Cashless Society, Financial Inclusion and Information Security in Nigeria: The Case for Adoption of Multifactor Biometric Authentication

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Abstract:- Cashless society is a system in which all purchases of goods and services are made by credit card or e-payments system. It is a policy that reduces the amount of physical cash that people carry around. Therefore, the system heavily rely on the alternative banking channels (contactless payments terminals) to achieve it purpose. The Central Bank of Nigeria announced its intention to transform Nigerian economy into cashless one in 2011. We argue that it is difficult, if not impossible for a cashless financial system to work under the present state of the Nigerian financial system. This cannot be overemphasized because forging growth in alternative payment system requires inclusivity, proper infrastructure and security of funds and information. The main objective of this study is to make a case for multifactor biometric authentication system in the Nigerian financial service industry. The study also highlight the level of financial inclusion as well as the security vulnerability of the existing system in Nigeria. Descriptive statistical technique of data analysis is employed for the secondary data from 2013-2018. The study concludes that electronic payments fraud has been on increase because of a weak security framework in the existing payment system in Nigeria. This is as the result of cashless policy needs for the inclusion of adults' population into the formal financial system to achieve an effective cashless economic society. The study is also of the opinion that the increase in the volume of fraud in the payment system and the losses of funds is related to the recent increase in the number of adults in the formal financial system in Nigeria. The study therefore recommends that policymakers (CBN) should embark on the search for the solution to the problem of information security in the Nigerian financial system. The study is recommending the multifactor biometric authentication for users as a remedy to the increased electronic payment system fraud in Nigeria.

Keywords:- *Banks, Biometric Technology, Financial Security, Informal Sector.*

I. INTRODUCTION

Cashless society is a society in which all purchases of goods and services are made by credit card or e-payments system, rather than with physical cash or check. It is a policy that reduces the amount of physical cash that people carry around. It is an economic system that lays emphasis towards a future without money, it is not a moneyless society. In an effort to reap the monumental benefits of cashless economy, the Central Bank of Nigeria (CBN) announced its intention to transform Nigerian economy into cashless one in 2011. The system heavily rely on the alternative banking channels (contactless payments terminals) to achieve it purpose. The main purpose of moving Nigeria into cashless society according to CBN are to modernize and develop the payment system consistent with the global trend so as to achieve the Nigeria's vision 2020:20 goal. Nigerian is striving to be among the top 20 economies in the world by the year 2020, and as such cashless is a way towards achieving the goal.

Transition to cashless economy could improve financial inclusion and the costs efficiency in banking services and drive economic growth and development. Specifically, the policy is expected to minimize the costs of cash handling, high subsidy, informal economy sector and inefficiency and mismanagement of funds. Moreover, the policy could be of benefit to customers, government and corporate entities; as it reduces inconveniences for customers, provide more service options, reduce cash-related crimes, easy access to banking services and financial inclusion. Corporations in cashless society could benefits from access to cheap capital, reduction in cash handling costs and revenue leakages; while governments could have low tax evasion, and inclusive economic growth and development.

However, the target operating environment (Nigerian financial system) upon which the success of the cashless society hinges revealed some challenges towards successful transition to the cashless economy. Which include a significant number of adults that are excluded from the formal financial system, financial illiteracy, poor supportive infrastructures, and poor data and information security system. These factors are found to be the main components of successful cashless society in other countries around the globe. For instance, according to a survey by Enhancing Financial Innovation and Access (EFInA, 2018), out of the 99.6 million adults population (age 18+) in Nigeria, only 39.5 million (39.6%) have bank accounts, 8.9 million (9.0%) operate other formal financial services, while 36.6 million (36.8%) are financially excluded completely. Summarily, the survey indicated that there are 51.2 million adults that are excluded from the formal financial services in Nigeria. In Nigeria several policies, programs and institutions are established to enhance the level of financial inclusion, but the results of such policies and programs are far away from the principal target of reducing the rate of adults Nigerians that are excluded from formal financial services from 46.3% in 2010 to 20% by 2020 in line with the National Financial Inclusion Strategy (NFIS, 2012).

Poor state of supporting infrastructure posted a thread to the security of financial resources and other confidential information in the financial system. Information security is critical to the availability, integrity, safety and confidentiality of information. It generally ensures the required protection to information system and the supporting processes and infrastructures from any form of possible threats and vulnerabilities (Sharifah, Borhanuddin, & Wan-Azizun, 2012). It covers the protection of both the physical and logical access controls; logical access controls protect the systems from threats of unauthorized access. Therefore, financial security entails the security of funds and information databases, it involved activities like identification, verification, authentication and authorization of access to funds and information.

The increased threats to information security and evolution of biometric technologies have necessitated the use of human biometric characteristics to protect and preserve information system from unauthorized attacks and vulnerabilities in many countries. Biometrics are a unique personal characteristics or traits of human body, used for identification and authentication of each human being. The unique human body is used by the biometric technology as unique biometric data to serve as that person's identity for access control purpose. It therefore measure individuals' unique physical or behavioral characteristics to recognize or authenticate identity (Jain, 2004).

While Nigeria is going into cashless society, which largely relies on alternative payments systems (e-payments), the importance of data and information security cannot be overemphasized. It is worth noting that with the recent cashless policy and other efforts to improve financial inclusivity in Nigeria, there will be an unprecedented increase in the number of banking customers and the expansion of other financial institutions. For instance, according to the Nigeria Interbank Settlement System (NIBSS), in the year 2015, the Central Switch alone processed over 100million transactions in terms of volume with a corresponding value of over N40 Trillion. This indicated that volume of transactions grew by over 50% between 2013 and 2014 with its value also growing by 28%. This therefore emphasized the need for a stronger and reliable security measures in the banks and other financial institutions, in order to safeguard the banking public confidence in the financial service industry. Until the recent introduction of biometric verification and authentication system in Nigeria, the existing information security mechanisms are mostly the use of passwords and Personal Identification Numbers (PINs). The security level of these mechanisms in e-transactions varies and is mostly exposed to different degrees of risks. This is because they can be easily compromised through imitations and identity theft, and eventually destroy the whole system.

For example, the 2015 e-fraud reports by the NIBSS shows that electronic payments fraud has been on the increase in the recent time following the changes in the modes of payments in Nigeria. Moreover, the reports indicates that internet banking, the ever increasing use of the ATMs and other electronic platforms have one way or the other accelerated the growth of fraudulent activities. On the other hand, the report also revealed that cheques and over-the-counter fraud has given more room to a sophisticated and more concise electronic type of fraud. In essence, the NIBSS report indicated that internet banking and ATM scored as the lead channels for perpetuating e-fraud in 2014. In quantitative terms, the report shows an increase in reported fraud volume from 822 in 2013 to 1,461 in 2014, with corresponding attempted reported fraud value from N19.15 billion in 2013 to N7.75 billion in 2014. The actual value loss to fraudsters increased from N485.19 million in 2013 to N6.22 billion in 2014 (NIBSS e-fraud report, 2015). Similarly, according to the director of banking and payment system of the CBN, the 2017 e-fraud report has shown that the value of electronic fraud has increased from N2.2 billion in 2016 to N5.571 billion in 2017 (Dipo, 2018).

As part of the efforts to address the security issues in the payment system, the CBN introduced and mandated the use of customer biometric identification system. This is to ensure identity protection by making all customers use authentic identification documents with the correct identity. The apex bank mandated all the banks to capture and use fingerprint biometric technology as customers' identity for verification

and authentication during all banking transactions. Biometric technology is usually an automated system of verifying or recognizing the identity of a customer based on a physiological or behavioral characteristics like fingerprint. Currently, in Nigeria banks' customers have Biometric Verification Number (BVN) used for identification, verification and authentication in all banking transactions.

The main objective of this study is to make a case for multifactor biometric authentication system in the Nigerian financial service industry. The study also highlight the level of financial inclusion as well as the security vulnerability of the existing system in Nigeria.

II.   LITERATURE REVIEW

Cashless economic system according to Claudia and De Grauwe (2002) is a system in which private financial institutions issue coins and notes rather than central banks. Ernest and Fadiya (2013) relate the term to banking and defined cash-less banking as that banking system which aims at reducing, not eliminating the amount of physical cash (study notes and coins) circulating in the economy, whilst encouraging more electronic based transactions (payment for goods, services, transfers etc.). They further explained that, it

is a combination of two e-banking and cash-based systems, in which in most developing countries, it represents a middle phase in the development of payment system. EFInA (2015) defined cashless policy as a system aim at reducing the amount of physical cash that citizens can carry around.

➢ *Overview of the Cashless Policy in Nigeria*

Cashless system is one of the new world economic order embrace by almost all the countries of the world. Cashless policy relies heavily on electronic payments technology to eliminate physical cash in circulation. Nigeria has recently announced its plan for changes from the cash-based economy to cashless economy, by encouraging Nigerians to adopt electronic payment system and introduction of a single-factor biometric authentication technology. Properly implemented, cashless economy could improve economic stability in Nigeria in so many ways; for instance, there would be saving of about N192 billion in currency printing annually, with cash-related transaction of about 99%.

The Nigerian cashless system is part of the efforts towards taking the country into the 20 most developed nations by the year 2020. The policy contents are presented in table 1 as follows;

Policy Elements	Initial Policy 20th April, 2011	Revised Policy 19th March, 2012
Daily cumulative cash withdrawal/lodgment limit (without charges)	*N150,000 by individuals *1million by corporations	*N500,000 by individuals *N3million by corporations
Processing fee for withdrawals above limits	*10% for individuals *20% for corporations	*3% for individuals *5% for corporations
Processing fee for lodgment above limits	*10% for individuals *20% for corporations	*2% for individuals *3% for corporations
Exemptions	None	*MDAs of the federal and state governments on lodgments for accounts operated by them, for revenue collection purpose only. * Foreign diplomatic missions, discount houses and micro-finance banks are exempted from 27th February, 2012.
Effective Data	*1st January, 2012 for partial implementation (pilot test without charges) in Lagos state *1st June, 2012 for implementation across Nigeria	*1st January, 2012 for partial implementation in Lagos state *1st April, 2012 for full implementation in Lagos state (with charges from that date). *1st July, 2013 for partial implementation in Abia, Anambra, Kano, Rivers and Ogun states. *1st January, 2013, for implementation across Nigeria.

Table 1:- Overview of the Nigerian Cashless Policy Contents
Source: CBN

➢ *Financial Inclusion*

Financial inclusion is defined by EFInA (2014) as the provision of a broad range of high quality financial products, such as savings, credit, insurance, payments and pensions, which are relevant, appropriate and affordable for the entire adult population and especially the low income segment. According to the EFInA, an inclusive financial sector is characterized by the diversity of financial services providers,

the level of competition between them and the legal and regulatory environments that ensure the integrity of the financial sector and access to financial services for all. In the words of CBN, financial inclusion is achieved when adults have easy access to a broad range of financial products designed according to their needs and provided at affordable costs. These products includes payments, savings, credit, insurance and pensions. Inclusivity is critical as evidence from

around the globe indicate that access to financial services contributes both to economic growth and wealth creation, and is therefore a key to addressing the poverty problem in Nigeria. The Nigerian government in pursuant of Maya Declaration have introduced many policies and strategies towards achieving lower financially excluded adults in Nigeria.

One of the major initiatives is the National Financial Inclusion Strategy (NFIS, 2012), which contained the framework and guidance on achieving the financial inclusion targets through various programs such as Financial Literacy, Regulatory Framework for Mobile Payments Services, Agent Banking, Tiered Know-Your-Customer (KYC) requirements, Linkage Banking, Consumer Protection, Micro, Small and Medium Enterprises (MSME) development funds and Credit Enhancement Programs. Guidelines of POS and Card Acceptance Services (2011), Cash-less Policy (2012), National Financial Literacy Framework (2012), Tiered Know-Your-Customer (KYC, 2013), Guidelines for the Regulations of Agent Banking and Agent Banking Relation (2013), Revised Guide to Bank Charges (2013).

There is no doubt that the exclusion of a significant number of Nigerian adults from the formal financial system will constraints the success of the ongoing transition to cash-less society. Financial inclusion is the second key objective of cash-less policy and has been the topic among the regulators, policy-makers and researchers. A number of researches have been conducted on the current state of financial inclusion in Nigeria, prominent among them is the "Access to Financial Services Survey and the Assessment of Financial Inclusion in Nigeria" by EFInA from 2008 to 2014.

According to the survey, the financial service landscape in Nigeria is composed of four categories (formally banked, formal other, informal only and completely excluded). Formally banked are adults who have access to or use financial services supplied by deposit money banks. Formal other are adults who have access to or use formal financial services and products not supplied by deposit money banks. Informal only are adults who have access to or use any unregulated financial institution or informal service such as cooperatives or moneylenders. Completely excluded are adults without access to formal or informal financial products and services. The formally banked and formal other are termed formally included; the formally banked, formal other and informal only are termed financially served; while the completely excluded are termed financially excluded.

➤ *The National Financial Inclusion Strategy (NFIS 2012)*
In its commitments to achieve the desired level of inclusivity in Nigeria, the government through the CBN came up with the National Financial Inclusion Strategy in 2012. The strategy maps the current landscape of financial inclusion in Nigeria by category of financial services and defined targets

for Nigeria in terms of access to and use of financial services within a define timeframe. The financial services strategy and defined targets are presented in table 2 as follows;

Type	Targets			Units
	2010	2015	2020	
Payments	21.6%	53%	70%	% of total adults
Savings	24%	42%	60%	
Credit	2%	26%	40%	
Insurance	1%	21%	40%	
Pension	5%	22%	40%	
Branches	6.8	7.5	7.6	Units per 100, 000 adults
MFB branches	2.9	4.5	5.0	
ATMs	11.9	42.8	59.6	
POS	13.3	442.6	850	
Mobile Money Agents	0	31	62	
KYC ID	18%	59%	100%	% of population

Table 2:- Financial Inclusion Targets
Source: National Financial Inclusion Strategy (2012)

The government initiatives to improve the state of financial inclusion in Nigeria follows the fact that Nigeria is lag far behind its principal target of the NFIS of reducing the rate of adults Nigerians that are excluded from financial services from 46.3% in 2010 to 20% by 2020. Moreover, the adults' population in the formal sector is set to increase from 36.3% in 2010 to 70% by 2020.

➤ *Information Security*
Information security according to Sharifah, Borhanuddin, and Wan-Azizun (2012) is critical to the availability, integrity, safety and confidentiality of information. It generally ensures the required protection to information system and the supporting processes and infrastructures from any form of possible threats and vulnerabilities. While transactions conducted on the electronic payment system are less cumbersome and faster, the rate of risk of fraud and failures is high. Moreover, the increase in utilization of e-payments system has increased and amplified existing fraud risk. This therefore necessitated the needs for a speed in detecting and predicting new risk challenges, such as the multifactor biometric technology.

Information security covers the protection and authorization at both physical and logical access controls. Logical access controls usually the information system from unauthorized access of the network and computers. This is controls whereby an individual's identity is verified through either one of the three following means: `by something he knows', `by something he has' or `by something he is' (or through combinations of any of the three means). Traditional approaches are basically based on the first two methods. The former implies password authentication that can be forgotten, guessed or cracked through dictionary or brute forced attacks,

whereas the latter involves the use of tokens as identifiers such as keys or smartcards for authentication purposes. Unfortunately, the second method is also at risk of being shared, lost, duplicated, or stolen. The emerging solution is based on biometric which is claimed to be more reliable and more fool-proof that relies on `something that you are', to make personal authentication.

With the ongoing cashless economic system across different countries, financial institutions particularly banks conducts transactions through electronic documentations. For instance, as part of the CBN commitments to ensure the safety effectiveness of the financial system, in 2011, the CBN in collaboration with Bankers Committee embarked launched a project to change the retail payment system Nigerian from cash for P2P, P2B and G2P transactions, to electronic alternatives payments system (Nigerian Electronic Fraud Forum, NeFF 2014). As part of the effort, NeFF was established in December, 2011, and evidences from studies indicated that one of the major concern of the stakeholders is security.

In essence, banks manage financial data, customer information and products using electronic documents. The sensitive nature of the information requires the highest level of security to prevent unauthorized access and fraud. For example, Kumar, Agrawal and Chauhan (2013) opined that the widespread use of electronic documents make the security of top secret documents critical for banking, and the confidential and customer data require stringent use and security protocols. Which they argue biometric security system will ensures secure and authorized access to critical data residing in electronic documents.

The use of e-electronic payment system in Nigeria has created an additional layer for fraudsters to commit fraud because of the sophistication of the technologies in use. According to NIBSS (2014) there is a huge rise in across the Counter fraud and internet banking fraud as the nation grows in use of mobile banking, ATMs, e-Commerce, POS, cloud computing and social media. It added that over the years most of these incidents have gone unreported.

In 2013, NIBBS under the CBN directive developed the Anti-Fraud Portal with a view of getting the Banks to report their e-payment frauds as it occurs. According to the 2014 e-fraud report, internet banking, the ever increasing use of the ATMs and other electronic platforms have one way or the other accelerated the growth of fraudulent activities. Similarly, non-electronic payments (Cheques and over-the-counter) fraud has also given more room to a sophisticated and more concise electronic type of fraud.

➤ *Biometric Technology*

Biometrics according to Jain (2004) are a unique personal characteristics or traits of human body, used for identification and authentication of each human being. The unique human body is used by the biometric technology as biometric data to serve as that person's identity for access control purpose. It therefore measure individuals' unique physical or behavioral characteristics to recognize or authenticate identity (Jain, 2004). Therefore, biometric technology measure individuals' unique physical or behavioral characteristics to recognize or authenticate their identity. Presently it is the most secure and convenient authentication tool, because it cannot be borrowed, stolen, or forgotten, and forging one is practically impossible (Liu & Silverman, 2001). The physical biometrics are the fingerprints, retina, iris, voice, hand/palm geometry, DNA and facial characteristics, while the behavioral traits are the signature, keystroke pattern and gait.

Biometric technology has come to stay and as it effectiveness improves no one can afford to ignore it. For instance, Liu and Silverman (2001) stated that biometrics technology provide many security benefits to Information Technology Vendors, end users, security system developers and users among others. However, in selecting a biometric technology to be used in any industry, there must be a comparative analysis of the following security measures in Table 2;

Characteristics	Fingerprints	Hand-Geometry	Retina	Iris	Face	Signature	Voice
Ease of Use	High	High	Low	Medium	Medium	High	High
Error Incidence	Dryness, Dirt, Age	Hand injury, age	Glasses	Poor lighting	Lighting, age glasses, hair	Changing signature	Noise, colds, weather
Accuracy	High	High	Very high	Very high	High	High	High
Cost	*	*	*	*	*	*	*
User Acceptance	Medium	Medium	Medium	Medium	Medium	Very high	High
Required Security Level	High	Medium	High	Very high	Medium	Medium	Medium
Long-Term Stability	High	Medium	High	High	Medium	Medium	Medium

Table 3:- Comparison of Biometric Technology
*the number of factors cannot be compared, Adopted from Liu and Silverman (2001)

It is worth noting that biometric technology uses different devices in different situations because they are not user friendly. That is, ease of use of biometric technique is important in selecting a biometric to be used. Error incidence on the other hand influences biometric data based on time and the environment. Biometrics characteristics changes as an ages of an individual changes, while environmental conditions could directly affect the biometric or interfere with the collection of data.

False-acceptance rate or False-rejection rate are the main metrics used to measure the accuracy of biometric technique. Both methods focus on the ability of the system to permit limited entry to users with authority to access, depending on the adjustment to the biometric mechanism's sensitivity. For example, physical biometrics are more accurate than behavioral biometrics. Another important factor in the selection of biometric technology is cost. On user acceptance, required security level is at the heart of biometric technology

selection, especially in the financial service industry. Moreover, long-term stability is also a factor to consider when choosing biometric system to be used.

III. METHODOLOGY

This research adopts descriptive research methodology in collecting secondary data for the study. The data from CBN, NIBSS and NFIS are used in the study, while descriptive statistics are use as the technique of data analysis, which cover a period of 6 years (2013-2018).

IV. ANALYSIS AND DISCUSSIONS

In this section, the analysis of the data collected for the study is conducted and presented. The section begins with the trend analysis of the financial inclusion in Nigeria post National Financial Inclusion Strategy 2012.

Years	2013	2014	2015	2016	2017	2018
Financially Included Adults (in Millions)	37.8	45.4	45.4	46.9	46.9	48.4
As a Percentage of Total Adult Population (%)	43.0%	48.6%	48.6%	48.6%	48.6%	48.6%

Table 4:- Financial Inclusion
Source: NFIS 2018 Annual Report & EFInA (2018)

The National Financial Inclusion Strategy was established in 2012 with the sole aim of reducing the number of adult Nigerians without access to financial services from 39.2million adults (46.3%) in 2010 to 20% by the year 2020. However, the trend from the table indicates that there is an improvement of 28% from 2013 to 2018. The data is based on the adult population (18+ years) of 99.6million in 2018; the financially included adults comprises of the banked and

formal other. The table also shows that the NFIS target of 70% payment system inclusivity by 2020 is away by 21.4%. Therefore cashless policy is a way making progress in a positive direction, as the number of financially excluded adults in the economy is substantially reducing by increased number of adults in the formal financial system. Figure 1 graphically represents the trend of adults in the formal financial system in Nigeria during the period 2013 through 2018.
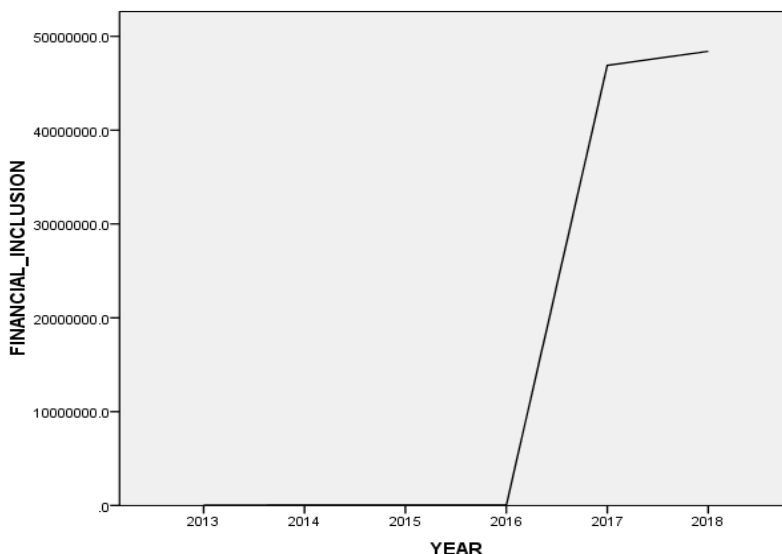

Fig 1:- Adults in the Formal Financial System in Nigeria

The graph indicates that there is a significant increase in the number of adult Nigerians in the formal financial service industry from 2013 to 2018. Particularly from 2016 the curve rise up to the peak in 2018.

This paper therefore relate the levels of financial inclusion with the security levels in the Nigerian financial service sector using the volume of fraud, attempted fraud value and the actual value lost to the frauds as shown in the table below;

Years	2013	2014	2015	2016
Fraud Volume	822	1,461	10,743	19,532
Attempted Fraud Value (N'billions)	19.15	7.75	4.40	4.40
Actual Value Loss (N'billions)	0.485	6.22	2.20	2.20

Table 5:- Payment System Fraud in Nigeria
Source: NIBSS 2014, 2015 & 2016 Fraud Report

The table shows that volume of fraud reported has substantially increased from 822 in 2013 to 19,532 in 2016 (an increase of over 2000%). This indicated a very poor information security in the financial service sector of Nigeria. In contrast, the value of attempted fraud has declined from 19.15 billion in 2013 to N4.4 billion in 2016 (a decrease of 77%). Similarly, the table indicates that there is a significant increase in the actual value of money lost to fraud during the period; from N485 million in 2013 to N2.2 billion in 2016 (an increase of 354%). It is also an evidence of poor information security in the system which requires a very effective authentication system such multifactor biometric authentication system.

Figure 2 indicated the relationship between the level of financial inclusion and the volume of fraud committed as follows;
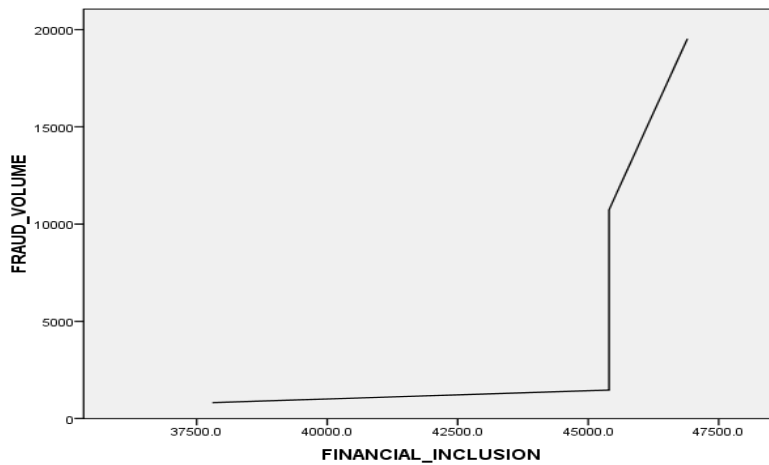

Fig 2:- Level of Financial Inclusion and Fraud Volume in Nigeria

Figure 2 indicates that there was a steady increase in the volume of fraud following the increase in the number of adults in the formal financial system in Nigeria. This is evident by the curve from figure 2.

The study further analyzes the relationship between the level of financial inclusion and the value of attempted fraud as follows;
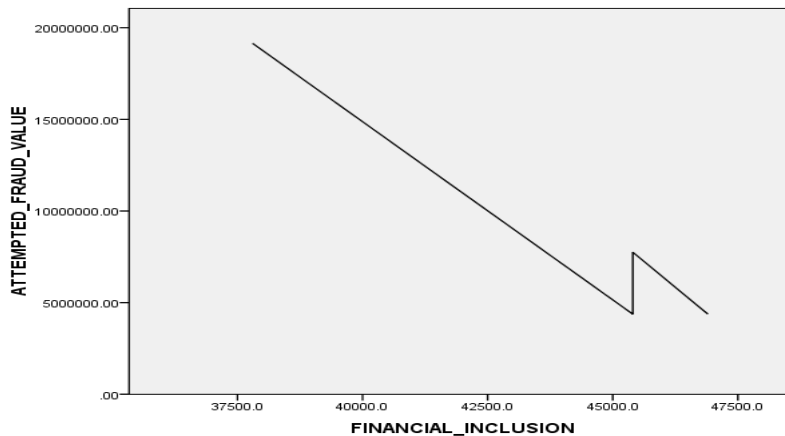

Fig 3:- Level of Financial Inclusion and Attempted Value of Fraud in Nigeria

Figure 3 indicates that there was a steady decrease in the attempted value of fraud as the level of financial inclusion increase, the number of adults in the formal financial system in Nigeria. This is evident by the curve from figure 3, which indicated a decline downward.

The study further analyzes the relationship between the level of financial inclusion and the actual value of fraud as follows;
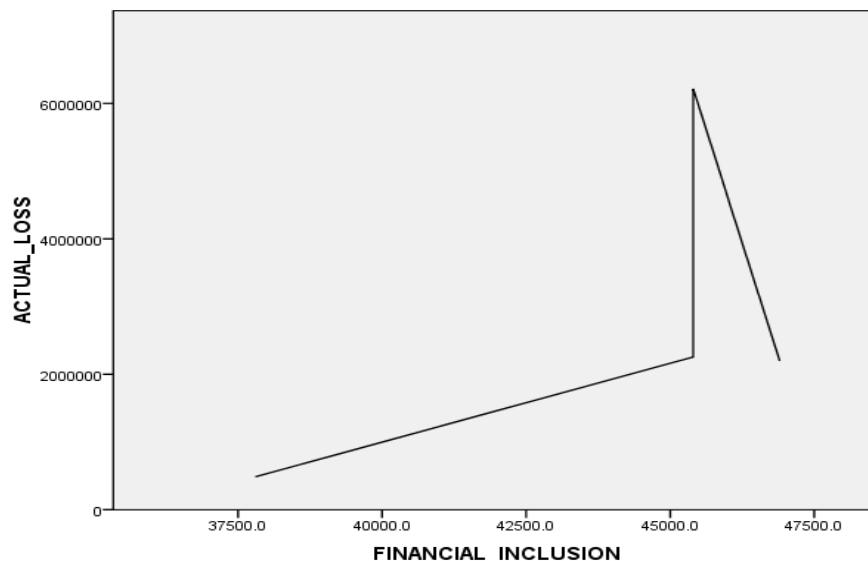

Fig 4:- Level of Financial Inclusion and Actual Value of Fraud in Nigeria

Figure 4 shows that there is an increase in the actual loss value of fraud as the level of financial inclusion increase. Although the curve indicate a decline during the periods, it was not proportinate with the increase in the number of adults in the formal financial system in Nigeria.

V. CONCLUDING REMARK

Based on the analysis of the available data, the study concludes that there is an increase in fraud as a result of weak security in the existing payment system in Nigeria. This is as the result of cashless policy that requires that the adults' population must be in the formal financial system to achieve an effective cashless economic society. The study is also of the opinion that the increase in the volume of fraud in the payment system and the losses of funds is as related to the recent increase in the number of adults in the formal financial system in Nigeria. The study therefore recommends that policymakers (CBN) should embark on the search for the lasting solution to the problem of information security in the Nigerian financial system. The study is recommending the multifactor biometric authentication for users as a remedy to the increase in electronic payment system fraud in Nigeria.

REFERENCES

[1]. Central Bank of Nigeria (2014). 2014 Financial Statistics
[2]. De Grauwe, P., & Costa Storti, C. (2002). *Monetary policy in a cashless society*. (March). https://doi.org/10.4324/9780203222614.pt4
[3]. Dapo, F. (2018). Reported e-banking Fraud Cases Hit N5.6bn–NeFF.https://www.dailytrust.com.ng/reported-e-banking-fraud-cases-hit-n5-6-bn-neff.html
[4]. Ernest, S. & Fadiya, B. (2012). Cashless Banking in Nigeria: Challenges, Benefits and Policy implication. *European Scientific Journal*, June Edition, 8, (12).
[5]. Jain, A. K., A. Ross & S. Pankanti, (2006). Biometrics: A Tool for Information Security, *IEEE Transactions on Information Forensics and Security*, 1(2); 125-143.
[6]. Jain, A. K., Ross, A., & Prabhakar, A. (2004). An Introduction to Biometric Recognition, *IEEE Transactions on Circuits and Systems for Video Technology*, 14(1):4-20.
[7]. Jain, A. K. & A. Kumar, (2010). Biometrics of Next Generation: An Overview, *The 2nd Generation Biometrics*, 2010.
[8]. Kim, S. (2007). Governance of information security: New paradigm of security management, *Computational Intelligence in Information Assurance and Security, Studies in Computational Intelligence*, 57:235-254.

[9]. Liu, S. & Silverman, M. (2001). A Practical Guide to Biometric Security Technology.

[10]. National Financial Inclusion Strategy (2018). 2018 Annual Report.

[11]. Nigeria Interbank Settlement System (NIBSS, 2015). 2015 Electronic Fraud Report.

[12]. Rhodes, K. A. (2003). *Information Security: Challenges in Using Biometrics*, United States General Accounting Office, 2003.

[13]. Sharifah, M. S. A., Borhanuddin, M. A. & Wan-Azizun, W. (2012). Technical Issues and Challenges of Biometric Applications as Access Control Tools of Information Security. *International Journal of Innovative Computing, Information and Control* ICIC International 2012, 8(11): 7983-7999.