Blockchain Technology: A Panacea for Corruption in Nigerian Government Financial Processes

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Abstract: Government financial processes in Nigeria are known to lack credibility mostly because there is centralization, manipulation of accounts and lack of trust between the government officials and the citizens of Nigeria. Attempts to end or at least reduce corrupt government practices have failed miserably mostly because most processes are still manual or use systems that can be manipulated easily. Nigeria has vastly turned to spiritual mentorship, activists and whistle-blowers to curb government financial corrupt practices. However, there have been limited attempts in applying technology to solve this delicate issue. In this study the missing application of technology, that is, the application of block chain which is referred to as the technology of trust will be the in-depth focus, investigating the state-of-the-art of block chain technology, its applications and challenges of using block chain technology and providing suggestions for handling finance of the government to eradicate corruption. The study draws its data from a review of literature on major applications of block chain, data, interviews and annual reports of Nigerian government agencies and bodies. The thesis argues that block chain technology can reduce corrupt government practices and easily track all financial government processes. Thus, government should apply this technology. It also suggests, implementation models and processes. It is also concluded that the implementation of blockchain on government accounts would reduce corruption and make all transactions decentralized, unchangeable, unforgeable and highly trackable.

I: INTRODUCTION

Blockchain is a distributed database solution that maintains a continuously growing list of data records, that are confirmed by the nodes participating in it. The data is recorded in a public ledger, including information of every transaction ever completed. Blockchain is a decentralized solution which does not require any third party organization in the middle [4]. Each block is connected to a previous block by a hash, thus enabling traceability; meanwhile, cryptography is used to guarantee that the block data cannot be tampered with and cannot be forged.

Fig 1: Structure of a block on a blockchain a structured Michelin, R.(2020)

The creation of each block is dependent on the consensus of participants in the sequence of events and the current state of the entire system's transaction records. Each participant can record and store data, and can have backups of the entire blockchain data. The information about every transaction ever completed in Blockchain is shared and available to all nodes. This attribute makes the system more transparent than centralized transactions involving a third party.

Decentralized Ledger

Fig 2: A Decentralized Ledger from cbinsights(2020).

In addition, the nodes in Blockchain are all anonymous, which makes it more secure for other nodes to confirm the transactions. Bitcoin was the first application that introduced Block chain technology [4], and some studies e.g [7] consider a proof-of-work consensus as the main innovation from Satoshi Nakamoto's blockchain, which is known as Bitcoin. Exactly this mechanism replaces the central authority and provides incentives that would keep members of the network honest. This honesty is what is lacking in Nigeria's government financial processes.

All blocks of a blockchain include transactions and hash pointer, which serves as a link to the subsequent block. In such a way, it is not possible to delete any block or insert a new one in the middle of a chain, because then hashes will not match. Blocks are created by network participants, who are processing transactions by running blockchain's client software. Such a participant is called a "node" [6]. For a block to be included in a chain all network participants must confirm its authenticity. A block is included in a chain after some definite number of confirmations; however, it is being validated by all network nodes, until everyone has an up-to-date blockchain structure. Consensus can be reached in different ways, which depend on the consensus mechanism used (proof-of-work, proof-of-stake, etc.). One of the main theory of blockchain is immutability of the recorded entries.

Some users may try to hack the blockchain by using an automated system to set up a large number of separate identities to validate their transactions. There's a clever way of avoiding this problem, using an idea known as proof-of-work and mining. As a result, a cheater would need enormous computational resources to cheat, making it impractical. The solution to this problem is to reward people who help validate transaction even though that's now been made a computationally costly process. Provided the value reward is large enough that will give them an incentive to participate in validation.[12]. Without a central control node, a distributed peer-to-peer network has been built. Blockchain technology has many advantages such as decentralization, trustlessness, tamper resistance, and traceability.

Fig 3: Blockchain and Government from BlockChainLion(2020)

Nigeria faces various corrupt practices in the government. In 2012, Nigeria was estimated to have lost over 400 billion dollars to corruption since Independence. In 2018, Nigeria Ranked 144th in the 180 countries listed in Transparency International's Corruption Index with Somalia at 180th, being the most corrupt and Denmark 1st being the least corrupt. This suggests that corruption is a major problem in Nigeria and most Nigerians have deemed it the major reason why Nigeria has not lived up to its potential and name "The Giant Of Africa".

Sadly, quite a number of government officials abuse this power and funds, entrusted to them and the citizens are made to suffer from their decisions. These abuses include stealing of funds, improper fund allocations, no salary payments, and fake/manipulated reports on government projects etc. The aforementioned actions are opposed to code of conduct for Nigerian government officials.

II: LITERATURE REVIEW

2.1 Theoretical Concepts/Framework

The theoretical background gives an overview of the technologies used in developing the block chain models for government and the general concept of the research topic as seen by the other researchers. The technology is chosen in order to create a more rigid system which cannot be manipulated in order to prevent government officials from carrying out various corrupt practices and thereby increase trust among government officials and citizens. The following themes are discussed; block chain models for government, the extent of block chain models for government design issues, and solutions to challenges confronting corruption government.

Some of the concepts of blockchain for government are;

- a. Budget support and project management based on a private blockchain.
- b. Smart Contracts.
- c. Fraud Detection Mechanisms
- d. Consensus Mechanisms

2.2 Review of related works

In [3] it is stated that in February 2018, the US House of Representatives held two blockchain hearings in succession to explore new applications of blockchain technology. The US State Department emphasized transparency through blockchain technology to address corruption, fraud, or misappropriation of public procurement funds. The US Treasury is conducting a pilot program to determine whether blockchain technology can be used for supply chain management, and has also taken measures to improve the "Anti-Money Laundering/Combating the Financing of Terrorism (AML/CFT)" law against blockchain-based cryptocurrencies.

South Burlington, Vermont proposes to also implement blockchain technology to record real estate transactions. California lawmakers have filed a bill that, if passed, the state's electronic record law will approve blockchain signatures and smart contracts. Although this work also state that Bitcoin is the first successful application of blockchain technology. As of now, the Bitcoin blockchain system has been in operation for more than eight years. Except for a limited number of forks, there have been no major security incidents, which fully demonstrates its strong stability and security. In my research paper I would explore in depth instances where blockchain has been unstable and which mechanisms can be implemented to prevent such occurrences from happening.

[12] acknowledges that the most widely accepted application for the blockchain technology is in the field of finance, it goes further to explain that it ensures the much valued transparency between the trading parties. Every transaction in public or private equities, stocks, bonds or derivatives could be transcribed in the blocks and afterwards be confirmed by the local authority for its legitimacy. From this point, it's easier to detect fraud cases or money laundering through stock exchange moves.

Many international development organisations provide budget support or financing for specific projects to recipient countries. These payments are often vulnerable to corruption. In 2017, German development bank KfW initiated TruBudget, a pilot project to provide budget support and project management based on a private blockchain. All stakeholders involved in a project can access the TruBudget. Requests, submissions of documents and approvals can all be processed in real time through the platform and by all the stakeholders involved. These can include a donor organisation, national

governments, local governments, implementing agencies, banks and others. Basing the platform on the blockchain can establish trust between the different partners as data is hosted in a decentralised manner and secured against subsequent alteration. TruBudget is currently in development and is scheduled for testing soon [1].

In 2017, the World Food Programme (WFP) began a pilot programme to distribute food vouchers in one of Jordan's refugee camps using the Ethereum blockchain. Food vouchers are assigned to refugees, who can access them in supermarkets in refugee camps using biometric data. The project uses a private "fork" of the Ethereum database, so that it does not need miners to verify transactions and that the data is not stored openly on all nodes of the Ethereum network. So far, the WFP has transferred over US\$1.4 million in food vouchers to 10,500 Syrian refugees and it plans to extend the programme to 100,000 refugees in 2018. The implementation using the blockchain runs more efficiently and provides better security against fraud [3].

2.3 Propose contribution to Knowledge

This study proposes models that if implemented could reduce corrupt practices drastically in Nigeria. The study would create an avenue of discussion for Nigeria to deliberate on how blockchain can be used to build trusted government financial systems.

III: RESEARCH METHODOLOGY

3.1 Data gathering/analysis techniques

In this research the data gathering and analysis techniques that would be used include:

- Literature review (journals, annual reports and conference papers on the chosen topic),
- Internet resources (TED talks, Online Videos etc.)
- Personal interviews.

This paper solely researches on blockchain as a panacea for corruption in Nigerian government financial processes. With no ambiguous or bias intent this research specifically on blockchain for government financial processes and what features and requirements the blockchain model would use to operate. The government processes are delicate would require a robust blockchain model to handle its processes.

3.1.1 Planning the research.

The collection of important and appropriate papers, resources and related to block chain and its ability to implement trust-based systems. This will be the basis search to the research, this will be carried out using internet databases for high ranking journals, conference papers in block chain and annual reports and published accounts from the Nigerian government and MDA's. The review will be limited to recent studies ranging from the year 2005 to 2020 with high relevance to the topic and scope of research.

3.1.2 Conducting the research.

In this phase, the papers were selected and downloaded and the details of each were read carefully in order to examine its relevance to this study. Documents were reviewed. However, only papers with significant contributions were selected deliberately. As such only about twenty papers were selected and then thoroughly read, searched, and studied for relevant details that relates to the study. The date of publication of each publication will also be taken into consideration during selection in order to filter out dated papers. These selected papers span from 2005-date.

In carrying out this research, different databases were used such as; Research Gate, Academia.edu, Google scholar, FIRS, TED talks, Articles from THISDAY Newspaper, Scholar works and from various institutions like universities and public organizations

.Table 1. Selected journals and conference papers

S/ N	Journals	Year Publi shed	Author	Conference Papers	Year Publi shed	Author
1	Blockchain Technology as an institution of property	2017	G. Ishmaev Metaphilosophy and John Wiley & Vol. 48, No. 5, October 2017	Blockchain Use Cases and Their Feasibility	2018	Kaspars Zīle, Renāte Strazdiņa Riga Technical University, Riga, Latvia.
2	"A Synopsis of Blockchain Technology View project".	2018	Alex Kibet. Lakipla University College. International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 7	Technology Development and Application of Blockchain: Current Status and Challenges". Institute of Computing Technology.	2018	Sun Yi, Fan Lingjun, Xuehai Hong (2018) Chinese Academy of Sciences, Beijing & University of Chinese Academy of Sciences, Beijing.
3	"Sustainability of Bitcoin and Blockchains," Current Opinion in Environmental Sustainability,	2017	H. Vranken	"Where Is Current Research on Blockchain Technology? —A Systematic Review". Article in PLoS ONE	2016	Jesse Yli-Huumo, Deokyeon Ko, Sujin Choi, Sooyong Park, Kari Smolander. Dept. of Innovation and Software, Lappeenranta University of Technology.

4	Bitcoin and Cryptocurrency Technologies.	2016	Narayanan, J. Bonneau, E. Felten, A. Miller, and S. Goldfeder, Princeton University Press, 2016, 308 p.	"On Scaling Decentralized Blockchains,"	2016	K. Croman, C. Decker, I. Eyal, A. Gencer, R. Wattenhofer et al.
5	Blockchain Technology and Decentralized Governance: Is the State Still Necessary? Journal of Governance and Regulation	2017	Atzori, M.	The uses of the Blockchain Smart Contracts to reduce the levels of corruption:	2018	EdimaraMezzomo Luciano, Rodrigo Couto de Souza, Guilherme Costa Wiedenhöft
6	"Survey of Consensus Protocols on Blockchain Applications,"	2014	L. S. Sankar, M. Sindhu, and M. Sethumadhavan, 4th IEEE International Conference on Advanced Computing	Further applications of the blockchain".	2015	Anna LaliTsilidou, Georgios Foroglou. Conference Paper · University of Macedonia.
7	Blockchain, bitcoin and corruption :A review of the linkages ".Transparency International Anti-Corruption (NiklasKossow, 2018)	2018	NiklasKossow, Victoria Dykes	The Opportunities and Challenges of Blockchain in the Fight against Government Corruption "	2018	Nikita Aggarwal , Luciano Floridi Feature Article in the 19th General Activity Report of the Council of Europe Group of States against Corruption
8	"So You Want to Use a Blockchain for That?,"	2016	A. Lewis	"A Critical Review of Blockchain and Its Current Applications," International Conference on Electrical Engineerin.2017, pp. 109–113.	2017	B. A. Tama, B. J. Kweka, Y. Park, and K. H. Rhee,

Table 2. Selected Videos Interview and Tutorials papers

S/N	Video	Year Published	Author	Interview/ Tutorials	Year Published	Author
1	TED x UCLA "Blockchain for a better government"	2016	Mike Alonso	Government Accounts Auditing	2019	Alh. TaofikLawal
2	Blockchain: The real world use cases.	2017	Nick Menye Enterprise Architect, Capgemini			
3	Blockchain Revolution- the END of Representative Democracy	2016	VisualPolitik EN			

Exclusive Criteria

All paper that included any of the following topic where excluded from our papers gathered which include; Non-Government Organisations, Centralized systems, Unpublished papers, Year of publication less than 2005, Bias Justifications and unproven facts.

Inclusive Criteria

To choose a publication for our references we ensured that each paper consisted of all the following relevance which include; Government Organisations (with preference to Nigeria), Corruption in Nigerian Government, Decentralized database systems, Published Journals and Conference papers, Year of publication (2005-2020), Proven facts with good references.

IV: ANALYSIS OF RESULTS

4.1 Results

Blockchain uses Triple entry accounting, it takes general accounting further and provides a third entry which is public which means everyone can see state of every account, how much money is in circulation and look at the records of the blockchain and audit it.

If the government were on a blockchain, we would be able to easily know government expenditures on budget allocations down to the penny in under very little time, how much contractors are paid, foreign aid allocations and which departments are fraudulently wasting our money [19].

Where does block chain work well?

- i. Where there is value being transacted
- ii. Busy ecosystem, not one app.
- iii. Systems that lack trust

Fig 4: Ways Blockchain can reduce corruption from blockchain-council(2020)

For example, blockchain-based account control platforms could reduce the scope for corruption on government financial accounts by providing a tamper-proof record of incomes and expenditures that does not rely on verification by a third party and cannot be manipulated. The greater transparency and efficiency afforded by such platforms also promises to boost accountability, and to increase trust among government officials and citizens, particularly in Nigeria where corruption is a huge problem.

Among the Blockchain applications in public organizations, the following ones can be named:

- i. The transfer of funds from one government level to others or from government to private companies,
- ii. Smart Contracts can be used for all government payments as a way to increase transactions transparency, as well as to avoid overbilling, provided that contracts and bids are typical ways to exert frauds and money misappropriation.

The self-execution characteristic of contracts can reduce the expenses of manual payments, and also errors and delays, as well as the vulnerability to frauds and misconduct. Smart Contracts are autonomous and execute all the activities without any help or interference of any third party, showing unparalleled transparency, increasing efficiency and reducing vulnerabilities. One of these issues is the governance, which is decentralized in Blockchain, which constitutes an important variable when contracts evolve government and public funds. According to [16] challenges can vary from traditional mechanisms of State authority, citizenship and democracy. Particularly, the paper verifies to which extent Blockchain and decentralized platforms can be considered as hyper-political tools, capable to manage social interactions on large scale and dismiss traditional central authorities. According to this concept, the most important role of public organization is to create value to citizens, regardless of the technology use [15].

On December 10, 2019, it was reported by ThisDay that President Muhammadu Buhari directed the Office of the This system would require a permissioned blockchain that would be hybrid in nature and run on a secure encrypted cloud

Accountant General of the Federation (OAGF) to publish daily financial statements of federal government's transactions at the launch of a new Financial Transparency Policy/Open Treasury Portal designed to give the citizenry access to information on fiduciary matters, improve accountability and transparency in public financial management.

The policy/portal compels daily statements from the Office of the Accountant General of the Federation (OAGF) giving summary flows in and out of the treasury with a breakdown of agencies responsible. Henceforth ensure the publication of daily inflows and outflows of MDAs. To enable the implementation of the policy, the online portal, www.opentreasury.gov.ng, was activated yesterday for all MDAs to publish all the information required by the policy and for immediate access by all Nigerians [18].

4.2 Proposed Model

With the research done I am able to derive and build a blockchain model which can be implemented on all government accounts.

The implementation process for this model in relation to a guide by [17] would be as follows:

Step 1: Identify making government financial transactions corruption-free as our goal.

Since there are 3 things that blockchains can do very well which are Data Authentication & Verification, Smart Asset Management and Smart Contracts.

Step 2: Identify the Most Suitable Consensus Mechanism

I recommend a Delegated Proof-Of-Stake (Their "stake" is their trustworthiness in this system) in which there will be groups who will select trusted delegates to verify each government transaction before implementation. They will also be able to remove a delegate if there are fraudulent transactions accepted on their behalf.

The original blockchain, , used proof of work as a consensus mechanism. But Proof Of Work mechanism requires high computational power and energy which is not readily available in Nigeria. The Delegated Proof-Of-Stake consensus mechanism uses less electricity, is faster and less centralized than the proof of work consensus mechanism.

Step 3: Identify the Most Suitable Blockchain Platform

There are many blockchain platforms out there today and most of them are free and open source. Some of the more popular platforms, in alphabetical order are:

BigChainDB, Corda, Ethereum, HydraChain, EOS -*Preferred Choice based on consensus algorithm

Step 4: Designing the Nodes

platform. It will consist of Government workers, Nigerian defense and security agencies, regular citizens and religious leaders.

Step 5: Design the Blockchain Instance

Most blockchain platforms need very careful planned configuration for the following elements:

Permissions, Asset issuance, Atomic exchanges, Native assets, Key formats, Block signatures Hand-shaking are key design elements in this model. Some configurations can be changed at run-time but some cannot, so this is a very crucial step.

Step 6: Building the APIs

Step 8: Adding Future Tech

This model can be greatly enhanced by integrating Artificial Intelligence, Biometrics, Bots, Cloud, Cognitive services,

The major categories of APIs that would be needed are for:

- i. Generating key pairs and addresses
- ii. Performing audit related functions
- iii. Data Authenticating Through Digital Signatures smart Contracts

Step 7: Design the Admin and User Interface

At this stage you would need to choose the front-end and programming languages (e.g. HTML5, CSS, PHP, C#, Java, Javascript, Python, Ruby, Golang, Solidity, Angular JS, Nodejs). You would also need to choose external databases (e.g. MySQL, MongoDB, Firebase) as well as servers (including Web servers, FTP servers, mail servers).

Containers, Data Analytics, Internet of Things and Machine Learning to provide a highly robust system.

4.3 Process Flow of Proposed Model.

Fig 5: Process Flow of Proposed Model.

V: FINDINGS, SUMMARY, RECOMMENDATIONS AND CONCLUSION

5.1 Findings

My Findings are as follows:

- Blockchain uses Triple entry accounting.
- If the government were on a blockchain, we would be able to easily know government expenditures on budget allocations down to the penny [19].
- Blockchain works well in where there is value being transacted, Busy ecosystem, and systems that lack trust
- For example, blockchain-based account control platforms could reduce the scope for corruption on government financial accounts by providing a tamper-proof record of incomes and expenditures that does not rely on verification by a third party and cannot be manipulated.
- Smart Contracts can be used for all government payments as a way to increase transactions transparency. The self-execution characteristic of contracts can reduce the expenses of manual payments, and also errors and delays, as well as the vulnerability to frauds and misconduct.
- The online portal, www.opentreasury.gov.ng, was activated for all MDAs to publish all the information required by the policy and for immediate access by all Nigerians but was not built on a blockchain [18].
- A Delegated Proof-Of-Stake (Their "stake" is their trustworthiness in this system) in which there will be groups who will select trusted delegates to verify each government transaction before implementation. They will also be able to remove a delegate if there are fraudulent transactions accepted on their behalf would be the best consensus mechanism.
- EOS- Preferred Blockchain Platform based on consensus algorithm
- By integrating Artificial Intelligence, Biometrics, Bots, Cloud, Cognitive services, Containers, Data Analytics, Internet of Things and Machine Learning to provide a highly robust system.

5.2 Discussion of Findings

Most government reports reviewed were not detailed today-to-day transactions and these report figure sending were mostly "charm prices" figures that end in "9", "99", "95" etc. An attempt used by most sales personnel to trick the buyers and make them trust the actual cost of items. Also use of figures like "4" and "7" are also tricky as they usually stand out and usually affect user perception [20]. Therefore government reports are not trustworthy and blockchain can greatly enhance government financial processes and create a trust worthy system to the public

5.3 Recommendation

The following recommendations are made to help the Nigerian government implement block chain to implement transparency and reduce corruption

1. Use blockchain to reduce permissions and access to centralized government accounts.
2. Enable constant energy to allow total uptime on all nodes.
3. Creation of awareness programs on blockchain.
4. Impementation of the proposed blockchain model in the results of this research.

5.4 Conclusion

This study has examined how blockchain can be implemented to curb corrupt government financial practices. From the findings of the study, it can be concluded that blockchain can provide a transparent and unchangeable record of all government transactions and eradicate 70% of financially corrupt practices in Nigerian Government. Blockchain would also create an automatic ledger of all transactions concerning government accounts to make auditing easier.

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