# BLOCKCHAIN TECHNOLOGY FOR MANAGING LAND TITLES

## OBAMEHINTI ADEOLU SEUN & Dr. SELLAPPAN PALANIAPPAN

Department of Information Technology, School of Science and Engineering,

Malaysia University of Science and Technology

## ABSTRACT

Blockchain in recent years have received interest, as it is known to be a technology that can't be tampered with and is durable for record keeping, also to write executable contracts and manage properties. This paper examines how this technology and executable (smart) contract can be used for sale and purchase of land in Nigeria. Specifically, it gives a detailed smart contract procedure on land transfer between land owner and buyer, and the state government, which is the regulatory body.

**KEYWORDS:** Blockchain, Smart Contract, Ethereum, Solidity & Cryptocurrency

## 1. INTRODUCTION

Researchers have shown interest in Bitcoin and Blockchain in the past years. Bitcoin is a cryptography cash that inclines toward the Blockchain technology. In course of this paper, we investigate Blockchain application that centers on Ethereum and smart contract.

The Blockchain is a novel disruptive technology, which is created by Nakamoto. Nakamoto, S. (2008) "this is a type of technology which is tamperproof, clear, secure, and highly immutable". Blockchain can be integrated to help sectors such as estate management, financial system to improve their sectors.

In Nigeria, the management of land titles has not been given good consideration by the government. This has caused major dispute because of its direct impact on the masses, and this has led to loss of life, violence and environmental degradation. Land titles is expected to be overseen accurately by the government, hence to meet the world class standard on how the said sector is properly managed.

The research is based on importance of blockchain and how it can be used to manage land titles. Section 1 briefs about introduction to Blockchain technology. Previous work of research is covered in section 2. Methodology to be adopted is explained in section 3. The characteristics of participant in Blockchain is covered in section 4. Design and Implementation approach is detailed in Section 5. Conclusion is covered in Section 6.

## 2. BACKGROUND AND RELATED WORK

Blockchain technology, "permits transactions go through the laid down rules embedded in the executable contracts "according to Tschorsch, F. and Scheuermann, B. (2016). This said exchange can be ascertained by the people involved in the dealings without involving someone else or an organization. All these transactions could be validated between parties who fully trust each other without relying on a trusted middleman.

The Blockchain technology according to Glaser F, et al, (2017) "indicates that a couple of financial institutions currently develop their vision by using this technology". Walsh C, et al. (2016) "indicated that an important criteria for this

technology is the algorithm that is used in other to guarantee how secured, how private the data is kept". Tschorsch, F. and Scheuermann, B. (2016], "discovered that evidence-of-work concept need energy but it also yield consistency and guide against being faked by any participant. Noyes, C. (2016a) "certain things need to be put into consideration before the deployment of the implemented blockchain here".

Some establishments has improved the idea of no need to rely on third party with virtual organizations and smooth business dealings of IoT devices Das, Maniklai, (2015). "Contends that the present strategies is commonly not appropriate for Internet of Things".

The major concern for this innovation is how effective it can be. Today, the approval time for every exchange, for example, Bitcoin is about 10 min accomplishing 7 exchanges per seconds as the most extreme throughput.

A few scientists have enhanced proficiency of the technology. Atzori, Marcella (2016) "Proposed a decentralized Blockchain which is designed to secure the individual information and guarantees clients claim and guild their information". The technology improves proficiency by utilizing record keeping information. Decisively, this has actualized a convention that transforms a Blockchain into a robotized that does not need verification from an outsider. Paul, G, et al. (2014) suggested another strategy which enhances the productivity.

Researchers included additional bytes in header field to use timestamp adequately. Blockchain innovation stages can be categorized into two kinds: Open and Private Blockchain. In public Blockchain, anybody can join the Blockchain and transact. Private Blockchain permits only selected clients on the system. This is usually owned and controlled by an organizationThe below Table 1, shows two types of Blockchain, which are open and private.

**Table 1: Types of Blockchain**

| Open Blockchain | Private Blockchain |
|---|---|
| Ethereum   (with executable contract) | hyper-ledger |
| Bitcoin   (with currency exchange | Multichain |

**2.1 Layers of Blockchain**

These are the components of the technology layer: blocks, smart contracts, transactions, applications and consensus. These components are of different layers and they make up the Blockchain system. The important key aspect of Blockchain consists of layers namely as below:

- **Application Layer:** The Application Layer consist of applications, smart contract and state machines. This layer is an independent layer and thus does not include blockchain. The executable contract written is important in this layer, as it will be discussed extensively, in the preceding section.

- **Blockchain Layer:** The Blockchain Layer contains the block view and status where you can find all necessary information. This layer is where electronic coin is used to process digital signature. It is possible for the person paying for the transaction to verify the signature to attest to the fact that the chain of ownership is correct.

- **Trust Layer:** This layer comprises of the algorithm, evidence of effort done and evidence of fault.

  o **The Consensus Algorithm:** A consensus mechanism is needed to get the required decision in a state of the network among distributed processes. This mechanism sets rules that makes decisions on the input of various participant of the Blockchain. Algorithm used in blockchain are of various types and work on different

principles.

- o **Evidence (proof) of work:** This require every participant to find solution to puzzle using the 'brute force". For instance, if the power of work is used to select a block which is established by the node or participant that wins, it is broadcasted to all participants that a participant in the node has successfully mined a block using the designated communication network.

- o Proof of fault tolerance**:** This type of consensus mechanism assumes that people participating in the network can ascertain the important participants.

- **Transaction Layer:** This layer consists of the transaction validation process, where the blocks are being validated by participant public and unique key of the owner of the dealings. Mining process also under the transaction layer, this is the process of mining block.

- **Network Layer:** It consist of the Peer to Peer Network and Ethereum Node where the Peer to Peer Network system is one in which all the participants play the role of client and server at the same time. This is used in the Blockchain technology so that it makes it almost impossible for transactions to be tampered with, where everyone is involved in the processes of validation.

Ethereum uses solidity language that permits any participant to write contracts and decentralized applications. Executable code (rules) can be written for the purpose of possessing and exchange properties.

## 3. METHODOLOGY

Methodology proposed for managing land titles in Nigeria is adopted from Ioannis, k., et al (2018). The method which is used to write the contract is contained in steps. Ethereum Blockchain is the technology that is used to develop executable contracts. Actions performed in this dealing is based on state machine. The language used is solidity.

Code is executed on anethereum virtual machine. Buterin, v. (2015). Structure approach for the smart contract is made up of sections. To start with, clients' hub (node) is important, the setup of the Ethereum hubs (node) is required. Secondly, the commercial activities administrations/capacities is characterized. Lastly, procedures between the clients is portrayed.

Smart contract conveyed on Blockchain system can send messages to different contracts. The decentralized application is used to provide a friendly user interface for the participant to interact with executable contracts. An instance of a decentralize application is crypto-currency, which runs on a network. This consist of a Client end and Server end.) This decentralized application does the interaction with the ethereum virtual machine using (json rpc) which is lightweight and stateless procedure. The message sent by the smart contract, contains the details of the owner of the contract, the details of the interested person, estimated exchange information section that gives details of the beneficiary the instruction is created by executable contract.

### 3.1 Smart Contract Structure

The important aspect of executable contract is its abilities and functions. Every dealing has details which is necessary in the transaction. The executable code is written in lofty level language. The contracts are mostly written in Solidity and Python. After coding, it is converted to bytecode with the help of a solidity compiler executable code is transferred to the

network after it is executed. Every transaction is allocated space in the network.

Fundamental part of transaction depend on its state machine abilities. The executable stage depend on the decentralized distributed record. Plan and usage of ethereum is anonymous. Solidity language is utilized in other to compose executable contracts and Dapp. Miners make transaction group, changes, occasion capacities, and guild lines for owners. Figure 1, discusses frame work of how the transaction is made using the smart contract as executable code. The product code is executed on virtual machine (EVM). Karamitsos, I (2018)
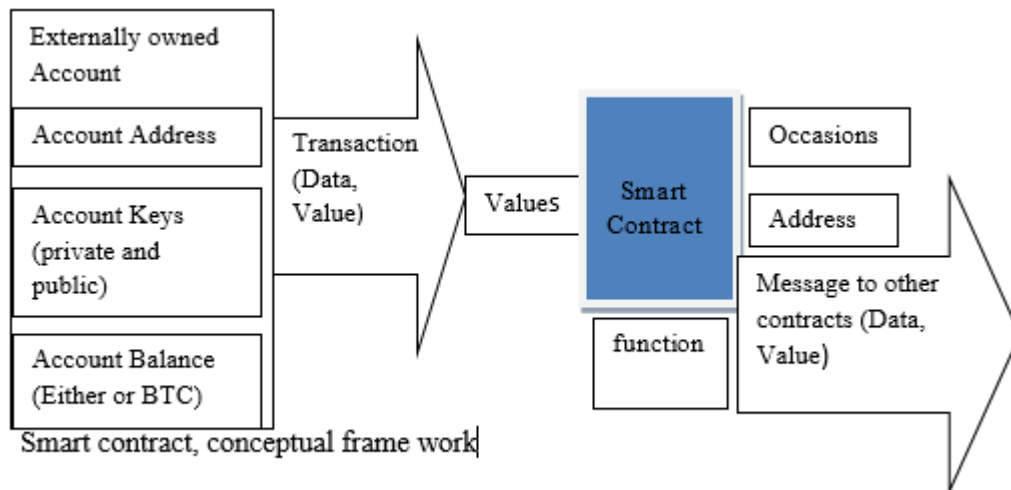


**Figure 1: Smart Contract Frame Work for Land Title (Source: Karamitsos, I, 2018)**

**Tools used for Ethereum Blockchain Application**

- Testnet
- Mainnet
- Python
- Solidity
- Web3
- Ethereum gas
- Ether
- Ethereum wallet

**3.2 Node Structure**

The parts of the node structure are participants, dealings and procedures which are recounted in figure 2. Source (Karamitsos, I, 2018). Figure 2 shows the proposed land title component.
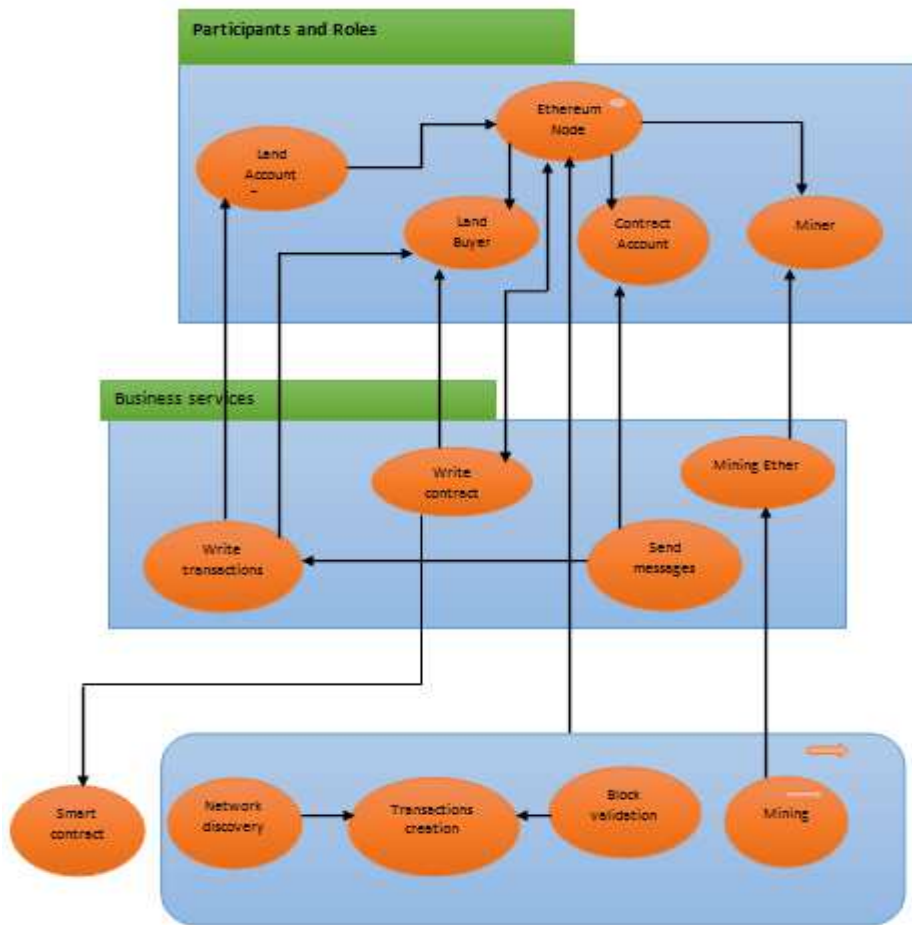
**Figure 2: Proposed Land Title Component Source (Karamitsos, I (2018)**

## 4. CHARACTERS OF PARTICIPANTS OF THE BLOCKCHAIN

Executable contracts, have to plan the use case layout, that is single-to-numerous clients. The following are participants for the executable contract:

- Contract possessors which are the land owner/land proprietors that are in charge of creation of executable contract, usually the landowner or land proprietor who is in charge of the creation of the smart contract and land Account Owner.

- Land clients/buyers who are in charge of the formation of their Ethereum wallets so as to approach in the general population/private Blockchain P2P network.

## 5. DESIGN PHASE

Participants of the Ethereum Blockchain are identified and the account has been set up, the executable contract is developed. This component of the executable contract consists of tasks and the procedures. The coding of the executable contract is done at the stage of implementation. The task and procedures is explained in this stage and in turn put into coding. For Smart Contract for Land proprietor Management, the Ethereum Blockchain stage is chosen. The Land proprietor goes about as landowner for the lands which is for sale for private and business purpose.

## 5.1 Land Title the Executable Contract Task

Executable contract applies within the land possessor and buyer. In this case, every participant in the Blockchain has its own Ethereum wallet (created an account) and has the required ether, would be considered in the process of validating the said transaction with their public key (digital signature). The reason for the contract is to ensure that the agreed sum is paid on time, and the agreement is executed accurately. The accompanying depicts the smart contract capacities:

- **Capacities Created:** The Land owner drafts the agreement by arranging the buy conditions and subtleties of land proprietor and buyers. From this point onward, condition of agreement is set to "Made".

- **Capacities Established:** The buyer, appends his/her signature on the agreement, then, new owner takes it and the condition of the possession is set to "Began" when the state is "Began", the buy understanding can't be affirmed once more, consequently wiping out the likelihood of overwriting the present buyer stages Land title the executives Contract Procedure. For utilization, this procedure is single-to-numerous. The following are the procedures for the purchase:

  - Purchase Contract Sign; this procedure the two gatherings' sign the smart contract (buy understanding) where the owner use is private key to authenticate that is the owner of the said transaction, the buyer and other participant then use the public key to validate that the seller, is actually the owner of land and is fit for sale.

  - Purchase Payments Process This procedure depends on the agreement and states of buy understanding. Executable contract starts processing for the buyer to get to the owner. Once the participant validate the transaction, the conditions of the smart contract is been confirmed then the transaction is made.

## 5.2 Dealing Services-Functions

The following are the trading processes with capacities which is needed for executable contract:

- write/make transaction

- write/make executable contracts

- Send Instructions

- Pit Ether

There are four procedures which are:

- **Mining:** This process requires the mining of block and broadcasting the block to Blockchain.

- **Block Authorization:** a technique for endorsing block.

- **System Finding:** a technique for interested participants to join

- **Deal Created:** It empowers customers make trades and empowers executable contracts to send instruction to every node in the Blockchain.

## 6. CONCLUSIONS

The paper has introduced a review of the technology as innovative for land transactions. This investigation gave incite on

the impact of smart contract in managing land titles. Government which serves as the regulatory body, should evaluate when it is utilized to be in charge of land titles in Nigeria. For the selection of this technology into this sector, it is essential to meet procedures so as to demonstrate the productivity, also, gain investigation is arranged once government, the land owner, and buyers recognizes this procedure that is prepared for Blockchain technology to effectively managed land title.

## REFERENCES

1. Atzori, Marcella, Blockchain-Based Architectures for the Internet of Things: A Survey (2016). Available at SSRN: https://ssrn.com/abstract=2846810

2. Buterin, V. (2015) On Public and Private Blockchain. Ethereum Blog, Crypto Re-naissance Salon. 7th August 2015.

3. Das, ManikLal, "Privacy and Security Challenges in Internet of Things," Distributed Computing and Internet Technology. pp. 33-48, 2015.

4. Karamitsos, I., Papadaki, M. and Al Barghuthi, N. B. (2018) Design of the Blockchain Smart Contract: A Use Case for Real Estate. Journal of In-formation Security, 9, 177-190.

5. Kosba, A., Miller, A., Shi, E., Wen, Z. and Papamanthou, C. (2016) 'Hawk: the Blockchain model of cryptography and privacy-preserving smart contracts', Proceedings of IEEE Symposium on Security and Privacy (SP), San Jose, CA, USA, pp.839–858.

6. Kraft, D. (2016) 'Difficulty control for Blockchain-based consensus systems', Peer-to-Peer Networking and Applications, Vol. 9, No. 2, pp.397–413.

7. Miorandi, D., Sicari, S., Pellegrini, F. D. and Chlamtac, I. (2012) 'Internet of things: vision, applications and research challenges', Ad Hoc Networks, Vol. 10, No. 7, pp.1497–1516.

8. Nakamoto, S. (2008) Bitcoin: A Peer-to-Peer Electronic Cash System. https://bitcoin.org/bitcoin.pdf

9. Noyes, C. (2016a) Bitav: Fast Anti-Malware by Distributed Blockchain Consensus and Feed forward

10. Omohundro, S. (2014) 'Cryptocurrency, smart contracts, and artificial intelligence', AI Matters, Vol. 1, No. 2, pp.19–21

11. Paul, G., Sarkar, P. and Mukherjee, S. (2014) Towards a More Democratic Mining in Bitcoins. In: Prakash, A. and Shyamasundar, R., Eds., Information Systems Security, Vol. 8880 of Lecture Notes in Computer Science, Springer International Publishing, Berlin, 185-203.

12. Peters, G. W. and Panayi, E. (2015) 'Understanding modern banking ledgers through Blockchain

13. Sharples, M. and Domingue, J. (2015) The Blockchain and kudos: distributed system for educational Record, reputation and reward', Proceedings of 11th European Conference on Technology

14. Skarmeta, Antonio F., Jose L. Hernandez-Ramos, and M. Moreno., "A decentralized approach for security and privacy challenges in the internet of things," in Internet of Things (WF-IoT), 2014 IEEE World Forumon, 2014.

15. Survey Monkey Analysis for the response of people on problem of land use title] Nigeria watch databases 2014

16. Tschorsch, F. and Scheuermann, B. (2016) Bitcoin and Beyond: A Technical Survey on Decentralized Digital Currencies. IEEE Communication Survey Tutorial, 18, 2084-2123. https://doi.org/10.1109/COMST.2016.2535718

17. Walsh, C., Reilly, P. O., Gleasure, R., Feller, J., Li, S. and Cristoforo, J. (2016) New Kind on the Block: A Strategic Archetypes Approach to Understanding the Block-chain. 37th International Conference on Information Systems, Dublin, 1-12.

18. Chavan, A. B., & Rajeswari, K. The Design and development of Decentralized Digilocker using Blockchain.