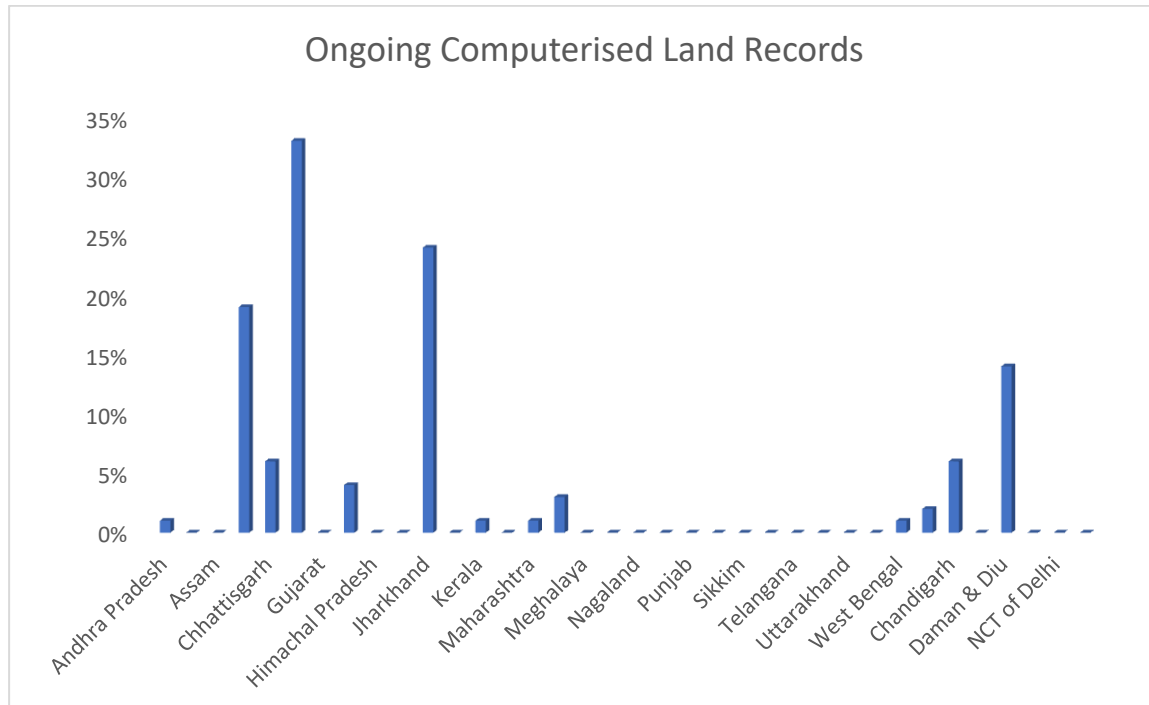**Figure 7**. Computerized Land record in all states of India

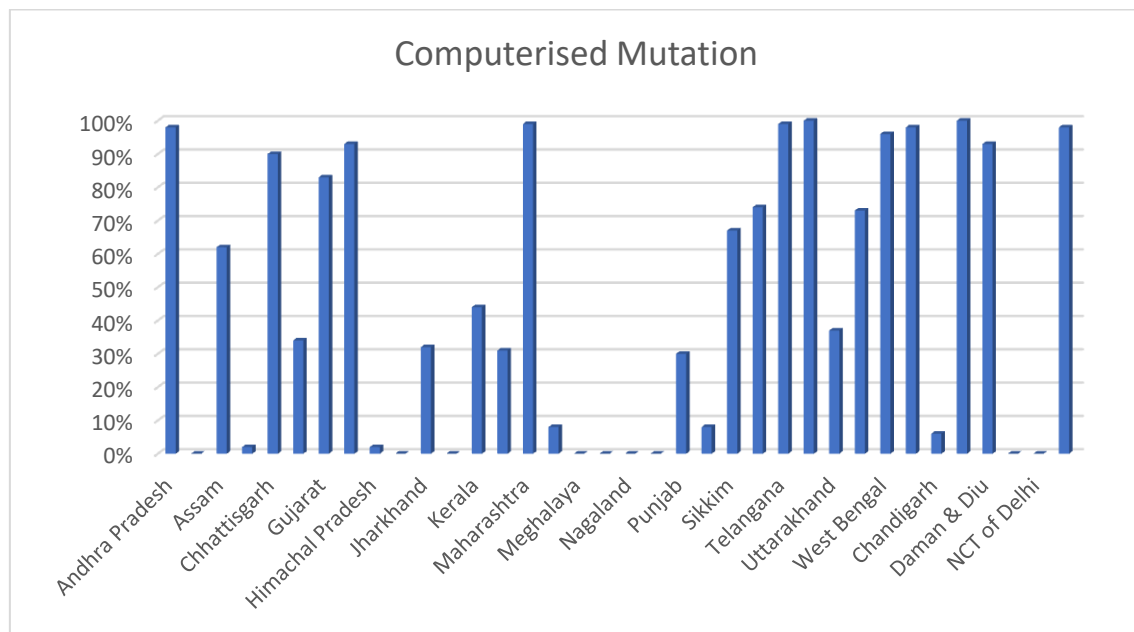**Figure 8**. Ongoing computerized land record in all states of India

Figure 9. Computerized Mutation record in all states of India

From the above graphs it is clear that, India needs to digitize the land records in the remaining states. Indian Government push to digitise land records and establish conclusive rather than presumptive title system, with that of conclusive titling with title guarantee [45].

And, even as computerization continues, some more attention is paid to the possibilities offered by new technologies such as blockchain. Figure 10 shows the government program of digital India land record modernization.
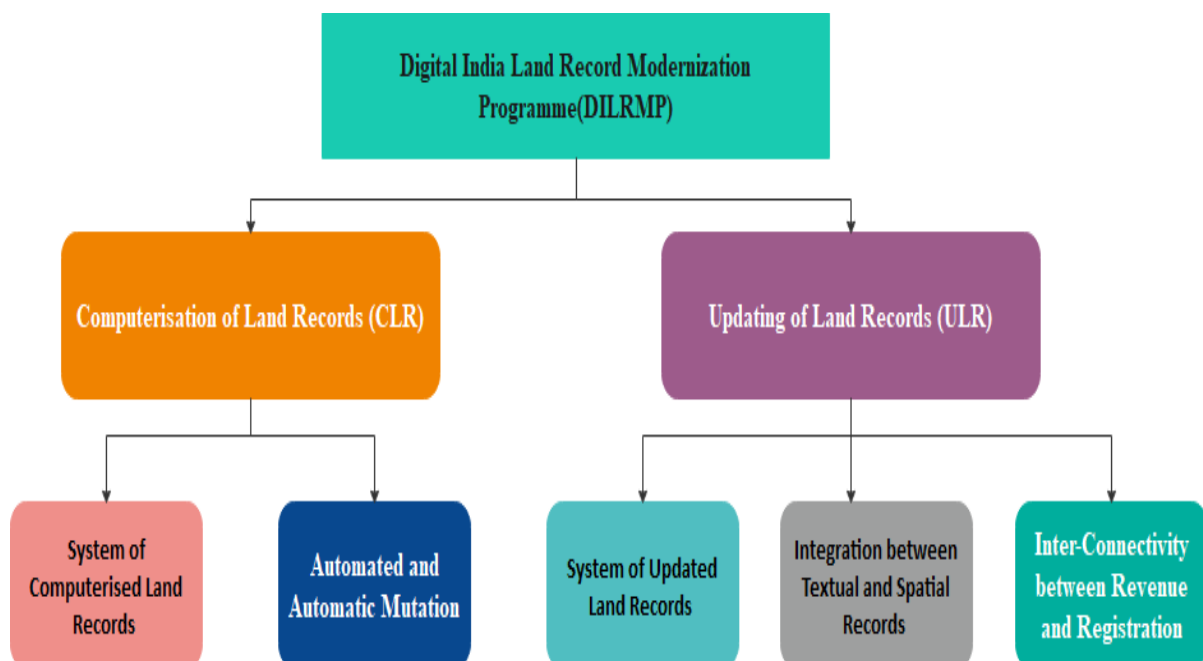

Figure 10: Details of digital India land record modernization programme

As the Blockchain is a tamper-resistant process and this makes a user more comfortable to buy, sell or to get details about the land and its purchase history.

The Land registry method can be simplified by applying blockchain technology and can be a secure, fast, and transparent way to operate the system [46-50].

1. The land registry in Blockchain, the property owner, can automatically check their own and whether they are eligible to transfer the legal ownership to others or to sell the property.
2. The Buyer and the Seller, both parties, are the user in the blockchain channel and can get easy access to each other, as it connects users over the single platform.
3. The banks can also check the status of the current legal owner of the asset over the blockchain platform.
4. The verification of property and the land records becomes very accessible and very easy.
5. Once the verification gets complete, the users who are buyers and sellers can quickly move to the next process of registration that is the transaction.
6. The Purchase of land or asset gets executed by using a smart contract.
7. The seller transfers the ownership to the buyer.
8. The payment process automatically gets completed by transferring the amount from Buyer's Bank to the seller's bank.
9. Everyone, buyer, seller, and the bank can verify the status of the contract over the blockchain smart contract platform.

The legal steps can automatically execute the process with the help of a smart contract platform. The smart contract platform verifies all the legal checks and the legal ownership & transfer the asset from one person to another. Also, it keeps a record of ownership of that asset or property [51-56].

9. Conclusion

Blockchain in the land registry has been an essential aspect of today's world. Once the land transfer task completes, the information automatically updates and saved on that blockchain platform, and this process is the safest and tamper-free mode of the operating system. No one can change the legal right of the ownership, and no one can damage the data asset; others cannot make a change in that transaction and ownership. The history of past transfers of ownership uses to help in verifying the current legal owner of the land. There is no need for authority in the Blockchain, which is a huge advantage in today's world. There is no requirement of middleman or authority and is simply called as Decentralized ledger. The term blockchain has been gaining popularity because of success, such as Bitcoin, Ethereum, and Hyperledger fabric. The use and implementation of Blockchain in the land registry and its assistance in maintaining the land records are quite transparent. Blockchain helps to make the process of land registry transparent, straightforward and more accessible. It is very useful in the land registry where this application enables us to know how, when, where, which, etc. about the land title. It also empowers us to know if there had been any activities in a particular land. It shows every record of the land registered. This application will indeed take us towards development and easy accessibility to life not only for us but also for the future generation.

References

[1] Oprunenco A, Akmeemana C 2018 Using blockchain to make land registry more reliable in India, LSE Business Review, UK.
[2] Baliga A, Subhod I, Kamat P, Chatterjee S 2018 Performance evaluation of the quorum blockchain platform, *arXiv preprint arXiv* **1809** 03421.
[3] Chandra V, Rangaraju B 2017 Blockchain for Property A Roll Out Road Map for India, India Institute, India.
[4] Manjunath P, Herrmann M, Sen H 2019 Implementation of Blockchain Data Obfuscation Innovation in Medicine and Healthcare Systems, and Multimedia eds Chen YW, Zimmermann A, Howlett RJ, Jain LC (Singapoure: Springer) chapter 3 pp 545-553.

[5]   Swan SM 2015 Blockchain: Blueprint for a new economy, O'Reilly Media Inc., Boston.

[6]   Underwood S 2016 *Communications of the ACM* **59**(11) 15-17.

[7]   Vigna P, Casey M 2015 The age of cryptocurrency: How bitcoin and digital money are challenging the global economic order, Martin's Press, New York.

[8]   Garzik J, Donnelly JC 2018 Blockchain 101: an introduction to the future, Handbook of Blockchain, Digital Finance, and Inclusion, *Academic Press* **2** 179-186.

[9]   Nakamoto S 2008 A peer-to-peer electronic cash system. Bitcoin

[10]   Bal M 2017 Securing property rights in India through distributed ledger technology, Observer Research Foundation, New Delhi.

[11]   Catalini Ch, Gans JS 2019 Some simple econmomics of the blockchain, National Beurau of Economic Research, Massachustes.

[12]   Graglia JM, Mellon C 2018 *Innovations: Technology Governance Globalization* **12**(1-2) 90-116.

[13]   Buterin V 2014 *Ethereum White Paper* **3**(37) 1-36.

[14]   Anand A, McKibbin M, Pichel F 2016 Colored coins: Bitcoin, blockchain, and land administration, In Annual World Bank Conference on Land and Poverty.

[15]   Morini M 2016 From 'Blockchain hype' to a real business case for Financial Markets, Available at SSRN 2760184.

[16]   Hyperledger F 2019 A Blockchain play form for the enterprise.

[17]   Mougayar W 2015 A decision tree for blockchain applications: Problems, opportunities or capabilities? Startap Management, Toronto.

[18]   Ølnes S, Ubacht J, Janssen M 2017 *Government Information Quarterly* **34**(3) 355-364.

[19]   Anand A, McKibbin M, Pichel F 2016 Colored coins: Bitcoin, blockchain, and land administration, In *Annual World Bank Conference on Land and Poverty*, Washington.

[20]   Thakur V, Doja MN, Dwivedi YK, Ahmad T, Khadanga G 2020 *International Journal of Information Management* **52** 101940.

[21]   Collindres J, Regan M, Panting G 2016 Using Blockchain to Secure Honduran Land Titles, Fundacion Eleutra, Honduras.

[22]   Digital India Land Records Modernization Programme - MIS 2.0, Department of Land Resources, Ministry of Rural Development, Last accessed on September 22, 2017.

[23]   Success Stories on National Land Records Modernization Program, Ministry of Rural Development, http://dolr.nic.in/dolr/downloads/pdfs/revenue_ministers_document.pdf.

[24]   Buterin V 2014 *Ethereum White Paper* **3**(37) 1-36.

[25]   Mohanty D 2018 Ethereum for Architects and Developers, Apress Media LLC, California.

[26]   Luu L, Chu DH, Olickel H, Saxena P, Hobor A 2016 *Proceedings of the 2016 ACM SIGSAC conference on computer and communications security,* pp 254-269.

[27]   Mohanty D 2018 Deploying smart contracts *Ethereum for Architects and Developers* eds Mohanty D (Berkeley: Apress) p 105-138.

[28]   Schmitz AJ 2020 Making Smart Contracts 'Smarter' with Arbitration, American Arbitration Association website (Forthcoming) , University of Missouri School of Law Legal Studies, Missouri.

[29]   Casetllanos A, Benbunan-Fich R 2018 *Thirty Ninth International Conference on Information System*, San-Francisco.

[30]   Grimsley M, Meehan A 2007 *European Journal of Information Systems* **16**(2)134-148.

[31]   Krishnapriya S, Greeshma S 2020 *Procedia Computer Science* **171** 1708–1715.

[32]   Priem R 2020 *Financial Innovation* **6** 11

[33]   https://landrevenue.assam.gov.in/information-services/integrated-land-records-management-systemilrms.

[34]   Digital India Land Records Modernisation Programme (DILRMP) - Implementation in Urban Areas - regarding [Policy circular no. 2 of 2017], February 21, 2017, Department of Land Resources, Ministry of Rural Development.

[35] DILRMP: Digital India Land Records Modernization Programme 2008, Government of India.
[36] Torun A 2017 In *Proceedings of the UCTEA International Geographical Information Systems Congress*, Adana, Turkey.
[37] Nelson RT 2003 Honduras country brief: property rights and land markets, Minds & UW.
[38] Graglia JM, Mellon C 2018 *Innovations: Technology Governance Globalization* **12**(1-2)90-116.
[39] Benbunan-Fich R, Castellanos A 2018 *Thirty Ninth International Conference on Information System*, San-Francisco.
[40] Robinson N 2013 *Journal of Empirical Legal Studies* **10**(3) 570-601.
[41] Stefanović ĐM, Pržulj D, Ristic S, Stefanović D 2018 *International Scientific Conference on Contemporary Issues in Economics Business and Management*, University of Kragujevac, Republic of Serbia.
[42] Model Draft Sale Deed, Government of Delhi, http://districts.delhigovt.nic.in/DEEDS/sale.pdf.
[43] RoR in Practice and Coding Scheme in Major States, National Informatics Centre, Ministry of Communications and Information technology, November 2008, http://dolr.nic.in/dolr/downloads/pdfs/CLR_ROR_REVISED2a.pdf.
[44] Record of Right, Revenue Department, Government of Gujarat, last accessed on July 4, 2017, https://revenuedepartment.gujarat.gov.in/record-of-right.
[45] State and District Administration, 15th Report of the Second Administrative Reforms Commission, Government of India, April 2009, http://arc.gov.in/15threport.pdf.
[46] Cabinet Note: National Land Records Modernization Programme (NLRMP) - 2008, Department of Land Resources, Ministry of Rural Development, http://dolr.nic.in/NLRMP-2008.pdf
[47] Ying W, Jia S, Du W 2018 *International Journal of Information Management* **39** 1-4.
[48] Dobhal A, Regan M 2016 *Annual World Bank conference on land and property: Annual World Bank conference on land and property*, Washington.
[49] Domeher D, Abdulai R 2012 *Third World Quarterly* **33**(1) 161-175.
[50] Thakur V, Doja MN, Ahmad T, Khadanga G, Pal M 2019 Interoperability issues and data models in integrating land administration systems in India.
[51] Hughes L, Dwivedi YK, Misra SK, Rana NP, Raghavan V, Akella V 2019 *International Journal of Information Management* 49 114-129.
[52] Glaser F 2017 *Proceedings of the 50th Hawaii International Conference on System Sciences*, Hawai.
[53] Swan M 2017 *Technology Innovation Management Review* **7**(10) 6-13.
[54] Hughes E, Graham L, Rowley L, Lowe R 2018 *The Journal of The British Blockchain Association* **1**(2) 3741.
[55] Spielman A 2016. Blockchain: digitally rebuilding the real estate industry, Doctoral Dissertation, Massachusetts Institute of Technology, Massachusets.
[56] Lemieux VL 2016 *Records Management Journal* **26** 110-139.