

A literature review of land title with the aim of maximising the benefits of Blockchain technology in the management of Land Title in Nigeria

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Abstract. *Blockchain is a trending technology that has paved way to solving various challenges in different sectors. It has received much interest from researchers over the years, as it is known to be a transparent, secured, no third party and tamper-proof public records repository system for documents, contracts, properties and assets. Land title has been a major challenge in Nigeria due to the fact that existing system, digital archives, used to manage the sector is not effective, thus brought about issues such as, double spending, possibility of tampering, third party interference and non-transparency of operations. Hence the need for blockchain technology. Blockchain has characteristics, such as decentralization, security, immutability, smart contract, it is therefore expected to improve land title management. This paper applies a content-analysis based literature review blockchain technology and existing method of land title in Nigeria. This paper propose five benefits. Blockchain can help to improve proper land record keeping, information transparency, accountability, anonymity and avoidance of double spending.*

Keywords: *blockchain, land regulation, ethereum, smart contract*

1. Introduction.

The previous years have seen researchers pick interest in Bitcoin and Blockchain. Bitcoin is a cryptography type of currency which leans on the technology of Blockchain. The fact is, the original and most common application of Blockchain technologies is Cryptocurrency, in recent times further use cases have been proposed. The current trending and important Blockchain application which focuses on Ethereum and smart contract is explored.

The Blockchain is a novel disruptive technology based on cryptography. The Block Chain technology has been known to be the work of Nakamoto who defined Blockchain as a peer-to-peer network which is immutable, transparent, and secure



and needs no third party interference. Nakamoto S. (2008) explains how this technology can become the core component to support transactions of the digital currency (Bitcoin). With the introduction of Blockchain, many fields such as finance, accounting, and real estate will receive a positive impact using the benefits of this technology. One area in which Blockchain technology could play a vital role is the use of Blockchain technology to manage land titles.

Blockchain beyond currency, Ethereum and smart contracts. The main purpose of Bitcoin is to transfer currency, the highly immutability quality and openness of its Blockchain have given rise to the birth of new protocols, which uses Ethereum type of block chain where Ether is been spent and the smart contract code are written to permit transactions, beyond Cryptocurrency. Taking for instance, some protocols permit the certification of a document. The platform where smart contract is executed is written in a Turing complete language. The Consensus protocol of Ethereum makes sure all valid updates of the contract are recorded on the Blockchain, making sure of valid execution. These researches have provided some benefit in blockchain such as performing transaction on a secured network. Its efficiency, while there are also challenges including scalability and immature technology, this paper aims to fill the gap. The purpose of this paper is to explore how the current land title system in Nigeria operates and to propose using blockchain technology to address current restrictions. As a result, this paper responds to the following research topics.

1. Research question 1: what research has been carried out on existing method of land title in Nigeria?
2. Research Question 2: what research has been carried out on blockchain-related work?
3. Research Question 3: What is the importance of blockchain adoption to land title management in Nigeria?

To answer these questions and to achieve the aim of the study, a collective summary of related papers, for both the existing method of land management in Nigeria and existing method of blockchain technology are studied with literature review. The organization of the paper from section 2 provides blockchain overview, literature review on existing method of managing land title in Nigeria, literature review on blockchain related method, importance and challenges of blockchain technology and finally a conclusion is drawn to the research.

2. Blockchain overview

The core technology of this protocol, the Blockchain, is widely acknowledged as a major breakthrough in fault-tolerant distributed computing, after decades of research in this field. In overly concise terms, Deloitte (2016) we can define the Blockchain as a database that contains all the transactions ever executed in a peer-to-peer network. It consists of a permanent, distributed digital ledger, resistant to tampering and carried out collectively by all the nodes of the system.

The advancement presented by this innovation is that the system is open and members don't have to know or confide in one another to transact, the electronic exchanges, can be consequently confirmed and recorded by the hubs of the system through cryptographic calculations, without human interference, specialist or outsider (for example governments, banks, money related establishments or different associations). Regardless of whether a few hubs are problematic, unscrupulous or pernicious, the system can effectively confirm the exchanges and shield the record from altering through a scientific component called proof of work, which makes human interference or controlling specialist pointless. Sharples M. and Domingue j. (2015) Blockchain could therefore be regarded as a distributed ledger of records that is immutable to attack. The Ethereum V. Buterin, (2013) platform has been attracting attention for its good support to the execution of smart contracts, e.g. programs that are executed in a decentralized way. As an irreversible and tamper-proof public records repository for documents, contracts, properties, and assets, the Blockchain can be used to embed information and instructions, with a wide range of applications. These incorporate, for example: smart contracts, to be specific automated, self-executing activities in the assentation between two or different nodes; as against the old way of, multi-signature exchanges, which require the assent of numerous organization for their execution; smart properties, to be specific advanced responsibility for and elusive resources inserted to the Blockchain, which can be followed or traded on the Blockchain itself. In these cases, the benefit of the Blockchain is that there would not be need for a legal official, by authorizing the execution of directions by a cryptographic code, with insurance of members against dangers of extortion and a noteworthy decrease of the executives' overheads. On account of the exceptional preferences identified with computerization, straightforwardness, auditability and cost-adequacy, the Blockchain may in this way speak to a problematic advancement for some assortments of agreements and business exercises. Other critical uses of the Blockchain incorporate for instance Xu J (2016) the creation of decentralized domain name system resistant to top- level domains censorship (e.g. Name coin); (DAOs/DACs/DASSs), namely self-sufficient agents derived from artificial intelligence and capable to execute tasks without human involvement, for which the Blockchain can provide additional functionality.

The fields of application of the Blockchain are potentially countless since it allows the disintermediation of any digital transaction at global level. "Accordingly, all kinds of business and human activities are expected to be reconfigured, with pervasiveness similar to that of the Web" (Swan, 2015). For this very reason, the Blockchain has been described as fundamental for human progress as the Magna Charta or the Rosetta Stone (Swan, 2015), and it is often referred to as a "Black Swan" – namely an accident of major impact in history that cannot be anticipated, creates surprise to the observer and can only be rationalized by hindsight (Taleb, 2007).

3. Methodology

The method adopted for this research, is a content-analysis based literature review blockchain technology from Briner and Denyer (2012) in other to provide a transparent scientific literature review of blockchain application and Traditional system of managing land title Nigeria there are steps which are involved in this method approach:

Step 1: identify the related work of existing system and draw a comparison with blockchain technology, to ascertain the need for blockchain technology

Step 2: review blockchain related work and the research covered area to ascertain the proposed blockchain to land title is novelty.

Step 3: Identify and show the unique characteristics of blockchain in the reviewed literatures to provide an answer to the research questions

This section provides a brief review of the relevant concepts, including real estate as blockchain is yet to be explored for land title management this research paper therefore, set a precedence on land title in Nigeria. Blockchain, and traceability/ auditability, transparency, tamperproof to provide some background information as the basis for this study. For this section a review of existing method of land titling in Nigeria and a review of blockchain method is carried out.

3.1. Review on Land Title in Nigeria

A few studies have been carried out on land title in Nigeria, this section provide a literature review on land title in Nigeria. According to Ajoku et al (2003) and examination of how effective land administration in Lagos Nigeria with a consent of the government of right to certificate of occupancy within 30days interval, this at the time was introduced to improve the land title management and housing allocation in Lagos Nigeria. This study discovered, it has not brought about to significant improve has the reduction in the time for processing and issuing certificate of occupancy is yet to still give a smooth running of land title management.

According to babade (2003) findings of activities in Lagos Nigeria on land title allocation ministry in giving approval of Urban land in Nigeria. The author through its findings, who obtained data of land title record for this research and also administer questionnaire on the staff of the ministry to get their view, and other stakeholders in the land title management, the study indicated that there is no transparency in the allocation of land where the politicians and civil servants had greater access the this said urban land. Their by living the poor and the less bridge at the mercy of this few notables.

Omirin (2003) also state the challenges of land title in Lagos Nigeria. A non-empirical approach was devised by also stating related view from previous empirical studies, the research concluded on its findings and discovered that extant policy are not effective and our unproductive where they have produced barriers and bottleneck for private individuals to access land. The research also stated that the existing system of land titling is not effective as it is not equitable, sustainable, not transparent, brings about third party interference hence the need a proposed a new working technology.

In the study of how effective land title is on the less privilege people of Argentine, according to Galiani et al (2010), using survey data from 20003 to 2007, findings indicates that due to lack of land title to the poor masses it has barred them from getting access to decent housing and this is as a result of the lack of government to give access to improved credit system. Findings further stated if the citizen would have improved system of land title in Nigeria, this would improve the standard of living.

Nigeria land use act of 1978 according to, Ndukaku (2010) in Enugu Nigeria, emphasizing on land accessibility this law state that every land belong to the government. However the law has not been effective has it has become difficult for the common citizen to have access to land, researcher therefore propose, an amendment of law or a technology that could give a policy guidance to land title in Nigeria.

In Ondo Nigeria, an empirical study was carried out. According to ojo (2014) a survey on a hundred and eleven person was carried out by administering questionnaire, which was analyzed, findings show the dissatisfaction of respondent on how land title is managed in the state. Findings stated lack of transparency, time effectiveness and accessibility, accessibility. Also, there are possibilities that staff in the offices of the land ministry are tampering with the documents

Therefore stated the need for a new technology that would find solutions to the present limitations.

An examination of land reforms in Lagos Nigeria, was carried out with a respondent of 160, which includes the surveyors, legal practitioners, people and staff of land ministry. Thontteh et al (2015), discovered that the present system cannot effectively keep records of land title. Hence the ministry would need a new technology that can serve as public record of database which would effectively keep land title documents for proper accountability.

In a study carried by, Awolaja (2016) in Lagos Nigeria the researchers stated the importance of having a good technology to manage the land title, the researcher stated that it gives land guarantee, which in turn can be used to access loans for building or development of the said land however the researcher stated that the present system of land title hasn't given rise to this importance due to its challenges efficiency, improper storage of land documents, lack of proper documentation. The research therefore stated that a new technology should be look into to have a seamless process.

According to Udoka (2017) carried out a research on how effective land title registration is in Akwa Ibom Nigeria, a descriptive design was adopted by the researcher which he obtained is data from a secondary source. The research findings indicate that multiple people have access to the land title information which should be made private for every citizen who has a land title document in the ministry. I.e. every person's document should be private and not accessible to others. This has therefore lead to the double spending, where same land is sold to different parties and also there is no anonymity in this process.

The existing system reviewed above indicates that there are limitations in the present system use to manage land title hence the need for blockchain technology to manage land title effectively. The limitations of the existing system are;

1. Land title transparency
2. Third party interference
3. Land title tamperproof
4. Land title effective documentation
5. Land title double spending
6. Land title anonymity (privacy)

3.2. Review on Blockchain Technology

Blockchain has it was introduced to give override to primitive business process, where trusted parties are needed for transaction verification and it also run a centralized architecture. With blockchain technology, sectors can now run a decentralized system of transaction and no need for third part interference, with credible transactions. The unique characteristics of blockchain technology has provided security, tamperproof, transparent, database for proper public record keeping according to Devetsikiotis et al (2016) and Greenspan (2015).

Blockchain is regarded as a public ledger of database for public repository. According to Dasaklis, et al (2019) It was researched that blockchain can be used in banking sectors, where banks use same blockchain for customers transaction thereby providing transparency off transaction.

Blockchain is also seen to be used for auditing of transactions there it was proposed by Coinmarketcap (2017) for company to put resources together and invest in blockchain technology to used it to build a decentralized architecture thereby minimizing transaction cost as the technology also proffer safe, fast and transparent system.

Furthermore, it was stated by Tschorsch and Scheuermann (2016) that blockchain is being considered beyond cryptocurrency, with smart contract playing a pivotal role. Also according to Quintana et al (2015) considered smart contract has the next level of blockchain used as executable code for transaction policy.

Szabo (1994) define smart contract as an executable protocol that execute the terms of a specified contract. He also allows it to be translated into embedded code from the contractual clauses

It can therefore be said that smart contracts with the context of blockchain as embedded code run in a decentralized way used in the blockchain without the need of a centralized authority to operate the blockchain, according to Christidis et al (2016).

Blockchain system according to Zhao et al (2016) supports smart contract in other to accommodate complex transaction and interaction within the limitless application. This in a way has indicate another relevance of blockchain technology

In addition according to the research findings of IBM (2017) 33% of C-suite executives has shown interest in considering rather actively engages in blockchain.

Christidis et al (2016) pointed out developers are beginning to see the effectiveness and capabilities of blockchain technology and need to explore various application depending on sectors to adopt the technology.

Also according Zhao et al (2016) stated based on the audience there are three distinguished generations of blockchain which are: blockchain 1.0 this is the cryptocurrency digital transaction while Blockchain 2.0 includes smart contract, which provides a system beyond cryptocurrency and blockchain 3.0 involves the science, internet of things government and health sector.

Fully knowing that about the review of blockchain technology, Tama et al (2017) and another researcher known to be Brandao et al (2018) gave their basis of argument on the fact that blockchain technology enabled application has received limited attention.

It is also interesting to state that a researcher known as Zheng et al (2016) states that blockchain has not covered it full capabilities.

Another research was carried out by Conoscenti et al (2016) and Christidis et al (2016) on how blockchain and decentralized system can be used for internet of things and how it can also manage big data in a decentralized way this is according to Karafiloski et al (2017).

Table 1 shows the strength and weakness of the proposed blockchain for land management in Nigeria over the existing system.

Table 1.

Blockchain related work	Research area covered
Dasaklis (2019)	Proposed blockchain to bank sector
Karamitsos et al (2018)	Blockchain for real estate
Jonas Johansson et al (2018)	Proposed blockchain to use in sustainability of contractors in the construction industry

Blockchain related work	Research area covered
Coinmarketcap (2017)	Proposed blockchain for Auditing transaction
Jonatan. H (2017)	Proposed blockchain technology as privacy-preserving tools in the medical sector
Karafiloski et al (2017)	Blockchain for big data transaction
Conoscenti et al (2016)	Blockchain for internet of things
Zheng et al (2016)	Research on blockchain hasn't gotten to its full potential
Christidis et al (2016)	Blockchain for decentralized application
Tschorsch and Scheuermann (2016)	Blockchain beyond cryptocurrency
Devetsikiotis et al (2016)	Research on the characteristics of blockchain
Jonas Johansson et al (2018)	Proposed blockchain to use in sustainability of contractors in the construction industry

Karamitsos, I. (2018) researched that blockchain technology can be used in the real estate sector, for the purpose of tenant and landlord rent. It was clearly discussed in the research on how smart contract is written as executable rule for the purpose of the real estate sector so as to provide solution to the rental challenges and a secured platform for the said transaction.

However, owing to the review of the related works of blockchain stated none has seen to focus on land title management. It is therefore pertinent, to propose the use of blockchain technology to manage land title in other to solve the various challenges of existing method of land titling in Nigeria as stated in section 1. Table 2 indicates areas presently covered by blockchain research in related work

Table 2. Related work and researche covered

Blockchain related work	Research area covered
Dasaklis (2019)	Proposed blockchain to bank sector
Karamitsos et al (2018)	Blockchain for real estate
Jonas Johansson et al (2018)	Proposed blockchain to use in sustainability of contractors in the construction industry
Coinmarketcap (2017)	Proposed blockchain for Auditing transaction
Jonatan. H (2017)	Proposed blockchain technology as privacy-preserving tools in the medical sector
Karafiloski et al (2017)	Blockchain for big data transaction
Conoscenti et al (2016)	Blockchain for internet of things

Blockchain related work	Research area covered
Zheng et al (2016)	Research on blockchain hasn't gotten to its full potential
Christidis et al (2016)	Blockchain for decentralized application
Tschorsch and Scheuermann (2016)	Blockchain beyond cryptocurrency
Devetsikiotis et al (2016)	Research on the characteristics of blockchain
Jonas Johansson et al (2018)	Proposed blockchain to use in sustainability of contractors in the construction industry

This research as shown in table 2 gave a summary of literature review on the recent researches considered in blockchain. This has however not yet shown interest in land title management hence, necessitated this research to be carried out and propose the use of blockchain for land title.

4. Benefits of Blockchain for Land Title Management in NIGERIA

Blockchain has benefits that could be the solution to the challenges of land title in Nigeria if adopted. The following are the benefits of blockchain technology over the traditional system of land title in Nigeria

1. **Tamperproof:** according to Nakamoto, s. (2008), blockchain technology is tamperproof. A vital point that should be considered when transaction is being conducted is how tamperproof is the system that is being adopted. Blockchain system is known for its tamperproof quality and its best needed in conducting a land transaction through the blockchain as against the manual system where most times, documents are influenced or tampered with.
2. **Transparency and no double spending:** according to Tschorsch, F. and Scheuermann, B. (2016) discovered that blockchain system is highly transparent where nobody can influence any decision. It is a decentralized system that gives power to every participant and not just one person. That is why it has private and public key digital encryption, where the private key is own by the election team who declares the election process open and every citizen of age to vote/ participant has the public key to verify the land transaction.
3. **Secured:** an important part of an election system is for it to be secured. Blockchain in the voting system adoption, is highly secured everyone doesn't need to come out to perform land transaction just as it is done the manual way, all you need do is stay as you were and transact on a secured blockchain network. According to Walsh C, et al. (2016), discusses how secured blockchain transaction is secured. This in a way help to prevent every form.

4. No third party and Anonymous: according to Paul, G, et al. (2014), blockchain technology is anonymous and does not need a third party interference. One of the beauty of transaction is to make it completely anonymous in order to prevent victimization of land buyers as to who and why they bought from a particular individual. Blockchain system takes care of the anonymity aspect of the land transaction system. A unique Identity is generated for every participant of the blockchain that is not traceable to any participant. There is also no need for third party interference as the smart contract would serve as a guideline/ policy for every transaction initiated in the blockchain and with this two trustless individuals can perform transaction
5. Cost effective: there won't be need to bribe any officer of the ministry of land to fast track the process of land titling anymore. This would save the cost of spending on such frivolities. Also all that is need to do is to go on internet and log onto the application and make transaction this would also rule out the cost of travelling to the ministry of land title.
6. Accessible to everyone: blockchain technology as in this case for the purpose of this research is public blockchain which is a permissionless type of blockchain. This gives opportunity for every citizen of Nigeria to access the network system and transact land easily without duress.
7. Database for record keeping: Atzori, Marcella (2016), discusses blockchain as a ledger for keeping public records. Blockchain technology would serve as a database for keeping public record pertaining to land titles. This would make the records of land title in Nigeria secured and there would not be unnecessary loss of documents as the case use to be in the traditional way of land title in Nigeria.

5. Conclusion

For this research a literature review was carried out to show the strength and weakness of existing method of land titling in Nigeria and also a literature review was carried out on blockchain technology and the research areas covered in the previous years, and it was confirmed that blockchain for managing land title is novelty and such could be considered a precedent. The research questions as been answered with the result obtained in the course of undergoing this research.

1. Research question 1 is answered in section 3 and also with the table 1 therein. Related work to blockchain and existing work was study and a comparison is indicated to show the strength of the proposed blockchain technology over the existing, digital archives used to manage land title in Nigeria.

2. Research question 2 is answered in section 3 and also table 2, where the blockchain literature review was carried out and a comparison of research done so far identified to show that no research on blockchain on land title is yet to be carried out.
3. Research question 3 is answered section 4 Importance of blockchain and why it is needed to manage blockchain technology is stated.

References

- [1] Awolaja A.G., Land Registration in Nigeria: Issues and Challenges <http://convenantuniversity.edu.ng/content/download/33937/233886/file/Land+Registration+IN+NIGERIA> retrieved, April, 2016.
- [2] Atzori M., Blockchain-Based Architectures for the Internet of Things: A Survey Available at SSRN: <https://ssrn.com/abstract=2846810>, 2016
- [3] Babade T., Access to Urban Land in Nigeria; An Analysis of the Activities of Lagos State Land Use and Allocation Committee in Omirin, M.M., Nubi, T.O., and Fawehinwi, A. (Ed). *Land Management and Property Tax Reforms in Nigeria*. Lagos University of Lagos Press, 2003.
- [4] Buterin V., *On Public and Private Blockchain*. *Ethereum Blog*, Crypto Renaissance Salon. 7th August 2015.
- [5] Das M.L., Privacy and Security Challenges in Internet of Things, *Distributed Computing and Internet Technology*, 2015, pp. 33-48.
- [6] Galiani S., Scharagrodsky E., Property Rights for the Poor: Effects of Land Titling, *Journal of Public Economics*, 9, 2010, pp. 700-729.
- [7] Kosba A., Miller A., Shi E., Wen Z., Papamanthou C. 'Hawk: the Blockchain model of cryptography and privacy-preserving smart contracts', *Proceedings of IEEE Symposium on Security and Privacy (SP)*, San Jose, CA, USA, 2016, pp. 839–858.
- [8] Karamitsos I., Papadaki M., Al Barghuthi N.B., Design of the Blockchain Smart Contract: A Use Case for Real Estate, *Journal of Information Security*, 9, 2018, pp. 177-190.
- [9] Kraft D., Difficulty control for Blockchain-based consensus systems, *Peer-to-Peer Networking and Applications*, 9(2), 2016, pp.397–413.
- [10] Miorandi D., Sicari S., Pellegrini F.D., Chlamtac I., Internet of things: vision, applications and research challenges, *Ad Hoc Networks*, 10(7), 2012. pp.1497–1516.
- [11] Nakamoto S., Bitcoin: A Peer-to-Peer Electronic Cash System <https://bitcoin.org/bitcoin.pdf>, 2008

- [12] Noyes C. Bitav: Fast Anti-Malware by Distributed Blockchain Consensus and Feed forward, 2016a
- [13] Ndukaku L.I., *Critical Analysis of the Impact of the Land Use Act of 1978 on Property Development in Nigeria: A Case Study of Enugu Urban*. Unpublished M.Sc. Dissertation, University of Nigeria, Nsukka, 2012.
- [14] Omohundro S., 'Cryptocurrency, smart contracts, and artificial intelligence', *AI Matters*, 1(2), 2014, pp.19–21.
- [15] Ojo B., Evaluation of End-Users Satisfaction on Land Title Registration Process in Akure, Nigeria, *Covenant Journal of Research in the Built Environment*, 2(2), 2014, pp.176-194.
- [16] Omirin M.M., Issues in Land Accessibility in Nigeria in Omirin, M.M., Nubi, T.O. and Fawelinwi, a (Ed). *Land Management and Property Tax Reforms in Nigeria*. Lagos: University of Lagos Press, 2003.
- [17] Thontteh E.O., Omirin, M.M., Land Registration within the Framework of Land Administration Reform in Lagos State, *Proceedings of 21st Annual Pacific-Rim Real Estate Society Conference*, Malaysia, Jan. 2015, pp.18-21.

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