



CENTRAL BANK OF NIGERIA

ECONOMICS OF DIGITAL CURRENCIES:

A BOOK OF READINGS



RESEARCH DEPARTMENT
CENTRAL BANK OF NIGERIA

Edited by

Dr. Kingsley I. Obiora, FCIB
Deputy Governor, Economic Policy

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FOREWORD

The emergence of blockchain and distributed ledger technology birthed privately issued digital currencies, whose control lies outside the regulatory purview of central banks and spurred unprecedented advancement in technological innovation in the financial ecosystem.

Although, transactions in privately issued digital currencies (like cryptocurrencies) are faster and less costly, they also pose risks to the financial system, with attendant implications for the conduct of monetary policy. Most central banks around the world have responded, in part, to the proliferation of cryptocurrencies by considering the issuance of Central Bank Digital Currencies (CBDCs) in their jurisdictions.

In October 2021, Nigeria became one of the few countries to launch and commence full implementation of a CBDC, known as the eNaira. Given the evolving nature of CBDCs vis-à-vis the privately issued digital currencies, and outcome of the many research works carried out on the digital currencies, the need to document the gamut of ideas, results and lessons from these studies and the implications on the Nigerian economy, becomes expedient.

This book, perhaps the first of its kind, about digital currencies, is a compendium of studies on CBDCs with a focus on concepts, the literature, jurisdictional experiences, and implications for financial system stability, liquidity management, monetary policy, financial inclusion, cross-border trade, fiscal operations, fintech and financial markets, etc. It provides readers with a single and easily accessible reference material.

The main purpose of the book is to assist both professionals and the general public to easily understand the economics of CBDCs, without necessarily having to search large volumes of research papers and other publications. The book further plays a critical role of complementing the efforts of the Central Bank of Nigeria in promoting financial literacy, with a view to enhancing the understanding of the Bank's policies, products, and innovations.

This book attempts to provide an in-depth understanding of CBDCs, generally and in particular, the workings of the eNaira, highlighting the issues and challenges of implementation and adoption, as well as the prospects for Africa's largest economy in today's digital world.

The book fills a void and satisfies the yearnings of stakeholders including policy makers, financial institutions, researchers, academics, and students, who are expected to have basic knowledge of the evolving innovation around CBDCs. Therefore, the book remains an important contribution to the subject area with potential usefulness to interested stakeholders. Stakeholders in other countries, especially developing countries who are at the verge of launching digital currencies may also find this book as a reference material.

The book is written in simple and clear language for easy understanding with or without formal knowledge of Economics. The book also addresses ancillary topical issues and is expected to satisfy the curiosity of readers in a more comprehensive manner. It is, therefore, my privilege and honour to recommend this book as a relevant reference material for those that are interested in advancing their understanding of the economics of digital currencies. I would like to commend the contributors, reviewers, and the Economic Policy Directorate, particularly, the Research Department for making this project a reality.

Mr. Godwin I. Emefiele, *CON*

Governor,

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June 2023.

PREFACE

There are very few countries around the world that have launched a Central Bank Digital Currency (CBDC). This is because choosing a CBDC that is consistent with a country's monetary and fiscal policies can be quite daunting. The issuance of the eNaira, Nigeria's CBDC, is expected to accelerate financial inclusion, encourage cheaper and faster remittance inflows, make social interventions easier, improve monetary policy effectiveness, enhance tax collection and facilitate cross-border trade. The eNaira will further drive the adoption of the cashless policy introduced by the Central Bank of Nigeria (CBN) since 2012.

This book discusses the economics of digital currencies, with special emphasis on Nigeria's CBDC, the eNaira. It highlights the issues, challenges and the prospects of eNaira adoption. Given the vastness of the subject area of digital currencies, this book is divided into two volumes, which would be published in two parts. Volume one of the books consist of seven thematic areas including introduction and background; monetary policy and liquidity management; financial system stability; payments system and financial inclusion; fiscal policy and the real economy; eNaira adoption: opportunitites, challenges and prospects; and FinTech and financial markets.

Part 1, provides an introduction and background on the eNaira which are examined in two chapters. Chapter 1 provides an overview on the benefits and risks associated with issuing a digital currency in Nigeria, and highlights the lessons learned as well as the prospects of the eNaira. Chapter 2 evaluates the journey so far in the adoption of eNaira one year after its deployment, highlighting the success, challenges, and emerging opportunities.

Monetary policy and liquidity management issues as they relate to CBDCs are explored in Part 2 with two chapters. Chapter 3 investigates the impact of the eNaira on deposit liabilities of banks in Nigeria and finds that the current volume and adoption rate of the eNaira, has, so far, not exerted as significant impact on transferable deposits of banks. Chapter 4 employs the Generalised

Autoregressive Conditional Heteroscedasticity (GARCH) econometric method to test the hypothesis that the prices of Bitcoin affect monetary policy through inflation, exchange rate and the velocity of money in Nigeria. Results suggest that the prices of Bitcoin influence the real exchange rate, and consequently the price level with serious implication for monetary policy.

Issues surrounding financial system stability are discussed in Part 3, which consists of two chapters. Chapter 5 focused on the assessment of the dynamic impact of the demand for the eNaira on deposits and credit of financial institutions., . Using a stylised balance sheet approach and data generated from the CBN Monetary Survey carried out by the Central Bank???, Chapter 6 investigates the possibility of a crowding-out effect of Nigeria’s CBDC, the eNaira, may have on bank deposits. It finds that the risks of disintermediation may arise as liquidity conditions of banks are impacted when households demand for the eNaira in exchange for bank deposits.

Part 4 comprises of only chapter 7, which explores the eNaira and its potential to bolster financial inclusion in Nigeria.

Part 5 discusses in one chapter (Chapter 8) how CBDCs can be used to achieve fiscal policy objectives. It explores the possibilities of leveraging on the unique innovative potentials of eNaira, to effectively mitigate revenue leakages. It incorporates eNaira into a simple framework of revenue remittances and finds enormous potentials for an optimum revenue collection system due to cost efficiency, real time transactions, transparency, traceability, and accountability.

Chapter 6, which is made up of 3 Chapters focuses on the opportunities, challenges and prospects associated with the adoption of the eNaira. Chapter 9 surveys Nigeria’s social transfer programs, citing jurisdictional experiences and the possibility of incorporating the eNaira into current and future social transfer programs. Chapter 10 analyses sentiments on eNaira adoption, using information from 26,884 tweets. It finds that 39.29 per cent and 12.37 per cent of the tweets expressed positive and negative sentiments, respectively, while

48.33 per cent was neutral. Chapter 11 analyses the user experience of the eNaira speed wallet app based on the reviews posted by users during the period October 2021 to October 2022. Results imply that users were generally satisfied with their experience using the eNaira speed wallet apps.

Part 7 consists of four chapters and deals with issues regarding FinTech and the financial markets. Using correlation analysis, Chapter 12 examines the relationship between Bitcoin and stock market returns in Nigeria. The results indicate the presence of a positive relationship between Bitcoin and stock returns in Nigeria. Chapter 13, using a simple correlation analysis, investigates the relationship between cryptocurrencies and the fixed income market in Nigeria from 2018M01 to 2022M09. The result shows the existence of a negative relationship between the bid-to-cover ratio and bitcoin in Nigeria. Chapter 14 examines the approaches to FinTech regulation using jurisdictional experiences and a synopsis of regulatory frameworks, with possible lessons for Nigeria. It finds that FinTech regulation depends on the policy objectives, socio-economic conditions, extant legal structure, and the level of development of the ecosystem. A commentary on how money has evolved over time from one form to another, up to programmable money, the state-of-the-art form of money concludes the book.

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Deputy Governor, Economic Policy

Central Bank of Nigeria

June 2023.

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The Research Department wishes to sincerely appreciate and acknowledge the efforts of all those who contributed, directly or indirectly, to the publication of this book. Our foremost gratitude goes to the Almighty God for His grace and enablement.

Our gratitude goes to the Governor of the Central Bank of Nigeria, Mr. Godwin I. Emefiele, (CON), for providing the enabling environment for the staff of the Research Department to accomplish this feat. His groundbreaking policy initiative of launching Africa's first Central Bank Digital Currency, the eNaira, motivated the Department to embark on this book project. We would also like to commend the Governor for his exemplary leadership, vision, and commitment, without which this book would not have been a reality.

The Deputy Governor, Economic Policy, Dr. Kingsley I. Obiora, (FCIB), is highly appreciated for his unflinching support, guidance, leadership, and encouragement towards the successful completion of the Book.

We are deeply grateful to the authors of the various chapters of the Book and the administrative staff of the Research Department for the logistics support towards the timely completion of this book. We also acknowledge the insightful comments and reviews we received from Prof. Hassan Oiakhenan of the University of Benin.

Lastly, we acknowledge and appreciate the reviewers, whose observations and comments significantly improved the quality of this book.

Michael A. Adebisi, Ph.D

Director of Research

Central Bank of Nigeria

June 2023

LIST OF ABBREVIATIONS AND ACRONYMS

ABA	American Bankers Association
AfCFTA	African Continental Free Trade Area
AfDB	African Development Bank
ADF	Augmented Dickey-Fuller
AFIs	Authorised Financial Institutions
AMIS	Agriculture Market Information System
AML/CFT	Anti-Money Laundering/Combating the Financing of Terrorism
AML/KYC	Anti-Money Laundering/Know Your Customer
ANP	Analytic Network Process
APESS	Association for the Promotion of Livestock in the Sahel and in the Savannah
API	Application Programming Interface
ARDL	Autoregressive Distributed Lag
ASI	All Share Index
ATM	Automated Teller Machine
BoE	Bank of England
BdF	Banque de France
BIS	Bank for International Settlement
BIT	Bilateral Investment Treaty
BoJ	Bank of Jamaica
BMPIU	Budget Monitoring and Price Intelligence Unit
BOT	Bank of Thailand
BPSR	Bureau of Public Service Reforms
BTC	Bitcoin
BVAR	Bayesian Vector Autoregression
BVN	Bank Verification Number
CAR	Capital Adequacy Ratio
CBB	Central Bank of Bahamas
CBDC	Central Bank Digital Currency
CBDCAI	CBDC Attention Index
CBDCUI	CBDC Uncertainty Index

CBN	Central Bank of Nigeria
CBT	Community Based Targeting
CBUAE	Central Bank of the United Arab Emirates
CCT	Conditional Cash Transfer
CEMAC	Central African Economic and Monetary Community
CEO	Chief Executive Officer
CfA	Cash for Asset
CFT	Combating the Financing of Terrorism
CIC	Currency in Circulation
COB	Currency Outside Bank
CODC	Currency Outside Depository Corporations
COVID	Coronavirus Disease
CPMI	Committee on Payments and Market Infrastructures
CPU	Central Processing Unit
DCEP	Digital Currency and Electronic Payment
DCMS	Digital Currency Management System
DCOM	Digital Currency Operations Manager
DESI	Digital Economy and Society Index
DFID	Department for International Development
DLT	Distributed Ledger Technology
DMBs	Deposit Money Banks
DMO	Debt Management Office
DvP	Delivery versus Payment
DPR	Department of Petroleum Resources
DSGE	Dynamic Stochastic General Equilibrium
ECB	European Central Bank
ECCB	Eastern Caribbean Central Bank
ECCU	Eastern Caribbean Currency Union
ECOWAS	Economic Community of West African States
EFInA	Enhancing Financial Innovation and Access
ELB	Effective Lower Bound
EMU	European Monetary Union
EPS	Electronic Payment System
EthioSIS	Ethiopian Soil Information System project

ETF	Exchange Traded Fund
ETL	Economic Transformation Law
EUR	Euro
EWMA	Exponentially Weighted Moving Average
e-CNY	Peoples Bank of China Digital Currency
FAAC	Federation Accounts Allocation Committee
FATF	Financial Action Task Force
FIs	Financial Institutions
FIRS	Federal Inland Revenue Service
FMHDS	Federal Ministry of Humanitarian Affairs, Disaster Management and Social Development
FMIS	Financial Management Information System
FONRID	Fund for Research and Innovation for Development
FRSC	Federal Road Safety Corps
FSB	Financial Stability Board
FSS 2020	Financial System Stability Vision 2020
FinTech	Financial Technology
FTSE	Financial Times Stock Exchange
FX	Foreign Exchange
G20	Group of 20 Countries
G2P	Government-to-People
GARCH	Generalised Autoregressive Conditional Heteroscedasticity
GAS	Generalised Autoregressive Score
GBP	British Pound Sterling
GDP	Gross Domestic Product
GEEP	Government Enterprise and Empowerment Programme
GIFMIS	Government Integrated Financial Management Information System
GMM	Generalised Method of Moments
GSCs	Global Stable Coins
HGSFP	Home Grown School Feeding Programme
HKMA	Hong Kong Monetary Authority
HMT	Her Majesty's Treasury
ICT	Information and Communications Technology

IGR	Internally Generated Revenue
IMF	International Monetary Fund
INERA	Institute of Environment and Agricultural Research
IOSCO	International Organisation of Securities Commissions
ISO	International Organisation for Standardisation
IVR	Interactive Voice Response
JICA	Japan International Cooperation Agency
JPY	Japanese Yen
KALRO	Kenya Agricultural and Livestock Research Organisation
KYC	Know Your Customer
LDCs	Least Developed Countries
LM	Line Ministry
LVAS	Low Value Aggregation Services
M1	Narrow Money
M2	Broad Money
MAS	Monetary Authority of Singapore
MDAs	Ministries, Departments and Agencies
MENA	Middle East and North Africa
MoF	Ministry of Finance
MFBNP	Ministry of Finance, Budget and National Planning
MIS	Management Information System
MMOs	Mobile Money Operations
MNO	Mobile Network Operator
MPC	Monetary Policy Committee
MPOs	Mobile Payment Operators
MPR	Monetary Policy Rate
MSCI	Morgan Stanley Capital International
MTEF	Medium-Term Expenditure Framework
MTEF/FSP	Medium-Term Expenditure Framework/Fiscal Strategy Paper
NAFDAC	National Agency for Food and Drug Administration and Control
NAFEX	Nigerian Autonomous Foreign Exchange Rate Fixing
NASDAQ	National Association of Securities Dealers Automated Quotations

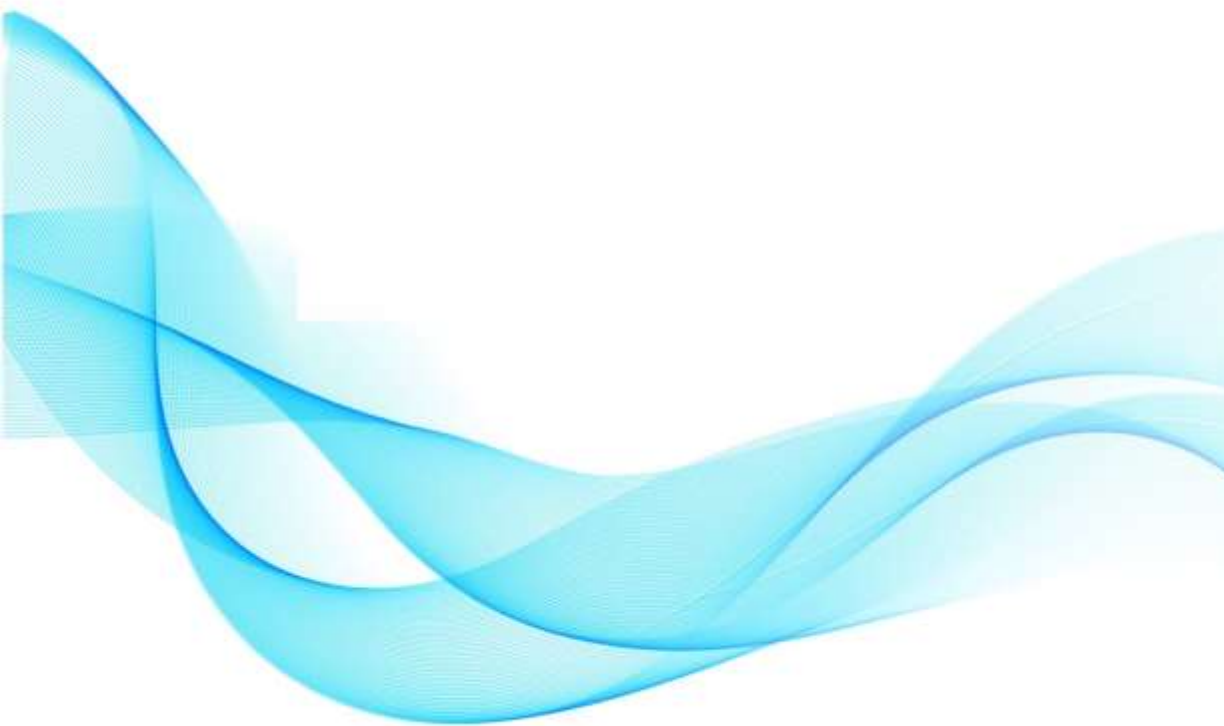
NASIMS	National Social Investment Management System
NASSCO	National Social Safety Nets Coordinating Office
NBS	National Bureau of Statistics
NCC	Nigerian Communications Commission
NCS	Nigeria Customs Service
NDA	Net Domestic Asset
NDDC	Niger Delta Development Commission
NDIC	Nigeria Deposit Insurance Corporation
NEFT	National Electronic Funds Transfer
NFA	Net Foreign Asset
NFIS	National Financial Inclusion Strategy
NGOs	Non-Governmental Organisations
NGX	Nigerian Exchange Group
NIBSS	Nigeria Interbank Settlement System
NIMASA	Nigerian Maritime Administration and Safety Agency
NIN	National Identification Number
NIP	NIBSS Instant Payments
NIS	Nigeria immigration service
NKPC	New Keynesian Phillips Curve
NLNG	Nigeria Liquefied Natural Gas
NNPC	Nigeria National Petroleum Company
NNPCL	Nigerian National Petroleum Company Limited
NPA	Nigerian Ports Authority
NPL	Non-Performing Loans
NPS	Nigerian Payments System
NSA	Nigeria Start-up Act
NSIP	National Social Investment Program
NZIA	Net Zero Insurance Alliance
OAGF	Office of the Accountant General of the Federation
ODCs	Other Depository Corporations
OECD	Organisation for Economic Cooperation and Development
OLG	Overlapping Generations Model
OLS	Ordinary Least Squares
OMO	Open Market Operation

PAPSS	Pan-African Payment and Settlement System
PBOC	People’s Bank of China
PwC	PricewaterhouseCoopers
PCSE	Panel-Corrected Standard Errors
PEFA	Public Expenditure and Financial Accountability
PEM	Public Expenditure Management
PK1	Project Khokha
POS	Point of Sale
PvP	Payment versus Payment
P2P	Peer-to-Peer
PP	Philips-Peron
PPT	Petroleum Profit Tax
PSSs	Payment Solution Services
PSV 2020	Payments System Vision 2020
PTSPs	Payment Terminals Service Providers
QTM	Quantity Theory of Money
RBI	Reserve Bank of India
R&D	Research and Development
RR	Reserve Requirement
RTGS	Real Time Gross Settlement
rCBDC	retail CBDC
SAGE	Social Assistance Grants for Empowerment
SANEF	Shared Agent Network Expansion Facilities
SCG	Senior Citizens Grant
SDG	Sustainable Development Goals
SEC	Securities and Exchange Commission
SMEs	Small and Medium scale Enterprises
SNGs	Sub-National Government
S&P	Standard and Poor
SSA	Sub-Saharan Africa
SVAR	Structural Vector Autoregressive
SWIFT	Society for Worldwide Interbank Financial Telecommunication
TMC	Ti Manman Cheri

TSA	Treasury Single Account
UAE	United Arab Emirate
UNCTAD	United Nations Conference on Trade and Development
UPSL	Unified Payment Services Limited
USD	United States Dollar
USEPU	United States Economic Policy Uncertainty
USSD	Unstructured Supplementary Service Data
VAR	Vector Autoregression
VAT	Value Added Tax
VCs	Virtual Currencies
VFG	Vulnerable Families Grant
WAEMU	West African Economic and Monetary Union
WEF	World Economic Forum
WFP	World Food Programme
WMC	Wealth Management Connect
wCBDC	Wholesale CBDC

PART 1

INTRODUCTION AND BACKGROUND



CHAPTER ONE: A PRIMER INTO THE BENEFITS, RISKS, LESSONS, AND PROSPECTS OF AFRICA'S FIRST CENTRAL BANK DIGITAL CURRENCY, THE eNAIRA.

Obiora, K. I.¹

Abstract

The dwindling use of cash, rise in electronic commerce, and advent of private digital currencies seem to have spurred central banks to consider issuing Central Bank Digital Currencies (CBDCs). The Central Bank of Nigeria (CBN) has led the way in this regard by issuing Africa's first CBDC. This paper, therefore, identifies the benefits and risks of issuing this form of currency. It notes that issuing a CBDC in Nigeria offers many benefits, including expanding financial inclusion, cash management cost-reduction, improving tax collection, boosting cross-border trade and remittances, and engendering economic growth. It also discusses some potential risks that policymakers must consider while highlighting some insightful lessons from the issuance and adoption of the eNaira in Nigeria.

Keywords: eNaira, central bank digital currency, digital payments, financial inclusion, blockchain.

JEL Classification: E51, E58, N17, O55.

1.0 Introduction

The proliferation of digital currencies that we see today is a result of the rapid development of innovative digital technologies which continue to disrupt almost every sector of the global economy, and money and payments are no exception (Ali et al., 2014). Digital technological innovations are already affecting the way people make payments for goods and services (Carstens, 2019). These innovations have recently led to the rise of private digital currencies, such as cryptocurrencies and stablecoins that can be used to make payments.

¹Dr. Kingsley Obiora is the Deputy Governor in charge of Economic Policy at the Central Bank of Nigeria, and Chair of the Bank's CBDC Technical Working Committee that designed and deployed the eNaira.

However, the emergence of private digital currencies has led to debates about what money would look like in the digital age and in the future (see, for example, Bjerg, 2017; Yanagawa & Yamaoka, 2019; Carapella & Flemming, 2020; Bordo, 2021; Cheng et al., 2021). These debates are pushing central banks around the world to study and debate on whether there is a compelling case to issue a central bank digital currency, and what the use cases might be. For some countries, these use cases might be to increase financial inclusion, while in others, it could be to facilitate efficient cross-border transactions.

Generally, research into ~~central bank~~ digital currencies by central banks aims to identify the benefits, risks and use-cases of a central bank digital currency. This paper identifies the benefits and risks of issuing a central bank digital currency in Nigeria, as well as the lessons learned and the future of Nigeria's central bank digital currency, commonly referred to as the "eNaira".

But first, what is a Central Bank Digital Currency (CBDC)? By way of conceptual clarification, a central bank digital currency is the digital equivalent of paper money, and it is a liability of the issuing central bank (Jabbar et al., 2023). It is an electronic version of cash, and it is intended to serve all the purposes of money, as we know it today. The issuance of the eNaira by the CBN on the 25th of October 2021 led to mixed reactions around the world. There were positive reactions from other central banks and such institutions as the International Monetary Fund (IMF) and the Bank of International Settlement (BIS), while it attracted some negative reactions from cryptocurrency enthusiasts and among those who do not think that central banks should be innovative with money in the digital age. These reactions are expected and normal, especially when a developing country, such as Nigeria, is among the first countries to issue a central bank digital currency, which most advanced countries are yet to issue. The mixed reactions to Nigeria's CBDC are not unique to Nigeria, because the academic literature on central bank digital currencies also presents several arguments for and against issuing a central bank digital currency.

Some studies in the CBDC literature provide arguments in support of issuing a central bank digital currency. For instance, some IMF scholars, such as Mancini-Griffoli et al. (2018), point out that a central bank digital currency is needed because it may be a way to reduce the cost associated with the use of cash in society, and it can help central banks to bolster the security of payment systems and consumer protection. Kiff et al. (2020) show that central bank digital currencies will not only expand financial inclusion, but it can also promote mobile money adoption and incentivise private-sector financial institutions to improve their digital product offerings. Other scholars, such as Nelson (2021), also show that issuing and adopting a central bank digital currency will ensure that interest rates are no longer constrained by the zero-lower bound. This means that a central bank digital currency will enable central banks to reduce interest rate as far as needed in the event of a deflationary spiral, thereby allowing central banks to use negative interest rates when it is needed. Also, a central bank digital currency that pays interest could increase central bank control of interest rates, as no financial institution would lend at an interest rate that is less than the CBDC interest rate.

Some further arguments in support of issuing and adopting a central bank digital currency include the potential to enable central banks to: reduce fraud and money laundering (Bordo, 2021; Cheng et al., 2021), guarantee sovereign alternatives for digital payments (Bjerg, 2017; Carapella & Flemming, 2020), stimulate local payments innovation (Yanagawa & Yamaoka, 2019; Calle & Eidan, 2020), complement current forms of money and financial services (Barontini & Holden, 2019; Elsayed & Nasir, 2022), and ensure an efficient transmission of monetary policy (Bordo & Levin, 2017).

The common arguments against issuing and adopting a central bank digital currency in the literature, however, are that they could potentially disrupt the traditional payments system and the financial system (Kochergin & Yangirova, 2019; Bindseil, 2019); lead to loss of privacy for users (Darbha & Arora, 2020; Gross et al., 2021); increase cybersecurity risks (Tian et al., 2022); and heighten the risk of banks' disintermediation (Bindseil, 2019; Banet & Lebeau, 2022).

Despite these arguments, the benefits of issuing a central bank digital currency appear to outweigh the risks because of the potential cost savings, monetary policy benefits, improved cross-border trade, increased remittance inflows, and the financial inclusion benefits would offset the cost of issuing a central bank digital currency. This paper makes a compelling case for issuing a central bank digital currency in Nigeria by identifying the benefits of the eNaira for Nigeria.

The paper improves the existing literature on country-specific use cases of a CBDC (see, for example Darbha & Arora, 2020; Kochergin & Yangirova, 2019; Bindseil, 2019; Gross et al., 2021; Barontini & Holden, 2019; Bordo & Levin, 2017). Focusing on the Nigerian context, it identifies the benefits, risks and lessons learned in issuing the eNaira, and offers arguments in support of a CBDC, while identifying measures to mitigate the risks associated with issuing a central bank digital currency in Nigeria.

The rest of the paper is organised as follows. Section 2 presents the global trends which is serving to encourage the issuance of a central bank digital currency. Section 3 presents some benefits and risks of issuing a central bank digital currency in Nigeria as well as the lessons learned. Section 4 highlights the future expectation with respect to the eNaira in Nigeria. Section 5 concludes the paper.

2.0 Global trends encouraging the issuance of a CBDC

There are four distinct global trends that have encouraged central banks around the world to conduct research into the possibility of issuing a digital currency.

- i.** The use of physical cash in conducting business and making payments has been on the decline for a long time now. According to Global Payments Report by Worldpay, payments by mobile wallets exceeded payments by cash for the first time globally in 2021. In fact, their projection is that cash will account for only 13.0 per cent of in-store payments worldwide by 2024. This trend has, however, differed across countries. For example, a recent survey by Global Web Index found that 77.0 per cent of South Koreans prefer to make cashless payments,

compared to only 33.0 per cent of Filipinos. In Nigeria, the minting of banknotes has also fallen steadily (from 3.3 billion pieces in 2008 to 2.5 billion pieces in 2021) over the last couple of years, a pointer to the change in preference.

- ii.** Alongside the cashless revolution, has been an explosion in the adoption of electronic and digital payments across the world. According to a UK-based Consulting firm, Capgemini², the number of digital transactions has soared from 393 billion in 2014 to nearly 710 billion by 2019. Similarly, the digital payments market is expected to grow from US\$5.90 trillion in 2021 to US\$9.10 trillion in 2025, representing a compound annual growth rate of 11.0 per cent. In Nigeria, the value of digital payments has grown from about US\$324.00 billion in 2017 to US\$2.60 trillion in 2021.
- iii.** The absence of a swift and effective solution to preference for cashless payments as well as misplaced fears that central banks' actions sometimes lead to hyperinflation, created the space for non-government entities to establish new forms of "private currencies" that seemed to have gained popularity and acceptance across the world, including in Nigeria.
- iv.** There is growing expectation that central banks will issue a state-controlled digital currency in response to the rise of private digital currencies. A recent survey of over 1,600 financial leaders across 22 countries show that 85.0 per cent of payment leaders at financial institutions globally think their country will launch a digital currency in the next four years (see Ripple, 2020).³

It is because of the global trends as encapsulated in the discussions in the foregoing section that CBDCs have become a critical part of the conversation

²Consultancy.uk.

<https://www.consultancy.uk/news/25975/global-market-size-of-digital-payments-industry-soares>.

³A Ripple Report.

<https://ripple.com/insights/cbdc-from-the-hype-to-the-how-of-making-financial-inclusion-a-reality-part-2/>.

in many central banks. A 2021 BIS survey of central banks found that 86.0 per cent are actively researching the potential of CBDCs, 60.0 per cent were experimenting with the technology and 14.0 per cent were deploying pilot projects (Boar et al., 2020).

3.0 The Nigerian context: Benefits, Risks and Lessons Learned

Given the global trends described above, the Central Bank of Nigeria (CBN) commenced extensive study, consultations, identification of use cases and the testing of the CBDC concept in a Sandbox environment as far back as 2017. The objective of the research was to establish the appropriateness or otherwise of adopting a digital currency in Nigeria.

3.1 The Benefits of CBDC for Nigeria

The CBN was able to clearly establish that a digital currency, or the eNaira, would have significant benefits to Nigeria and Nigerians. Some of these benefits include:

- i.** Fostering rapid financial inclusion
- ii.** Reducing the cost of processing cash
- iii.** Enabling direct welfare disbursements to citizens
- iv.** Reducing the size of the informal economy and improving tax collection
- v.** Boosting Cross-border trade and remittances
- vi.** Reducing the cost and improving the efficiency of payments
- vii.** Engendering economic growth
- viii.** Aids in establishing credit history.⁴
- ix.** Access to peer-to-peer (P2P) loans.⁵

i. Fostering rapid financial inclusion

Although targeted policies of the CBN have helped to improve financial inclusion from 48.0 per cent in 2008 to 64.1 per cent in 2020, the Bank believes that the eNaira presents a unique opportunity to further improve this number

⁴A 2020 Ripple Report.

⁵A 2020 Ripple Report.

through the delivery of cheap, safe, and convenient payments to the unbanked and underserved segments of the population.

ii. Reducing the cost of processing cash

Nigeria, like most developing countries, operates a predominantly cash-based economy. For instance, the Currency-in-Circulation in Nigeria grew at 7.0 per cent (cumulative average growth rate) in 2020 with the cost of cash management totalling ₦65.40 billion (US\$142.00 million) in 2020 for a country with a GDP per capita of US\$2,097.10. In view of these statistics, the introduction of the eNaira is expected to promote the Central Bank's cash-less policy and lead to a significant reduction in the cost of cash management in the economy.

iii. Enabling direct welfare disbursements to citizens

The eNaira provides a more reliable, faster, cheaper, and more auditable platform for the Nigerian government to make payments directly to citizens who are eligible for specific welfare programmes such as the National Social Insurance Programme (NSIP), Conditional Cash Transfer welfare arrangements, etc. as it would ensure improved accountability and monitoring.

iv. Reducing the size of the informal economy and improving tax collection

The use of CBDC can help move many more people and businesses from the informal sector into the formal sector. In doing so, it can potentially bring more economic activity into the effective tax base, thereby increasing tax collections. Over the years, successive governments have sought to address Nigeria's current taxation problems with several reforms. A national digital currency can help the government streamline existing collection mechanisms to ensure increased tax revenue. The central bank access to transactions will be greatly enhanced and as such, can help in the monitoring of taxes via the central bank digital currency.

v. Boost Cross-border Trade and Remittances

Presently, cross-border payments for either trade or remittances are cumbersome, costly, and fragmented, especially for developing countries, including Nigeria. They are also quite expensive with the average cost of sending remittances standing at 7.1 per cent and 6.3 per cent in 2021Q1 for Nigeria and the world⁶, respectively.

In the case of international trade, the cumbersome payment procedures present both time and cost inefficiencies and expose counterparties in the transaction to credit and settlement risks. The introduction of CBDCs, such as the eNaira, would improve the efficiency of cross-border payments by removing third party intermediaries and reducing regulatory barriers, which would encourage increased remittance flow and international trade integration (Obiora, 2022).

vi. Reducing the cost and improving the efficiency of payments

The eNaira as a CBDC has huge potential for eliminating or reducing multiple intermediaries and stepwise clearing and settlement processes required in domestic digital payments (Obiora, 2022). It also helps to replace the persistent and nagging inefficient infrastructure problems with the newly optimised blockchain technology. In this way, time and cost inefficiencies are drastically minimised for all participants. Also, the potential to deploy interoperable CBDCs for cross-border payments helps to remove third party intermediaries and enhance the efficiency of cross-border payments for remittances and international trade.

vii. Engendering Economic Growth

Central bank digital currencies can foster economic growth alongside digital innovations. A recent study by a UK-funded research outfit based in Nigeria, EFINA, indicates that the adoption of CBDC and its underlying technology, called blockchain, can increase Nigeria's GDP by US\$29.00 billion over the next 10 years. The eNaira could offer a trustworthy digital currency jurisdiction that can create a comprehensive financial framework. This can lead to

⁶World Bank.

improved economic activity and provide spill-over effects in other technology sectors.

After identifying and internalizing these benefits, the CBN assembled the right mix of staff, from Banking Supervision, Information Technology, Monetary Policy, Currency Operations, Legal Services, Payments System, Research Departments and the like. The Bank also prepared a Design Paper. This design document, which it sent out for review by the IMF and the BIS, provided much more detail on the critical dimensions of the eNaira, including the eNaira design and architecture, the initial eNaira functionality, what roles the different economic actors will play as the eNaira is introduced, the risks of the eNaira and how they will be mitigated, and the eNaira Implementation roadmap. These critical details are sufficient to boost the confidence of Nigerians in the eNaira that it was well-conceived and planned. The Central Bank also hired external advisers and technical partners to guide the Bank through the process.

3.2 Potential Risks of eNaira Issuance and Mitigation Efforts by the CBN

In terms of risks, there are 5 key risks to look out for:

- i.** Banking sector disintermediation
- ii.** Operational risk (Need for non-stop service)
- iii.** Cybersecurity risk
- iv.** Internet disruptions and low penetration
- v.** Financial exclusion and illiteracy

i. Banking sector disintermediation

The first risk is banking sector disintermediation. If individuals shift most bank deposits to CBDCs, banks may feel pressured to hike deposit rates or obtain more costly or volatile wholesale borrowing. This may, in turn, lower a bank's profitability and limit their capacity to lend to the real economy. In Nigeria, this risk has been largely mitigated by ensuring that the movement of deposits from the banks to the eNaira wallet does not exceed a certain cap.

ii. Operational Risk (Need for non-stop service)

The second is the operational risk to the central bank. Central bank digital currencies are generally characterised by high operational demands and upfront costs that may create new risks. Since CBDC infrastructure are expected to run for 24 hours a day and 7 days a week, the cost of deploying a CBDC would thus depend on whether the CBDC would run on the more expensive Distributed Ledger Technology (DLT) real-time 24hrs payments and settlement system, or the existing legacy infrastructure.

iii. Cybersecurity risk

The third is cybersecurity risk. This might result from cyber-attacks and fraud arising from the multiplicity of account holders concentrated at a single source. In mitigating cyber risk, the CBN has put in place stringent macro-prudential guidelines across the different banks.

iv. Internet disruptions and low penetration

The fourth risk is internet disruptions and low internet penetration. Available statistics show low internet penetration in Africa, with an average of 43.1 per cent as against the global average of 66.2 per cent in 2021 (Kamer, 2022). Similarly, Nigeria's internet penetration stood at 41.0 per cent in 2021 (NCC, 2022). In addition, the low level of access to infrastructure, especially electricity, could disrupt internet connections and limit the usage of CBDCs such as the eNaira. In this regard, CBDCs deployed, particularly in Africa, should have "offline" capabilities as an important design and implementation consideration. This is important to improve financial inclusiveness within segments of the population without access to internet-enabled mobile devices. In Nigeria, the introduction of the Unstructured Supplementary Service Data (USSD) with the short code *997# would greatly facilitate offline transactions. Other options include leveraging on existing agent networks and merchants, and the use of hardware wallets in the form of smartcards and wearable devices.

v. Financial exclusion and illiteracy

The fifth risk relates to financial exclusion and illiteracy. Although financial inclusion is one of the major motivations for Nigeria's CBDC, the realisation

of this benefit depends on the choice of CBDC infrastructure (token-based or account-based) and other factors outside the CBDC design. Notably, the eNaira is account-based, requiring the identity of CBDC holders, and recording changes in ownership as the digital currency changes hands. Although such an identification requirement is important in tracking and stalling illicit transactions, particularly in an era of heightened insecurity, it may constitute a hurdle to financial inclusion, as it requires subscribers to ‘open an account’ which entails providing a means of digitally verifiable identification, an exercise beyond the reach of many potential users in rural communities. Furthermore, high level of financial illiteracy could constitute a barrier to financial inclusion in Nigeria. However, the eNaira is expected to leverage on existing agent networks and merchants for sensitisation and onboarding as well as the use of Unstructured Supplementary Service Data (USSD) in local languages and hardware wallets to improve access to the unbanked and the rural population.

vi. Other issues

Among the other issues that the CBN needs to look out for, is balancing the need for control versus the desire for innovation. The Bank needs to retain the ability to direct and influence the economy through physical and digital currency management while at the same time ensuring that the Bank does not miss out on innovations like programmable CBDC and smart contracts that blockchain technology enables (Ripple, 2020). Another issue is the need for a robust identity infrastructure that will be able to connect users and transactions. The CBN will also need to build on its efforts to create interoperable ID solutions that work nationally and globally (Ripple, 2020).

3.3 Lessons Learned

Below are some relevant lessons learnt from issuing the eNaira:

- i. The fear of commercial banks that a CBDC could lead to disintermediation is real. The CBN understands this fear and in addition to the use of a tiered wallet structure with wallet balances and transaction limits, it is taking further steps to address this fear in a collaborative way.

- ii.** A CBDC requires widespread collaboration with many agencies outside the banking system. Early and frequent engagement of stakeholders is critical.
- iii.** It is important to have an existing digital identity for consumers. It is a pre-condition for considering a CBDC. Nigeria already had bank verification number (BVN) and national identification number (NIN) prior to issuing a CBDC.
- iv.** Ensure that the legal aspects of a digital currency are covered by applicable extant local laws. The CBN Act has legal provisions for a digital currency, thereby reducing the time needed to build the system by removing the cumbersome requirement of getting legislative amendments to the existing laws as experienced in other jurisdictions, such as Ukraine and China.
- v.** Determine the winners and losers of the new digital currency, and deal with the losers' concerns and worries. Early identification of 'what is in it' for each stakeholder is critical.
- vi.** Adopt a phased approach to introducing a CBDC so that disruptions can be contained and managed. If consumers lose faith in a currency, it is very hard to regain their trust.
- vii.** Institute a strong governance mechanism for minting, issuing and circulating a CBDC, as this might have a completely different challenge to minting physical notes and coins.
- viii.** Have adequate resources in-house both financially and technically, regardless of the use of outside consultants. A lot of the work may still be done by central bank staff, not least in maintenance after launch.
- ix.** The cost of issuing a CBDC would depend on the current conditions of existing payments system, staffing, enlightenment with electronic transactions, and the like. In the case of Nigeria, the country already has one of the best payments system infrastructure in the world, and the citizens are already very comfortable with digital transactions. So, all the CBN had to pay for was the license fee for the blockchain framework, the software expenditure of developing a dedicated website and call centre, advisory services, project management itself

within the Central Bank, and implementation of the Distributed Ledger Technology.

4.0 The Future of the eNaira

The evolution of blockchain technology has paved the way for the development of payments system alternatives in the form of digital currencies. It is indeed a watershed moment in the payments system landscape. The CBN launched the eNaira as a digital form of the naira. Other central banks should be encouraged to explore the possibility of issuing a central bank digital currency.

For Nigeria, the implementation of the eNaira and the successes recorded since inception shows that it is a veritable tool for improving monetary policy effectiveness, enhancing the payments system and increasing financial inclusion, among other numerous benefits.

As the CBN takes proactive measures to establish consumer confidence in digital currency, a gradual substitution of cash for digital currency is imminent in the near future.

The CBN's projections show that both the number of wallets and volume of transactions are expected to increase significantly over the next 5 years. The Bank expects over 20 million eNaira wallets downloads and a projected 300 million in volume of transactions, respectively, by 2026. .

There are numerous opportunities for investment and innovation. Several jobs have been created for onboarding agents since the introduction of the eNaira, and more employment opportunities will be created as the adoption rate increases. There are also investment opportunities for wallet creators and designers of hardware tokens. Foreign investors are also invited to take advantage of these opportunities as this will foster innovation and enhance competition in the digital space in Nigeria.

Although a few countries have experimented with the issuance of digital currencies, the CBN's eNaira is unique because of its system features of scalability, interoperability, flexibility, and adaptability. The Bank has

designed the eNaira to be able to accommodate future expansion, interact sufficiently with other private sector CBDC-related payment innovations, multi-CBDC initiatives by central banks and accommodate changing policies of the government.

With the intensive sensitisation that is deployed to the second and third phases of the implementation exercises, it is expected that more users will be onboarded, with significant potential benefits to the economy.

5.0 Conclusion

The evolution of digital currencies and blockchain technology has created payment alternatives for countries across the world. Central bank digital currencies are gaining prominence as cheaper and faster alternative means of transactions with potential to improve the payments-settlement space, financial inclusion and monetary policy transmission. The eNaira was, therefore, launched to complement the physical naira in achieving a faster, cheaper, and more efficient payments system and widening participation in the payments value chain. The eNaira has enormous benefits and opportunities for the economy, government, and numerous stakeholders. Some of the potential benefits include boosting financial inclusion, reduction in the cost of processing cash, enabling direct welfare disbursements to citizens, facilitating diaspora remittances, and reducing cost and efficiency of cross-border payments.

In recognition of the associated challenges, proactive measures have been put in place to minimise vulnerabilities and avert potential setbacks. Some key lessons learnt in the design and launch of the eNaira included the need to create awareness and publicity of the project, elicit stakeholders' buy-in, secure a reliable national identity system, and develop a strong skillset to maintain the project.

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CHAPTER TWO: eNAIRA - THE JOURNEY SO FAR

Mohammed, R. S. and Yusuf, A. O.

Abstract

Central Bank Digital Currencies (CBDCs) are gaining prominence globally as the race to the digitisation of economies continues. The Central Bank of Nigeria (CBN) has blazed the trail in deploying the first CBDC in Africa, the eNaira, as a tool to achieve financial inclusion, monetary policy effectiveness and payments system efficiency, among others. This paper evaluates the deployment of the eNaira, highlighting the successes, challenges, and opportunities. The study recommends further collaboration with relevant stakeholders for the development of new use cases, and the sensitisation of the public to improve the adoption and harness the potentials of the eNaira.

Keywords: eNaira, blockchain, distributed ledger technology, central bank digital currency

JEL Classification: B26, D71, E58, O32

1. Introduction

The evolution of technology has constantly changed the way payments are made for goods and services. The cashless society era has witnessed less use of physical cash, with most transactions being settled electronically via online banking, Internet banking, Point of Sale (PoS), and Automated Teller Machines (ATM). This has boosted the volume and value of electronic transactions in Nigeria from 427.85 million and ₦27.11 trillion, respectively, in 2012 to 16.33 billion and ₦1,670.50 billion in 2021 (CBN, 2021).

The new trend in payment systems, referred to as digital currency, which exhibits some properties like traditional money, can be defined as currency or money-like assets that are primarily managed, exchanged, and stored electronically on a digital computer system over the internet (Grinberg, 2011). The Covid-19 pandemic further accelerated the adoption of digital currencies across the globe. The relative ease of transaction, anonymity and high (but volatile) investment returns of privately issued digital currencies has made

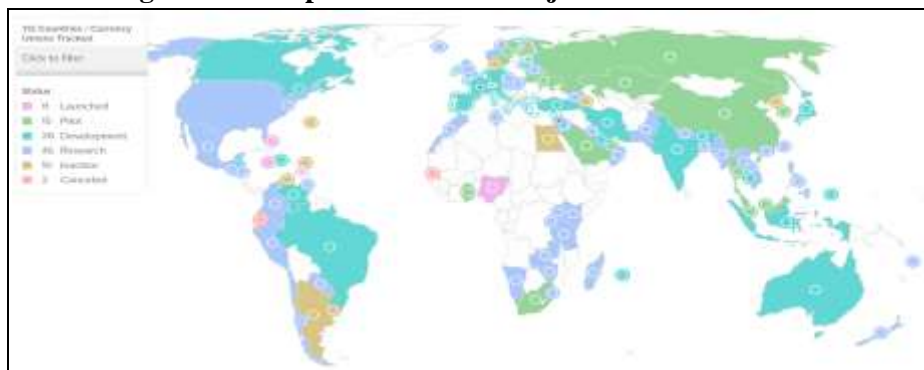
them very appealing to many investors, hence the increase in the volume of transactions on the different digital currency platforms.

The foregoing developments could have considerable impacts on the financial system and perhaps the wider economy. As a result, over the past few years, public authorities and central banks, worldwide, have been monitoring developments in the digital currency ecosystem and the implications as they affect their jurisdictions. To evolve and continue the pursuit of their public policy objectives in a digitally driven world, central banks are actively researching the likely benefits and challenges of offering a digital currency to the public.

Central Bank Digital Currencies (CBDCs) are new variants of money issued by a central authority like central banks to complement existing forms of money, such as cash. Simply put, it is digital banknotes issued by a central bank, and could be used by individuals to pay businesses, or between financial institutions to settle trades. (Boar et al., 2020). Continued access to central bank money is a direct responsibility of the central bank that issued the legal tender (WEF, 2021) and hence, access to cash is on the decline globally in the post-COVID-19 era.

A survey conducted by the Bank for International Settlements (BIS) in 2021, revealed that the main motivations for issuing retail CBDC by central banks across the globe could be categorized into six, including financial stability; monetary policy implementation; financial inclusion; payment efficiency (Remittances); and payment safety/robustness. More recently, a report published by Atlantic Council Geoeconomics Center in 2022 indicates that 100 countries, representing over 95 percent of global GDP were exploring different stages of deploying a CBDC, ranging from research, developmental, pilot, and launch. As of October 2022, only 11 countries have now fully launched a CBDC, including Nigeria (eNaira), Bahamas (Sand dollar), Jamaica (Jam-Dex), and some Caribbean islands (Dcash) (Atlantic Council, 2022).

Figure 2.1: Snapshot of CBDC Project around the World



Source: Atlantic Council (2022)

The journey to the deployment of the Nigerian CBDC, the eNaira started in 2017 with research being conducted on blockchain and DLT. It was based on this research outcome that a decision was taken by the Management of the CBN to launch a CBDC by the end of 2021. This study, therefore, aims to examine the journey so far in deploying the eNaira, highlighting successes, challenges, and emerging opportunities.

Following the introduction, the rest of the paper is organised as follows: section two discusses the eNaira journey, focusing on the motivation, governance framework and implementation roadmap. The section also details the design choices and regulatory considerations. Section three presents the achievements, challenges and opportunities associated with the deployment of the eNaira, while section four concludes with recommendations to optimise the benefits of the adoption of the eNaira.

2. The eNaira Journey

The Central Bank of Nigeria (CBN) has been at the forefront of embracing and adopting new technological innovations and trends to implement its policies, some notable policies implemented to drive the growth of a digital economy in Nigeria include: Payment System Vision 2020; Cash-less policy; National Financial Inclusion Strategy (NFIS); Bank Verification Number (BVN);

Shared Agent Network Expansion Facility (SANEF); Licensing Framework for Payment Service Banks; and Regulatory Sandbox.

Implementation of these laudable policies has been driven by the development recorded in the Nigerian payment ecosystem, over the years, has made the Nigerian payment ecosystem one of the most sophisticated and advanced payment systems globally.

A survey conducted by EFINA in 2020 puts the adult population in Nigeria at 106 million, with a financial inclusion rate of 64 percent (EFInA, 2022). Furthermore, there has been a surge in the number of mobile subscribers put at about 195 million as of December 2021 and currently stands at about 209 million in August 2022, with about a 101 million active mobile internet users as of December 2021, which has risen to about 194 million as at 2nd quarter of 2022 (NCC, 2022). This indicates that Nigeria has a large unbanked adult-rural population with access to mobile phones and broadband internet facilities.

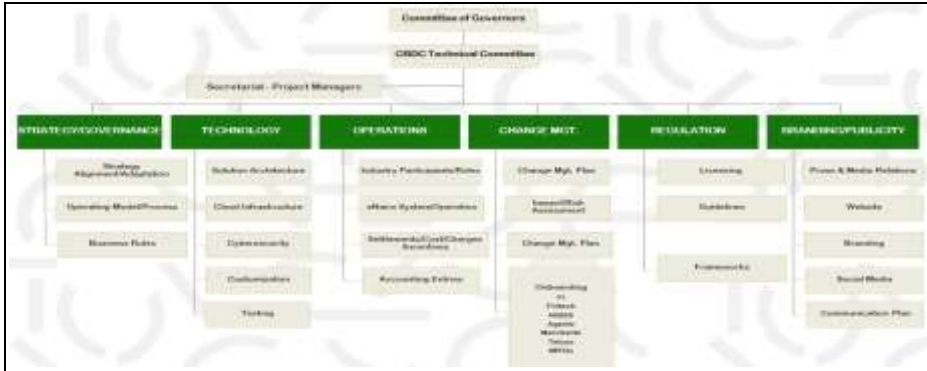
Figure 2.2: Economic, Technology, and Social Factors Driving Adoption of Digital Currency in Nigeria



Source: NCC, EFINA, World Bank, and Statista

The journey to the deployment of the Nigerian CBDC called eNaira started in 2017 with research being conducted on blockchain and DLT, the most viable use case identified from the research was the retail CBDC use case. It was based on this report that a decision was taken by the Management of the CBN to launch a Nigerian CBDC by year-end 2021.

Figure 2.3: Project Giant Implementation Governing Council



Source: Author’s Compilation

The committee developed a Project plan, inclusive of an implementation roadmap for the development, launch and enhancement of the eNaira as shown in Figure 2.4. Likewise, a white paper titled “the eNaira design paper” was released. The paper contains fundamental details in respect of the eNaira project⁷.

Figure 2.4: The Nigerian CBDC Roadmap



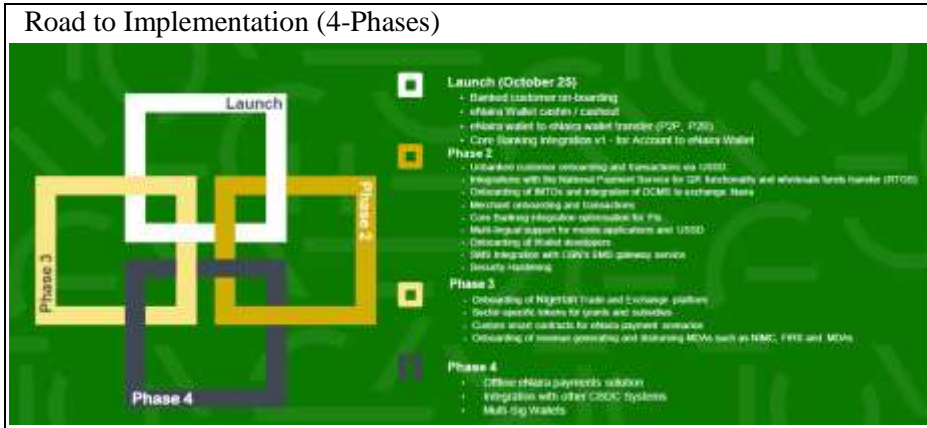
Source: Authors’ Compilation

The deployment and implementation of the eNaira follows a phased approach as stipulated in the eNaira Design Paper. Figure 2.5 illustrates the four phases of implementation. As of September 2022, the eNaira project was in its second

⁷ See <https://www.enaira.gov.ng>

phase of implementation which focuses on the onboarding of prospective unbanked users.

Figure 2.5: Phased Implementation Plan for eNaira



Source: CBN, 2021

2.1 Design Objective and Principles

The design and objectives of the eNaira, as stated in the design paper for the eNaira, were guided by internal reports and also by the Bank of International Settlement (BIS), International Monetary Fund (IMF), and World Economic Forum (WEF) CBDC policy-making toolkits. From a broad perspective, the objective behind designing the eNaira is to provide a fast, efficient, and reliable means of payments for businesses and households across and outside the country, while benefiting from a resilient, innovative, inclusive, and competitive payment system. This objective is hinged on three (3) fundamental principles echoed by BIS about introducing a CBDC by a central bank (Group of central banks, 2020). These principles are:

- i. Do No Harm
- ii. Co-existence
- iii. Innovation and efficiency

Figure 2.6: Objectives and Expected Benefits of the eNaira

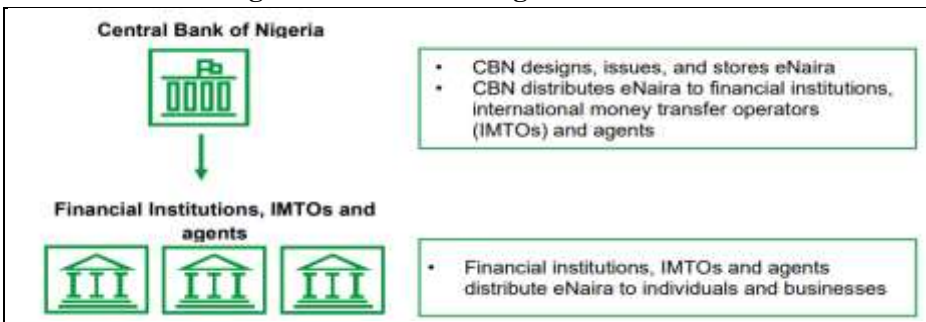


Source: CBN, 2021

2.2 eNaira Design Architecture

The CBN opted for a hybrid CBDC, referred to as two-tiered retail CBDC architecture. This design decision also emanates from the above-mentioned design principles and is one of the main factors that aided the quick adoption and launch of the eNaira. The apex bank decided to maintain the existing operational structure with the Financial Institutions (FIs), where CBN mints, issues and distributes the eNaira to FIs, while the FIs issue eNaira to the public.

Figure 2.7: eNaira Design Architecture



Source: CBN, 2021

Adopting the two-tiered CBDC ensured that the existing operational model with FIs was not disrupted and the eNaira complemented cash, thereby co-

existing with other forms of money and creating a layer for innovation and efficiency from the FIs and Fintechs.

2.3 Regulatory Considerations

Following a rigorous consideration of key areas such as regulation, compliance with Anti-Money Laundering/Combating the Financing of Terrorism (AML/CFT), Privacy, data protection, among others, a guidance note around the eNaira was issued by the CBN issued before the launch of the eNaira. Some specifics around regulation include:

- i. Compliance with AML/CFT:** The eNaira payment system complies with AML/CFT guidelines to ensure the integrity of the financial system. The eNaira system is designed in line with AML/CFT guidelines to guide against illicit flow and money laundering. The CBN adopted an account based CBDC to ensure compliance. Here, CBN will be able to identify users on the platform using unique key identifiers such as BVN and NIN. Also, a wallet-tiered structure was introduced for the eNaira platform.
- ii. Privacy and Data Protection:** The eNaira system is built with deep considerations around privacy and data protection and complies with the National Data Protection Regulations (NDPR). The customer linking process is a core aspect of the user onboarding process to access eNaira. The linking process enables financial institutions to support users and carry out functions such as AML/CFT checks.
- iii. Interest Bearing:** Since the eNaira was designed as a digital representation of the physical naira, it will not earn interest. This aligns with the CBN's objectives for the eNaira to complement existing banking products and services and not destabilize the existing system. The eNaira shares the same characteristics as the physical Naira, including its value. Thus, the conversion rate for the eNaira to cash is at par.

- iv. **Wallet Tier and Transaction Limit Structure:** The eNaira is an open system accessible to all Nigerians (home and abroad) based on a tiered-Know-Your-Customer (KYC) structure as shown in figure 2.8. The tiered-KYC structure ensures that Bank Verification Number (BVN) and National Identity Number (NIN) serve as a unique identifier, therefore, each eNaira Speed wallet is tied to a BVN or NIN.

Figure 2.8: Tiered KYC structure

Individual Wallet Tier					
Tiers	Category	Requirement	Daily Transaction Limit (NGN)		Daily Cumulative Balance (NGN)
0	Non-Bank Account Holders	Telephone number (awaiting NIN verification)	20,000		120,000
1	Non-Bank Account Holders	Telephone number (NIN verified)	50,000		300,000
2	Bank Account Holders	BVN	200,000		500,000
3	Bank Account Holders	BVN	500,000		5,000,000

Merchant wallet Tier					
Category		Requirement	Daily Transaction Limit (NGN)		Daily Cumulative Balance (NGN)
			Send	Receive	
Bank Account Holders		BVN, TIN and Bank confirmation	No Limit	No Limit	No Limit (with auto sweep trigger)

Source: CBN, 2021

Also, risks associated with the deployment of CBDC were evaluated and adequate measures were put in place to mitigate these concerns, like the risk of intermediation, cyber security, loss of privacy, and interoperability risk.

2.4 The Technology

The emergence of CBDC is underpinned by its unique characteristics & features, and the underlying Blockchain and Distributed Ledger Technology (DLT). Blockchain is a system in which a record of transactions made in digital currencies is maintained across several computers that are linked in a peer-to-peer network. While a Distributed Ledger (DL) is a consensus of replicated,

shared, and synchronized digital data geographically spread across multiple sites, countries, or institutions.

The choice of a technology partner was based on some critical evaluation criteria, which included; Technology ownership and control, Support for AML/CFT, Platform Security, Interoperability, Efficiency and ease of adoption, and Experience in the deployment of a CBDC and implementation timeline. After a rigorous and thorough evaluation, Bitss Inc was chosen as the technical partner for the project.

The eNaira infrastructure is built on the Hyperledger Fabric platform, powered by Linux, which is an open-source community. The Hyperledger Fabric is a distributed ledger solution that provides modular architecture, delivering high confidentiality, integrity, availability, resiliency, flexibility, and scalability. The system is designed to support the pluggable implementation of different components and accommodate complexity and intricacies across the payment ecosystem. The Hyperledger fabric platform supports the objectives of the eNaira provisioning of:

- i.** Permissioned System
- ii.** Strong Identity Management system
- iii.** Privacy and Confidentiality
- iv.** Chain code Functionality
- v.** Modular Design
- vi.** Efficient processing and scalability

The solution built on this platform for the management and administration of the eNaira is called the eNaira Digital Currency Management System (DCMS), with FIs interacting on a module within the system called Digital Currency Operations Manager (DCOM), while end-users operate the eNaira Speed Wallet (Speed app) which is publicly accessible via the Android play store and Apple IOS store respectively.

Figure 2.9: Hyperledger Fabric Technology Stack for eNaira Platform

IDENTITY MANAGEMENT	PRIVACY AND CONFIDENTIALITY	CHAINCODE FUNCTIONALITY	MODULAR DESIGN	EFFICIENT PROCESSING
<ul style="list-style-type: none"> Hyperledger Fabric provides a membership identity service that manages user IDs and authenticates all participants on the network. Access control lists are used to provide additional layers of permission through authorization of specific network operations. For example, a particular user could be permitted to invoke a chaincode application, but blocked from deploying new chaincode. 	<ul style="list-style-type: none"> Hyperledger Fabric enables competing business interests, and any groups that require private, confidential transactions, to coexist on the same permissioned network. Private channels are restricted messaging paths that can be used to provide transaction privacy and confidentiality for specific subsets of network members. All data, including transaction, member and channel information, on a channel are invisible and inaccessible to any network members not explicitly granted access to that channel. 	<ul style="list-style-type: none"> Chaincode applications encode logic that is invoked by specific types of transactions on the channel. System chaincode is distinguished as chaincode that defines operating parameters for the entire channel. Lifecycle and configuration system chaincode defines the rules for the channel. Databases and validation system chaincode defines the requirements for endorsing and validating transactions. 	<ul style="list-style-type: none"> Hyperledger Fabric implements a modular architecture to provide functional choice to network designers. Specific algorithms for identity, consensus and encryption, for example, can be plugged in to any Hyperledger Fabric network. The result is a universal blockchain architecture that any industry or public domain can adopt, with the assurance that its network will be interoperable across market, regulatory and geographic boundaries. 	<ul style="list-style-type: none"> To provide concurrency and parallelism to the network, transaction execution is separated from transaction ordering and commitment. Executing transactions prior to ordering their results, each peer node to process multiple transactions simultaneously. The concurrent execution increases processing efficiency on each peer and accelerates delivery of transactions to the ordering service.

Source: CBN, 2021

2.5 Channels for Accessing eNaira and Use Case

As of September 2022, there were three (3) channels to access the eNaira by end-users:

- i. eNaira Speed Wallet (publicly available on android and iOS phones)
- ii. eNaira web wallet (www.mywallet.enaira.gov.ng)
- iii. USSD Short code (*997#)

eNaira Speed Wallet: the eNaira Speed wallet was designed to enable existing banked customers with internet-enabled mobile phones to sign up and conduct transactions on the eNaira platform. The key identity is the BVN, and users are expected to register an account during the sign-up process. Key functionalities of the eNaira speed wallet include:

- i. Banked Customer onboarding
- ii. Electronic exchange of bank deposits and eNaira
- iii. eNaira wallet Transaction (P2P, P2B)

Figure 2.10: Features of the eNaira Speed Wallet

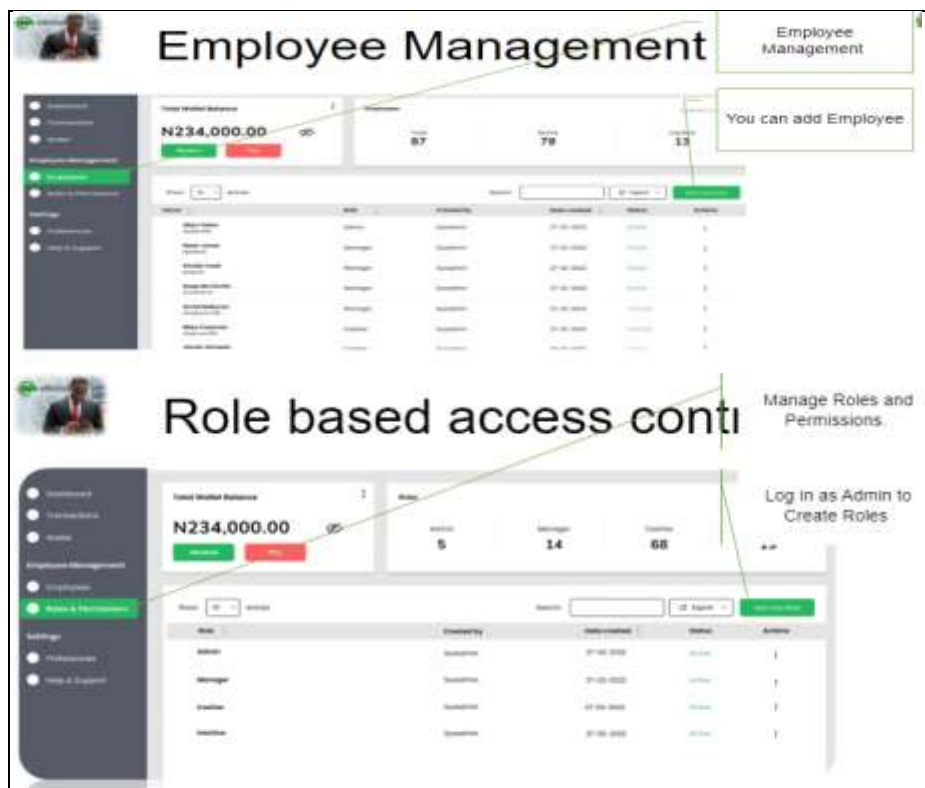


Source: Author's Compilation

eNaira web wallet: The eNaira Web Wallet was introduced as part of phase 2 implementation plans, it is available for both consumers & merchants and is publicly accessible on the internet via the link <https://mywallet.enaira.gov.ng>, the eNaira Web Wallets allows user to register, sign in and conduct transactions.

The eNaira Web Wallet design was tailored to suit merchants and business owners, it provides opportunities for a merchant to connect their internal operations via APIs and allows multi-level signatories. It also has an employee management console, which enables merchants with multiple branches to open a unique wallet for each branch's operations. Likewise, a role and permission button enable the merchant to assign appropriate roles and permission to its employees based on their needs.

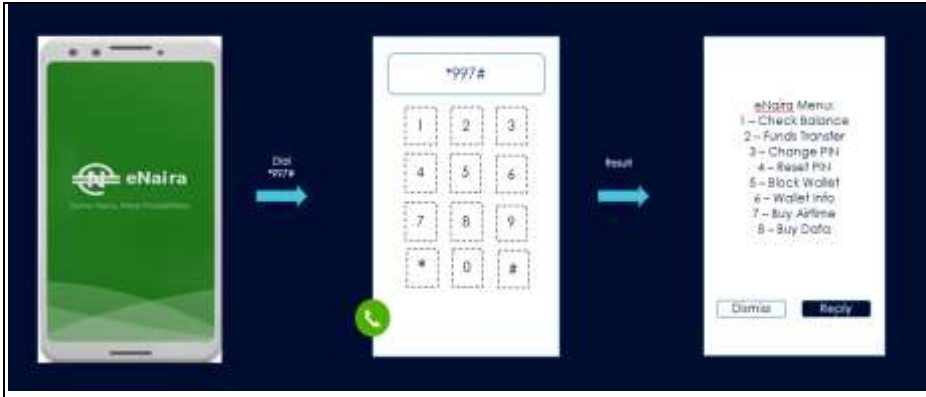
Figure 2.11: Employee Management and Role & Permission Features of eNaira Web Wallet



Source: Authors Illustration

USSD Short Code (*997#): Financial inclusion is one of the objectives of the eNaira; while Phase 1 of the project focused on the banked population, phase 2 of the project sees a shift in focus to the unbanked population with the introduction of the USSD services for onboarding of tier 0 and 1 customer. The eNaira project team got approval from NCC to use the 997 USSD shortcode for this service; additional services on the USSD shortcode include the purchase of airtime and data, funds transfer, eNaira wallet top-up, balance inquiry, change and reset the PIN, block wallet, and wallet info. It is expected that the launch of the eNaira USSD short code services will help drive the financial inclusion goal of the nation and positively impact the economy.

Figure 2.12: eNaira USSD Short code (*997#)



Source: Author’s Illustration

The availability of access channels to the eNaira platform has followed the development of the use cases, Figure 2.13 shows the status of use cases on the eNaira platform.

Figure 2.13: eNaira Use Cases



Source: Author’s Illustration

3.0 Achievements, Challenges, and Opportunities

The eNaira journey so far has been characterized by successes and challenges.

3.1 Success Achieved

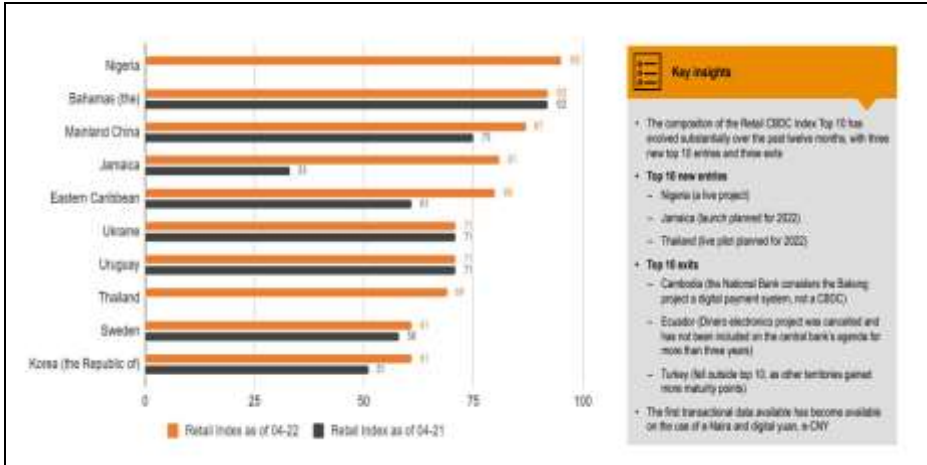
Before the release of the eNaira Speed Wallet application to the public on the 25th of October 2021, notable efforts were undertaken to ensure the successful launch of the eNaira. Some of these efforts included the integration of financial institutions in Nigerian onto the eNaira platform as well as the minting of the first batch of eNaira worth ₦500.00 million on the 2nd of October 2021.

The following successes have been achieved following the launch of the eNaira as of October 2022:

- i.** Full integration of 33 banks onto the eNaira platform.
- ii.** The Bank has successfully minted ₦3.00 billion.
- iii.** Issuance of about ₦2.10 billion in eNaira to financial institutions.
- iv.** About 1.0 million (919,000) customers have been onboarded.
- v.** Successful registration of over 3,305 merchants on the eNaira platform across the country
- vi.** Over 700,000 transactions amounting to about ₦8.00 billion have been recorded on the platform.

These accomplishments were further echoed by a PwC CBDC Global Index report released on the 4th of April titled “*The race to digital money is on*”. The report stated that overall, retail CBDC projects across the globe had reached greater maturity levels in comparison to the wholesale project, while the Retail projects in the Index are led by the Central Bank of Nigeria's (CBN) eNaira, the first CBDC in Africa, and the Sand Dollar, issued by the Central Bank of the Bahamas as legal tender in October 2020, making the Bahamas the first country to launch a CBDC (PwC, 2022).

Figure 2.14: Top 10 Retail CBDC Projects



Source: PwC Global CBDC Index, 2022

Furthermore, implementing the eNaira has put Nigeria in the global spotlight as one of the pioneers in deploying a CBDC into live production. This has continued to attract the interest of global stakeholders such as the IMF, World Bank, other Central Banks, and the CBDC community.

In addition, the CBN has become a hub for experience sharing with the CBDC Community. Most recently, delegates from the Bank of Uganda (BoU), Reserve Bank of Zimbabwe, and Bank of Ghana were at the CBN headquarters on an eNaira experience study tour, while other countries have also expressed interest in having a similar tour. The CBN has also played key roles as panelist and presenter in several international CBDC conferences. These cements CBN as a global leader in the CBDC spectrum.

3.2 Challenges and Lessons Learnt

While celebrating the successes achieved on the project and the global recognition of the achievements recorded by the CBN, it must be acknowledged that the journey was not been smooth as some challenges have been encountered in the process.

i. Challenges with Onboarding of users

The unique identifier for banked customer onboarding at go-live was the BVN. However, immediately after the launch, many customers trying to onboard were stuck as their BVN details didn't have a valid email or active phone number. The email and BVN tied to their BVN were supposed to receive an activation code for registration.

Table 2.1: BVN Statistics as at end November 2021

SN	Category	Count	Percentage
1.	BVNs with email addresses	5,760,945	11.46
2.	BVNs with phone numbers.	49,756,132	98.94
3.	BVNs with either email or phone no.	49,767,699	98.96
4.	BVNs with both email and phone no.	5,749,378	11.43
5.	Total BVN	50,288,882	

Source: NIBSS

The statistics above reveal that only 11 percent of users registered their BVN with email and phone numbers.

The CBN reacted swiftly to the challenge of email and phone numbers of customers not corresponding to their BVN details by releasing an app update (Speed 2.0 – Cowry 1) which enabled the users to onboard with any email and phone number of their choice. Subsequently, the user who had their BVN locked in because of the BVN issues were cleared and promptly contacted to register again. The CBN also urges banks to update their customer's BVN details on the ICAD database and there is an ongoing attempt to have a bank-wide KYC service on DLT.

ii. Adoption Rate

Another key challenge is the low adoption rate across the country largely due to the low literacy level in the country. However, CBN has engaged partner

agents across the country to help drive advocacy and adoption of the eNaira. Likewise, mobile money operators are now on board the platform and driving the adoption of the eNaira in the under-served and rural areas of the country.

3.3 Opportunities

The eNaira project team began taking steps towards harnessing the opportunities provided with the implementation of the eNaira, some strategic stakeholder engagements are ongoing, and it is expected to boost the acceptability and usability of the eNaira nationwide:

i. Ministry of Humanitarian Affairs

A Memorandum of Understanding (MoU) was signed between the CBN and the Ministry of Humanitarian Affairs, Disaster Management and Social Development (FMHADMSD) on the delivery of digitized payment to beneficiaries in the second phase of the project tagged “NASSP-Scale up” under the Conditional Cash Transfer Program (CCTP). This resulted in the creation of over 16million wallets for beneficiaries under the scheme.

ii. Ministry of Finance/Office of the Accountant General of the Federation

Discussions are ongoing for the eNaira platform to be integrated into the Treasury Single Account (TSA) to facilitate collections and disbursements of government funds.

iii. FinTechs

The Bank has also opened an innovation layer on the eNaira platform for FINTECH companies to develop innovative ideas that can ride on the eNaira platform to enhance service delivery in the payment ecosystem and to reach out to the unbanked population.

iv. Payment Service Banks (PSBs)

PSBs are expected to leverage mobile and digital channels to enhance financial inclusion and stimulate grassroots economic activities through financial services. Based on the strategic advantages of PSBs, the Project Giant team has

engaged and opened some APIs for the integration of PSB onto the eNaira platform

v. Association of Licensed Mobile Payment Operators (ALMPCO)

Mobile Money Operators (MMOs) have a deep reach to rural areas and were identified as major stakeholders in the success of the eNaira in achieving the aim of financial inclusion. They have been engaged and API integration is currently ongoing.

vi. Shared Agent Network Expansion Facilities (SANEF)

SANEF is an initiative of the CBN, supported by DMBs, NIBSS & Licensed Mobile Money Operators/Shared Agents, and was created to deepen Financial Inclusion in Nigeria through a robust ecosystem with strong regulatory oversight and consumer protection and an interoperable system. The eNaira project leverages the existing SANEF platform to reach out and reinforce the financial inclusion efforts ongoing in the country.

vii. Payment Solution Service Providers (PSSPs):

Top players in this space have been engaged and APIs shared with them for integration into the eNaira platform. They will play a significant role as solution service providers and make available the option of making payments with eNaira on their respective platforms.

viii. Cross-border Payment Settlement Solution

The eNaira project team collaborates with the African China project on a cross-border payment settlement solution between the eNaira and the digital yuan (e-CNY). The collaboration is at the advanced stages with the conduct of Proof of Concept (PoC).

4.0 Conclusion and Recommendations

CBDCs are gaining prominence globally as the race to the digitisation of economies continues. The CBN has blazed the trail in deploying the first CBDC in Africa, the eNaira, as a tool to achieve policy objectives of financial inclusion and payments system efficiency, among others. However, to

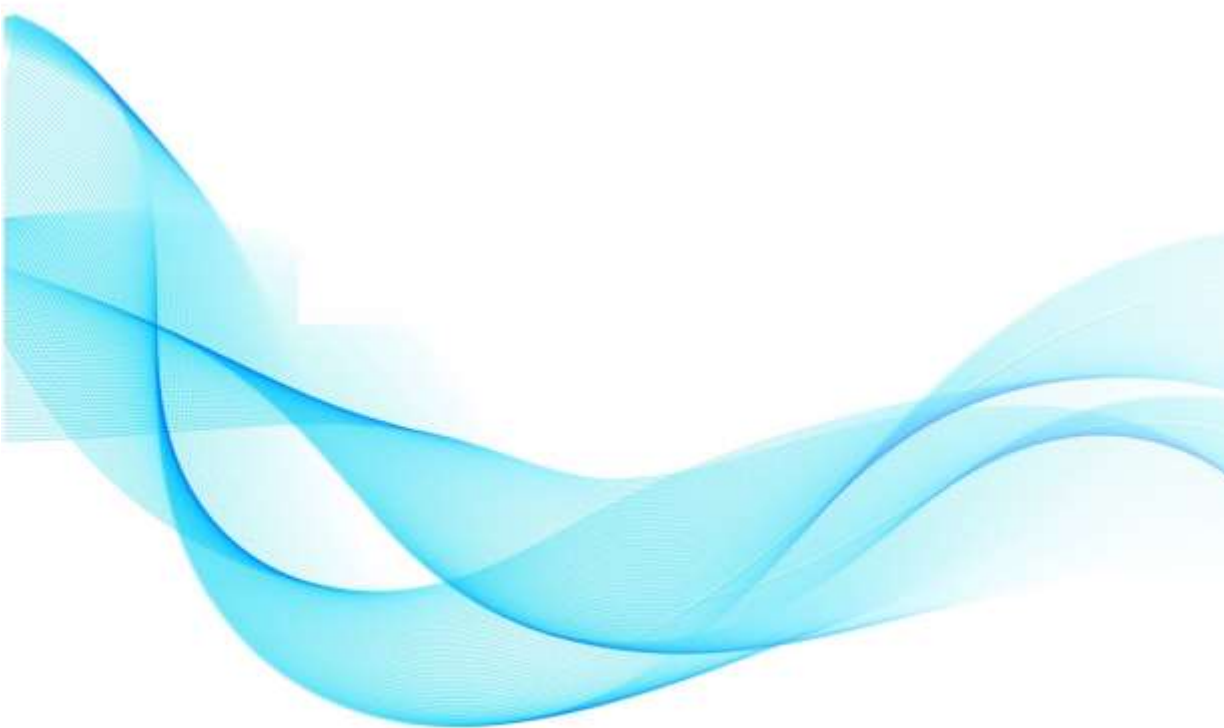
consolidate on the progress made so far, there is need for greater collaboration with stakeholders, especially around cross-border payments. In addition, there is a need for continuous engagement and sensitisation on the usage and value propositions of the eNaira. This would help drive the adoption and accomplishment of the set objectives for introducing the eNaira.

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PART 2

MONETARY POLICY AND LIQUIDITY MANAGEMENT



CHAPTER THREE: IMPACT OF eNAIRA ON THE DEPOSIT LIABILITIES OF BANKS IN NIGERIA.

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Abstract

The adoption of CBDC in recent times has been a subject of importance to most central banks, especially regarding the impact it has on the structure of deposits in the financial system. This study, therefore, analyses the impact of the eNaira on transferable deposits in Nigeria using a scenario-based approach. The results show that the current volume and adoption rate of eNaira does not exert a sizeable impact on the transferable deposits of banks. However, as the volume of the eNaira in circulation increases, transferable deposits are seen to decline slowly. The results stress the fact that interest payments would make the eNaira more attractive and cause a shrinking in the level of deposits in banks. The study recommends that the Central Bank of Nigeria sustains efforts towards increased adoption of the eNaira to drive financial system stability and update the existing macro-prudential guidelines to cover extension of credit through the eNaira.

Key Words: central bank digital currency, banks, eNaira.

JEL Classification: G13, E41, E51, G21.

1.0 Introduction

The advent of privately issued digital currencies fueled concerns about financial system stability and monetary policy efficacy. As a result, most central banks are either implementing or researching Central Bank Digital Currencies (CBDCs) (Linda et al., 2020; Kshetri, 2021; Mei et al., 2019). Buttressing the above assertion, a survey revealed that 86 per cent of 60 central banks were exploring CBDCs, with the Central Bank of the Bahamas (CBB) being the first to launch a CBDC, known as the “sand dollar,; in October 2020” (BIS, 2020; Kshetri, 2021).

Empirically, several works on CBDC, bordering on the choice of technology, interest rate bearing, opportunities, and challenges exist. Most available studies

focused on the essential qualitative analysis of CBDCs and their various features (Olga et al., 2017; Kochergin, 2021; Cunha et al., 2021; Li & Huang, 2021). They centered their discussion on conceptual issues in CBDC such as definitions, features, classifications, main models, implications of different variants of CBDC and potential advantages and risks of its emergence. The studies were optimistic about the introduction of CBDC, Olga et al. (2017), recommend the strategy of gradual testing and implementation which would minimise the potentially large disruptive costs to the current financial architecture and credit markets.

Other studies focused on the design and technological innovation of CBDCs (Lee et al., 2021; Qian 2019). Sun et al. (2017) suggested a multi-blockchain data centre model for CBDCs to help central banks manage the issuance of currency, prevent double-spending issues, and protect user privacy. On the other hand, Qian (2019) proposed a CBDC issuance framework designed for forward contingencies to ensure that the currency does not circulate beyond the real economy. The issue surrounding security and privacy of CBDCs were also investigated.

Several studies have investigated the implications of CBDCs for payment system, monetary policy, and financial stability (Berentsen & Schar, 2018; Barrdear & Kumhof, 2021; Keister & Sanches, 2021). They supported the introduction of CBDC, arguing that implementing monetary policy using CBDC would be more transparent. Keister and Sanches (2021), however, revealed that CBDC could crowd out the financial intermediation function of commercial banks. But Brunnermeier and Niepelt (2019) noted that the risk of disintermediation could be circumvented if the central bank can channel funds back to the commercial banks, in which case, CBDCs will not necessarily disintermediate them.

Further arguments in favour of CBDC by Andolfatto (2019) revealed that CBDC could lead to more financial inclusion, a higher deposit rate and more bank deposits, agreeing with the position of Chiu et al. (2018) that a CBDC

could limit banks' market power and increase deposit rate, bank deposits and bank lending.

In a bid to support the goal of fostering greater financial inclusion via the digital channels, the Central Bank of Nigeria launched the eNaira, on October 25, 2021. The eNaira is also expected to support cross-border payments and provide a reliable medium for remittance inflows into the country. It, therefore, becomes imperative to investigate the impact of the eNaira on the deposit liabilities of deposit money banks (alternatively termed other depository corporations (ODCs), commercial banks, or banks). The study therefore sets out to answer the following questions: Would the eNaira be a replacement for transferable deposits? What is the impact of the eNaira on deposit liabilities of the banks?

Against the foregoing background, this paper seeks to examine the impact of the eNaira on the deposit liabilities of banks in Nigeria. Following this introductory Section, Section two presents conceptual issues on the types and models of CBDCs, while Section three reviews the theoretical literature related to the subject matter. Section four presents a brief on the eNaira, focusing on design choices, the model adopted and trend in terms of adoption and usage. Section five analyses the impact of the eNaira on the deposit liabilities of banks within a scenario-based framework while Section six concludes.

2.0 Conceptual Issues

Digital currency is often referred to as currency, money, or any assets with the characteristics of money that is predominantly stored, managed, and traded on computer systems, particularly over the internet. It is broadly classified into centralised and decentralised digital currencies. The privately issued digital currencies, like Bitcoin, belong to the decentralised category, while central bank digital currency (CBDC) issued by central banks are classified as centralised currencies.

CBDCs are fiat currencies issued by central banks for different reasons, including but not limited to financial inclusion, increase in the availability and

usability of central bank money, improved cross-border payments, and the need to enhance resilience of payment system. The design of CBDC varies from country to country based on certain factors such as types, architecture, infrastructure, access, and whether they are interest bearing.

2.1 Types of CBDC

2.1.1 Wholesale CBDC

A wholesale CBDC is created for financial institutions holding reserve deposits with the central bank. It is done with the aim of improving payments and securities settlement efficiency, as well as to reduce counterparty credit and liquidity risks. A value-based wholesale CBDC is aimed at replacing or complementing reserves at the central bank with a restricted-access digital token. The token would be a bearer asset, by implication, during the transaction the sender would transfer value to the receiver without intermediaries. This would be something fundamentally different from the current system in which the central bank debits and credits the accounts without transferring actual values. The wholesale CBDC is seen as the most popular proposal among central banks because of the potential to make existing wholesale financial systems faster, less expensive, and safer (Neeta, 2020).

2.1.2 Retail CBDC

This is the category targeted at the public with the features of anonymity, traceability, and all-day availability. The retail proposal is relatively popular among central banks in emerging economies, motivated to take advantage of the rapidly emerging fintech industry, promote financial inclusion by accelerating the shift to a cashless society, and reduce cash printing and handling costs (Neeta, 2020).

2.2 Architecture

2.2.1 Direct model

Under the direct model, customer accounts and all services relating to CBDC payments are domiciled and handled by the central bank. This model eliminates the reliance on intermediaries, and it is most often considered attractive due to its simplicity. However, a major effect of this model would be a reduction in

bank deposits as money is moved to CBDC with the disposal of intermediaries (Gregory, 2021).

Some of the drawbacks of the direct model include the broad number of administrative responsibilities it poses to a central bank such as account opening, dispute resolution, transaction verifications, provision of account balances and anti-money laundering monitoring among others, which could bring some ambiguity to its major functions and require a tremendous increase in the workforce of the central bank to achieve these functions. There would also be a loss of access to data associated with processing transactions by the financial sector. As a result, most central banks, including the Central Bank of Nigeria find the direct model unfeasible and ineffective due to its numerous demerits and as such do not subscribe to it (Gregory, 2021).

2.2.2 Indirect or two-tier model

In an indirect model, account holders do not deal directly with the central bank. There is the presence of intermediaries (bank or non-bank) who warehouse the accounts -usually digital wallets- of the customers, where their CBDCs are held. The responsibility of providing CBDC when demanded by the customers rests with the intermediary and not the central bank under this model. Though, the central bank tracks the wholesale CBDC balances of the intermediaries. This relieves the central bank of the obligation to provide banking services.

The intermediaries are expected to hold equal amounts of CBDC in the central bank as the consumers hold with them in their wallets to guarantee that they will always meet the demands for CBDC from their customers. Accordingly, intermediaries cannot leverage on the CBDC holdings of customers in its custody, unlike cash deposits which banks can utilise for loan purposes. In essence, CBDCs on deposit at a bank would offer no funding for that bank to create credit or provide other types of financial intermediation. This is a similar case with the direct model (Gregory, 2021).

Most central banks, the Central Bank of Nigeria inclusive, adopt the indirect model architecture for their CBDC (eNaira) because it aims not to disrupt the

existing financial system structure in which banks perform the crucial role of intermediation.

2.3 Token-based or Account-based CBDC

The need to authenticate the CBDC accounts by those holding or spending the CBDC is indifferent to whether a direct or indirect infrastructure, centralised or distributed technology is chosen. To have access to the account, the holders need to be authenticated. This can be done through token-based or account-based systems.

2.3.1 Token-based system.

A token-based system would make the CBDC most equivalent to “digital cash” because, like a banknote, it would be a bearer instrument and could be transferred with secrecy. A token-based system could take the form of a general-purpose token targeted at retail transactions, or a wholesale token used only for wholesale and settlement transactions. The choice of either would be based on public key cryptography, with the owner holding the private key which conferred the right to ownership of the CBDC. Tokens could be held in digital wallets or accounts. This, however, comes with some challenges such as loss or theft of the private key which would allow criminals have access to the holder’s wallet. Loss or theft of the private key would allow criminals to fraudulently withdraw holders money irrevocably and to use it untraceably. And there would be no recourse for the holder. Again, this is a major reason people historically have wished to hold commercial bank money in lieu of physical cash (Gregory, 2021).

2.3.2 Account-based or identity-based system

The substitute to a token-based system is an account-based system, like commercial banking where the CBDC is attached to a particular owner and tracked as it passes from one owner to the other. Banks and other companies would retain relationships with clients and intermediate payments, although in CBDC rather than commercial bank money (Gregory, 2021).

2.4 Interest-bearing CBDC

The decision to pay interest on CBDC by the central bank is irrespective of whether it is account-based or token-based. This could make CBDC attractive compared to commercial bank money. Worthy of note is the fact that, if the central chooses to pay interest on CBDC, that rate would determine the interest rates that banks would offer on customers' deposits. This backs up the belief that CBDC and bank deposits are close substitutes. Therefore, a bank that offers lower interest rate than CBDC rate would probably experience significant deposit outflows. Conversely, a bank could probably attract deposits by offering an interest rate only slightly above the CBDC rate, aside from other competitive pressures. Thus, the CBDC rate would serve as a floor and suggest a ceiling for bank deposit rates. However, it is argued that during economic crises, businesses and consumers would prioritise liquidity and absolute safety over rate, hence, the competition over rate with CBDC by banks would diminish (Gregory, 2021).

3.0 Theoretical Underpinnings

The seminal work of Schumpeter (1934) was the first to put forth a convincing statement on the theory of financial intermediation. He argued that financial intermediation is an essential factor propelling the growth of the economy, though, using the term “banker” in place of the modern term “financial intermediation”. According to him, the banker stands between those with new ideas and innovation and possessor of productive means. He (the banker) makes possible the carrying out of new combinations, approves people, in the name of society as it were, to form them.

Tapen (2001) buttresses Schumpeter's view, noting the existence of information asymmetry in the market which necessitates the role of financial intermediation. Information asymmetry creates some basic problems; firstly, the problem of savers searching for investors in need of funds creates intermediation costs. Intermediation costs arise when financial institutions search for investors and convert savings into stocks and bonds thereby incurring processing charges. . Secondly, risks associated with investment projects vary. Large projects carry large risks, while small projects carry small risks. These

are popularly known as the problems of adverse selection and moral hazard. This theory is essential and adopted for the study because it brings to limelight the essential function the DMBs perform by receiving deposits from the surplus unit (depositors) and spreading same to the deficit unit (borrowers) which further buttresses the questions this study tries to answer, that is, the question of....

4.0 A Brief on Nigeria's CBDC - the eNaira

The interest to deploy CBDCs by central banks across the globe has increased significantly, following the surge in the use of electronic payments, which was occasioned by the outbreak of the COVID-19 pandemic. The deployment of a CBDC is highly dependent on the strength of the existing payment system in a country, design choices as well as the implementation framework. Furthermore, demand for CBDCs would depend largely on the level of importance different users attach to the CBDC, considering the various advantages relative to such other options as cash, bank deposits, e-money, and other tokens. (Group of Central Banks, 2021a, 2021b). Some of these advantages include safety, ease of access, interoperability, privacy, and reduced transaction costs.

Over the years, the Nigerian payment system has evolved significantly on the back of clearly thought-out policies and regulations by the CBN towards ensuring a safe, credible, and secure payment system that would drive economic activity, including the cashless policy, bank verification number, and shared agent network expansion facility, among others. These efforts have brought about a rise in electronic payments, as the total transactions on electronic platforms increased by 81.4 per cent from ₦18.30 trillion in February 2021 to ₦33.20 trillion in August 2022 (NIBSS, 2022). The Nigerian economy is currently transiting to a digital economy driven by the National Digital Economy Plan and Strategy (2020 – 2030) and, thus, the deployment of a digital currency would assist in fueling economic activity.

Consequently, the CBN launched Nigeria's CBDC (eNaira) in October 2021 with the goal of maintaining monetary and financial stability by bringing

stability, efficiency, and resilience to the Nigerian payment system to reduce cash processing costs and promote financial inclusion. The eNaira being a digital form of the traditional naira and a substitute for physical cash in circulation (currency outside depository corporations) carries the same value as the Naira and is exchanged 1:1. The eNaira has advantages over traditional cash to consumers including that it:

- is more convenient to use and has no transaction fees compared to the high circulation cost of cash;
- requires less transaction information;
- reduces credit and liquidity risk; and
- offers a safer payment option.

Therefore, it could compensate for the inadequacies of the less digitised payment system and replace traditional cash in the future, as individuals and merchants continue to appreciate these benefits and the rate of adoption increases, necessitating an increase in the total volume of eNaira issued for circulation. Thus, adopting the eNaira with its several benefits would further bolster other past efforts by the Bank towards achieving a well-digitised economy. According to the (CBN, 2021), the issuance and exchange of eNaira has several elements. These include:

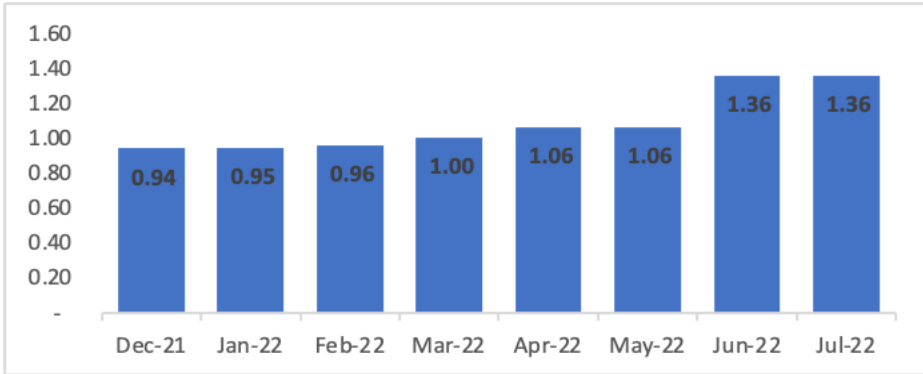
- Users can directly exchange eNaira with the traditional naira (including coins and banknotes), from their deposit accounts;
- The CBN does not distribute eNaira directly to individuals; it only does the issuance to licensed financial institutions because it adopts a two-tier operational model. The distribution to individual accounts is done by banks through their eNaira treasury and branch wallets held at the CBN;
- Users can transfer from their eNaira wallet to another eNaira wallet and between their eNaira wallet and bank accounts.

The elements of issuance and exchange which are listed in the foregoing have different implications for the structure of deposits in the Nigerian financial

system, especially the deposit liabilities of commercial banks. This is because the funds converted by customers from their existing bank deposits into eNaira would not be available for banks to utilise for lending activities, as the wallets are domiciled with the CBN. Since its launch, the total amount of eNaira minted by the CBN is ₦2.00 billion naira as of December 2021. However, out of this total, only ₦0.94 billion was in circulation as of December 2021. This increased by 6.4 per cent to ₦1.00 billion in March 2022, then made a significant climb to ₦1.36 billion in June 2022 and remained the same in July 2022. The rather lethargic growth can be attributed to the slow acceptance and adoption of the eNaira by individual users which is evident in the low number of active consumer wallets (wallets carrying out transactions) which stands at 10,420, compared with 187,190 wallets activated for use as of July 2022. This is an improvement from the 6,800 and 171,550 active and activated wallets in May 2022 and 5,090 and 161,120 active and activated wallets in March 2022.

Similarly, the pace of adoption by merchants is slow as shown by the 73 active wallets in July 2022 compared with the 2,068 activated wallets in the period. This is, however, a decline from the 82 and 76 active wallets in May 2022 and March 2022, respectively. The trend in the adoption by merchants depicts that even though the number of activated wallets is increasing (2,068 in March 2022 and 2,730 in May 2022), the number of active wallets is declining. Therefore, the slow growth in the volume of eNaira in circulation is, majorly, due to the low adoption rate, especially by merchants, which dampens the growth in volume of eNaira as active consumer wallets increase. This is because consumers with active wallets do not currently have sufficient outlets to spend their eNaira holdings, hence limiting the transactions motive for the demand for the eNaira.

Figure 3.1: Trend of eNaira-in-Circulation (₦ Billion)

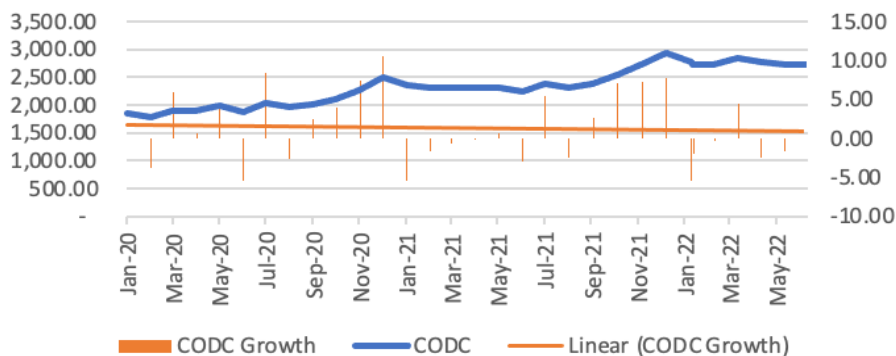


Source: Central Bank of Nigeria

5.0 Impact Analysis of eNaira on the Deposit Liabilities of Banks.

This Section examines the impact of eNaira adoption on the deposit liabilities of Banks' (ODCs). This quest is hinged on the intuition that increased demand and adoption of the eNaira would drive the amount of currency outside depository corporations (CODC) upwards as customers embrace its safety and cost minimising features, even though the eNaira was designed to co- exist with cash and complement it. CODC has exhibited an increasing trend overtime with the rapid development in the Nigerian economy. The total amount of CODC has continued to increase. From ₦820.53 billion in January 2010, it rose to ₦2,721.54 billion in July 2022 (CBN Statistical Database, n.d). However, the increase has been at a declining rate, especially in periods like the COVID-19 era. CODC plunged by 8.2 per cent in January 2020 when the pandemic emerged and further declined by 11.7 per cent and 6.5 per cent in February 2020 and March 2020, respectively, when Nigeria recorded its first case of the virus. The decline shows the increasing substitution effect of the development and increased acceptance of digital payments (debit and credit cards and third- party payments) on cash and further reinforces the consistent efforts by the Bank to minimise cash transactions and prioritise digital transactions, in a bid to improve the efficiency of the payment system and promote financial inclusion.

Figure 3.2: CODC and CODC Growth Rate



Source: Central Bank of Nigeria

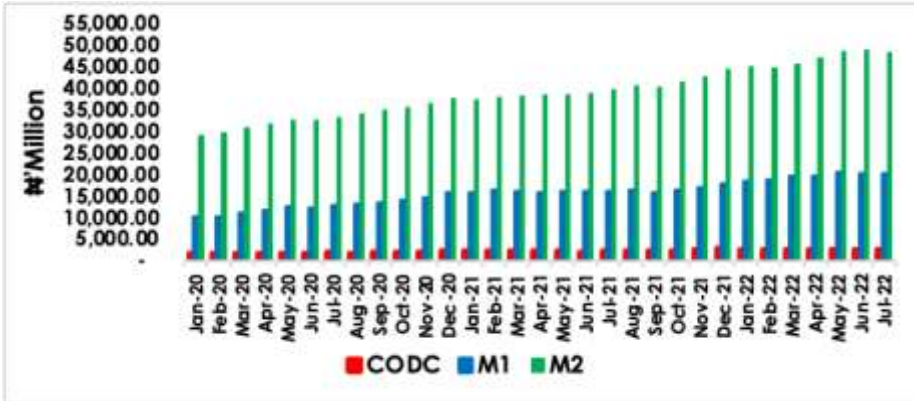
Since the introduction of the eNaira into circulation in October 2021, it is observed that CODC generally maintained its existing trend, although at a declining rate. Notably, CODC increased by 4.4 per cent in April 2022 when the eNaira in circulation increased to ₦1.06 billion from ₦1.00 billion in the preceding month, suggesting that there are other factors currently driving CODC and the eNaira has little or no effect on cash at this time. This could be as a result of the low adoption rate and the relatively low volume of eNaira in circulation compared to cash.

5.1 The change in the structure of money demand and the conversion between CODC, M1 and M2.

In recent times, narrow money (M1) and broad Money (M2) supplies in the Nigerian economy have been on the increase. From ₦10,324.56 billion and ₦29,132.38 billion, respectively in January 2020, they rose to ₦ 20,372.77 billion and ₦48,258.49 billion, respectively, in July 2022 (CBN Monetary Survey). Despite the growth in CODC overtime, it accounted for less than 1.0 per cent of M1 and M2 overtime, while transferable deposits and other deposits in banks have accounted for the remaining 99.0 per cent over time. The dominant share of transferable deposits and other deposits in monetary aggregates could be explained by the development of non-cash payment

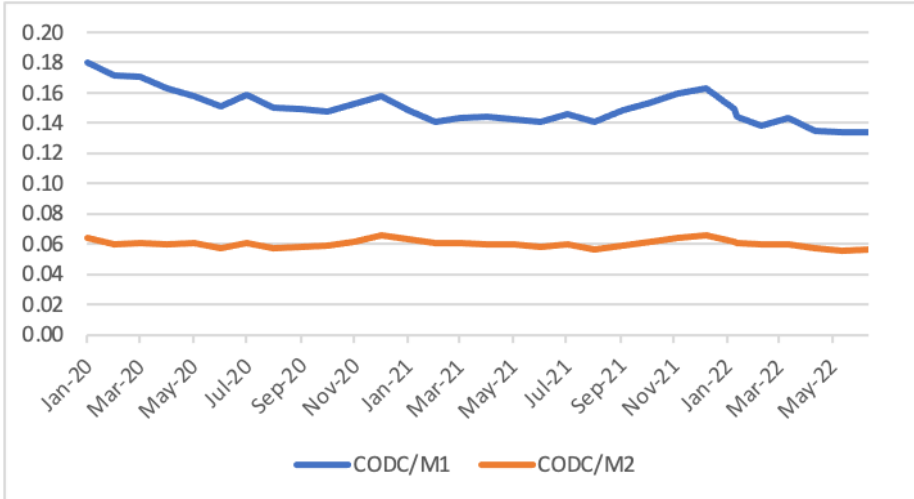
mechanisms which have a strong substitution effect on cash or due to the interest-bearing nature of some deposits.

Figure 3.3: Change in the Structure of CODC, M1 and M2



Source: Central Bank of Nigeria

Figure 3.4: Changing Path of Money



Source: Central Bank of Nigeria

Individuals hold transferable deposits to meet their daily transactions needs. The issuance of the eNaira may likely change the structure of the demand for

money and thus erode transferable deposits in banks because the more eNaira consumers and merchants hold in their wallets, the less deposits that would be held in banks. Notably, transferable deposit still maintained its trend even when eNaira in circulation attained its peak of ₦1.36 billion in June 2022. This could be attributed to the relatively low volume of the total eNaira in circulation, compared with transferable deposits.

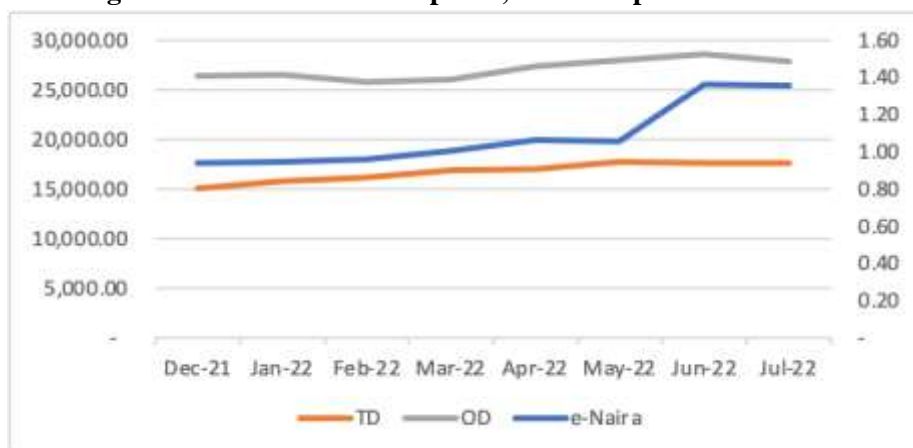
Given the foregoing, it may be safe to assume that the eNaira has not been present long enough to impact transferable deposits yet, but as people's positive perception about the convenience, security, efficiency and ease of use of the eNaira improves, both individuals and merchants will be more willing to take the initiative to convert some transferable deposits into eNaira, thereby causing an increase in the quantum of eNaira in circulation and a decline in the transferable deposits in banks which will reduce their lending capacity. The reduction in the lending capacity of banks could lead to high interest on credit assets, negative impact on banks' cost of funds and profitability and disruption of the existing strategies which they have tailored to the retail market (CBN, 2021).

Furthermore, the eNaira is built on a tiered wallet structure in which most individual wallets which have fulfilled KYC requirements have a transaction and cumulative balance limit of ₦200,000 and ₦500,000, respectively. This could as well water-down the impact the eNaira would have on banks deposits as the volume of transactions that individuals can carry out through their chequable accounts with higher transaction limits of up to ₦5.00 million in some cases and unlimited cumulative balances outweigh that of the eNaira platform, which can serve as a disincentive for adoption by individuals.

Similarly, other deposits (savings, time and foreign currency deposits), which are of a long-term nature, compared to the transferable deposits have also exhibited a rising trend over time. Interest payment is the primary motive of people who hold other deposits. According to Li (2021), interest payment is a vital feature that affects the prospective demand for CBDC and a remunerated CBDC would be an even more attractive substitute for cash, low interest-

bearing deposits, or other cash-substitutes. However, the eNaira is not interest bearing and currently has no evident impact on other deposits due to this reason as consumers may likely not trade off interest payments for convenience and other merits that the eNaira offers. This position may change in the future if the eNaira becomes interest bearing, and it may, most likely, cause a squeeze on the quantum of other deposits in banks.

Figure 3.5: Transferable Deposits, Other Deposits and eNaira



Source: Central Bank of Nigeria

5.2 Scenario Analysis

Having established the current relationship between the eNaira and banks deposit, we proceed to use two scenarios to explore the effect the adoption of the eNaira may have on banks funding in the future under certain assumptions.

5.2.1 Scenario 1

In this scenario, we assessed the impact of an increase in the growth rate of the eNaira in circulation on transferable deposit under the following assumptions:

- The eNaira has a direct impact on transferable deposit.
- The rate of increase in the volume of eNaira is driven by an equal growth in the level of adoption.
- Transferable deposit grows at an average of 2.3 per cent which is the average growth rate of transferable deposit for the period,

(December 2021 to July 2022) covered by the data used for this simulation exercise.

- The volume of eNaira in circulation is deducted from the corresponding value of transferable deposits.

Table 3.1: Impact of an increase in the growth rate of the eNaira

Growth Rate (%) of eNaira	eNaira (₦'Billion)	Transferable Deposits (₦'Billion)
0	1.36	17,651.23
5	1.43	18,048.72
10	1.50	18,048.65
15	1.56	18,048.58
20	1.63	18,048.52
50	2.04	18,048.11

Source: Central Bank of Nigeria

The baseline scenario is the current level of the eNaira and transferable deposits. The result shows that if the eNaira grows by 5.0 per cent from its current level of ₦1.36 billion, transferable deposits will rise to ₦18,048.72 billion, suggesting that a 5.0 per cent increase in eNaira at its current level is not sufficient to trigger a drop in the transferable deposits of banks. This further supports the current low ratio of eNaira to transferable deposits. However, as the rate of increase in eNaira increases, transferable deposits are seen to be declining slowly.

Consequently, a further 10.0 per cent, 15.0 per cent and 45.0 per cent increase in eNaira, will cause transferable deposits to decline to ₦18,048.65 billion, ₦18,048.52 billion, and ₦18,048.11 billion, respectively from its level at a 5.0 per cent increase. This implies that a boost in adoption of the eNaira would lead to a slight erosion of banks deposits in the future, as the amount of eNaira in circulation increases.

5.2.2 Scenario 2

Under this scenario, we evaluated the impact of a rise in the volume of eNaira in circulation on the transferable deposits of banks assuming that:

- The eNaira is interest-bearing.
- The increase in the volume of eNaira is driven by increased adoption due to its interest-bearing nature.
- People convert a portion of their interest-bearing deposits into eNaira, thereby increasing the volume of eNaira in circulation.
- The value of eNaira in circulation is deducted from the corresponding value of transferable deposits.

Table 3.2: Impact of a rise in the volume of eNaira on the transferable deposits

eNaira (₦' Billion)	Transferable Deposits (₦' Billion)
1.36	17,651.23
5.00	18,045.15
10.00	18,040.15
15.00	18,035.15
20.00	18,030.15

Source: Central Bank of Nigeria

On the back of a baseline scenario of the current level of eNaira and transferable deposits, the simulation showed that if the eNaira is increased to ₦5.00 billion, transferable deposits would be ₦18,045.15. However, as the volume increases, transferable deposits exhibit a declining trend. Transferable deposits would decrease by 0.03 per cent if eNaira in circulation is increased to ₦10.00 billion from the baseline and would continue to decline by the same magnitude with further increases in the volume of eNaira to ₦15.00 billion and ₦20.00 billion.

The result from this scenario alludes to the fact that interest payments would make the eNaira more attractive and cause the level of deposits in banks to shrink. Notably, this scenario proves that the eNaira has a more significant impact on banks' deposits when it is interest-bearing relative to when it is not, as the dwindling effect on transferable deposits is larger in this scenario.

6.0 Conclusion and Policy Recommendations

The adoption of CBDC in recent times has been a subject of importance to most central banks, especially regarding the impact it could have on the structure of deposits in the financial system. This paper discussed the effect of the eNaira on the structure of money and the deposits liabilities of banks. It was observed that the CODC maintained an upward trend despite the introduction of eNaira but constituted less than 1.0 per cent of narrow money (M1) and broad money (M2) due to the continued efforts by the Central Bank at digitising the financial system, which caused the increase in CODC to be at a declining rate. This suggests that eNaira may cause a decline in cash in the future as its distinct merits become more appreciated by consumers, hence increasing its adoption.

Similarly, the eNaira presently has no evident effect on transferable deposits and other deposits of banks, majorly because of its relatively low volume and adoption rate by both individuals and merchants. However, it was found that the eNaira would impact banks' deposits in the future as the rate of adoption and the volume of eNaira takes a positive turn. The eNaira would cause a decline in transferable deposits as individuals convert their deposits in banks into eNaira, thereby eroding the deposit liabilities of banks and limiting their capacity for financial intermediation. Also, if the eNaira becomes interest-bearing, it would serve as an incentive to consumers and encourage its adoption. This would have a more significant impact on the deposit liabilities of banks. Against this background, we recommend that:

- The Bank should sustain its efforts towards driving the adoption of the eNaira in a bid to promote financial inclusion, bearing in mind its consequence on the intermediation capabilities of banks.

- The Bank should update the existing macro-prudential guidelines to cover extension of credit through the eNaira to encourage interest-bearing features of the eNaira in the future.
- Policies geared towards encouraging bank lending using the eNaira should be formulated and implemented so as to maintain the existing banking system structure where banks play the role of intermediation.
- The Bank should sustain the monitoring and evaluation of possible consequences of increased adoption of the eNaira on all aspects of the financial system especially Anti-money Laundering (AML)/ Combatting Financial Terrorism (CFT) standards and Cybersecurity framework to guard against financial instability.

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CHAPTER FOUR: IMPLICATIONS OF TRANSACTIONS IN CRYPTOCURRENCIES ON MONETARY POLICY IN NIGERIA

Ezema, C. C., Igue. N. N. and Yunana, N. Z.

Abstract

The study investigates the impact of transactions in cryptocurrencies on monetary policy in Nigeria, with a view to providing guidance on policy direction concerning cryptocurrencies and their possible use for formal transactions in Nigeria. The study employs the generalised autoregressive conditional heteroscedasticity (GARCH) econometric method to test the hypothesis that the prices of Bitcoin, which is our proxy for transactions in cryptocurrency, affect the monetary policy through inflation, exchange rate and the velocity of money in Nigeria. Results of our empirical analysis suggest that Bitcoin transactions influence the real exchange rate, and consequently the price level. This could have serious implications for monetary policy and financial system stability if not adequately and continuously addressed. These findings tend to lend support to the CBN action of banning transactions in Bitcoin and other forms of cryptocurrencies for licensed banks and financial institutions in Nigerian.

Keywords: Bitcoin, cryptocurrency, monetary system, volatility and GARCH.

JEL Classification: C32, E42, O31

1.0 Introduction

Cryptocurrency is a peer-to-peer network for facilitating digital barter and transaction (Singh & Faisal, 2019). Cryptocurrencies represent a new form of money - privately issued, digital and enabling peer-to-peer transactions, following the emergence of decentralised ledger technology (DLT). Generally, cryptocurrencies do not have any government backing or financial institution. Several privately-issued cryptocurrencies have emerged since the invention of the first cryptocurrency – Bitcoin - in 2009. As of October 7, 2022, there were about 21, 238 cryptocurrencies with market capitalisation of more than

US\$958.00 billion dollars, up from about US\$3.00 billion in 2018. Of this volume, Bitcoin, the most popular cryptocurrency, accounted for about 40.0 per cent of the current market capitalisation (US\$383.00) and it is a major driver of the cumulative market capitalisation (CoinMarketCap, 2022).

The growth and volatility associated with cryptocurrencies such as Bitcoin has attracted the attention of the public and policymakers. Many countries have reacted to developments in cryptocurrency and its potential effect on the ability of the central banks to control the overall supply of money in their jurisdictions. Some have legislated its usage alongside official currencies; others have partially allowed it with some restrictions, while most central banks such as those of Nigeria, Indonesia, and others have banned it outrightly. In the event of cryptocurrencies replacing fiat money in the future due to increased adoption, how would this affect monetary policy and the ability of central banks to control the supply of money?

The central banks are empowered by law to monitor and regulate the value of currencies within their jurisdiction. The emergence of cryptocurrency as an alternative medium of exchange and its adoption in several countries such as Nigeria portends serious regulatory and systemic concerns. First, the extent of the substitution by economic agents of cash and bank deposits for cryptocurrencies could have serious implications on the effectiveness of monetary policy as extensive substitution of bank deposits would translate to reduced control over monetary conditions, because of the shrinking volume of broad money in the economy. At the extreme, the provision of base money and the resulting influence over interest rates would be rendered ineffective. The Central Bank of Nigeria took several policies actions on cryptocurrencies to stem the potential market instabilities and financial system stability implications associated with the use of such currency.

Studies on the effects of cryptocurrencies on monetary policy are relatively scarce, with limited understanding of the transmission mechanisms from cryptocurrencies to monetary aggregates. This study is based on the hypothesis that cryptocurrency can influence monetary aggregates, inflation and exchange

rates, three key variables that influence monetary policy decisions. According to Narayan et al. (2019), forecasts of inflation matter for economic growth, exchange rate expectations, and investment decisions. Effective monetary policymaking is reliant on a stable exchange rate, while the trend in money velocity could affect inflation and consequently render short-term interest rates ineffective. The objective of this paper is to examine the impact of cryptocurrency transactions on monetary policy in Nigeria, and to evaluate the policy response of the CBN. The findings would give clarity around the incipient effects of the CBN action of banning and/or restricting the trading and funding cryptocurrency transactions using licensed banks in Nigeria. The study would provide advice on policy directions concerning cryptocurrency use and transactions in Nigeria.

The study uses the Generalised Autoregressive Conditional Heteroscedasticity (GARCH) econometric method to test the hypothesis that growth in Bitcoin prices and volume affect the monetary system through inflation, exchange rate and money velocity. The estimation technique was chosen over other methods because of its ability to account for heteroskedasticity, inherent in the Bitcoin price series, due to its degree of volatility. Evidence from our empirical findings suggests that cryptocurrencies influence the real exchange rate and consequently the price level, thus, portending danger for financial system stability.

Following this Introductory Section, Section two looks at the conceptual approach to understanding cryptocurrencies and monetary policy, while Section three examines the empirical literature on the implications of cryptocurrency transactions for monetary policy variables. Section four examines the data, and empirical framework, and Section five analyses the results from the estimated regressions. Section six concludes the paper and provides policy recommendations.

2.0 Understanding Cryptocurrency and Monetary Policy

1. A Brief Introduction of Cryptocurrency

Cryptocurrency has evolved over time in response to the need for an alternative to money that would be devoid of bureaucratic controls, serve as a medium of exchange, store of value, unit of account, low transaction costs, fast, highly secure and capable of allowing for the creation of self-enforcing smart contracts and devoid of third-party interferences such as financial institutions, lawyers or accountants for their execution (Tredinnick, 2019; Masciandaro, 2018).

In 2008, Bitcoin was developed by Satoshi Nakamoto to challenge the conventional legal tender, which has clearly demonstrated how economic agents could shape the markets that they operate in (Breibach & Tana, 2021). Apart from being the most actively traded and most popular, Bitcoin happens to be among the cryptocurrencies with the highest market capitalisation (Ammous, 2018; Breibach & Tana, 2021). Bitcoin was first introduced in 2009. However, thousands of cryptocurrencies are being traded globally including Ethereum, Ripple and Litecoin, among others (Hileman & Rauchs, 2017; Brauneis, 2018).

What distinguishes Bitcoin from other globally traded financial assets is not only its established peer-to-peer payment system that does not rely on incumbent financial institutions, but the rules governing their supply and transactions which are typically mechanical. This is required, to insulate cryptocurrencies from the discretionary decision-making of major commercial and central banks. Consequently, some cryptocurrencies are perceived as an explicit solution to perceived shortcomings in the existing monetary and financial system.

2.2 The Potential Effects of Cryptocurrency on Monetary Policy

From the perspective of policy makers, it is important to understand the use cases of Bitcoin, which was initially designed to challenge the existing monetary and financial system, both in the discretionary decision-making by central banks and the intermediating role of commercial banks. Regulators are

not only interested in the role of cryptocurrencies as speculative investments and the potential threats to financial stability, but they also want to understand the extent to which cryptocurrencies could facilitate cross-border value transfers and potential capital flights associated with its use, and how they interact with the monetary transmission mechanism in general. This could provide insights into the use cases of global stable coin projects that currently occupy the minds of central bankers and regulators worldwide. Currently, cryptocurrencies operate alongside official currencies. The current volumes are small and do not challenge the position of official money as the main currency. But as the algorithms improve, the use and popularity, as well as the volatility of cryptocurrencies, could increase. This would lead to a coexistence with other official currencies. Russia has already used cryptocurrencies in some official transaction, to mitigate the effects of Western sanctions, occasioned by its war with Ukraine.

The interaction between cryptocurrencies and central bank monetary policy is treated in detail by Fernandes-Villaverde and Sanches (2018). Their theoretical model predicts that the coexistence of central bank and private money depends on the type of monetary policy the former follows. In particular, privately issued currencies would be used if the official currencies do not ensure price stability but would lose their value as a medium of exchange when the central bank credibly guarantees the real value of money balances. There are two important implications of this. First, the coexistence of government money and cryptocurrencies that are valued as media of exchange is not a theoretical impossibility. Second, the central banks have the advantage: by choosing a specific type of monetary policy, they can prevent cryptocurrencies from being valued as a medium of exchange (but they could still be valued for other reasons, for instance as a pure speculative asset). From this perspective, rather than posing a threat, the coexistence of government money and cryptocurrencies can have a positive effect by acting as a disciplining device on central banks. This goes to support Hayek (2015), who argues in favour of breaking the state monopoly on money, as a way of ensuring the stability of the official currency. Nevertheless, from a more practical standpoint, central banks could face some risks from the emergence of cryptocurrencies as

relevant media of exchange with stable purchasing power. First, the extent of the substitution by economic agents of cash and bank deposits for cryptocurrencies could have serious implications for the effectiveness of monetary policy.

Extensive substitution of bank deposits would translate to reduced control over monetary conditions, because of the shrinking volume of broad money in the economy. At the extreme, the provision of base money and the resulting influence over interest rates would be rendered ineffective.

However, as Stevens (2017) points out, if the money issued by central banks retain their roles as units of account, the switch to cryptocurrencies as a medium of exchange would be limited and thus the associated threat to monetary control would also be limited. Second, the shrinking role of central bank money creates a possible fiscal risk in the form of reduced seigniorage revenue. The response could be higher distortionary taxes that would hurt growth. Such risks appear to be exaggerated, given that seigniorage revenues make up an insignificant fraction of total government revenue. Most importantly, the threat does not emanate from the potential use of cryptocurrencies as money, but from their attractiveness as investment assets.

As a speculative investment, cryptocurrencies will be prone to bubbles. The collapse of a cryptocurrency bubble could reverberate into wider financial instability if households, corporates, and financial institutions hold unhedged debt positions. Central banks would then face double risk. The first is the risk to the stability of financial institutions, emanating from the potentially unregulated cryptocurrency debt markets. The second is risks to price stability, coming from the effects, on the real economy, of deleveraging and defaulting by economic agents.

3.0 Empirical Literature

The literature on cryptocurrency is still evolving. The available literature deepens the cryptocurrency literature across various strands. The first strand investigates the uses of cryptocurrencies, such as bitcoin. It was generally

observed that the currency was used mainly as a speculative asset than for transaction purposes, due mainly, to its higher returns, compared with traditional asset classes (Baur, Hong, & Lee, 2018). This view is further developed by Baek and Elbeck (2015) as they examine the relative volatility of bitcoin and found strong evidence to suggest that Bitcoin volatility is internally (buyer and seller) driven, thus making the asset a very speculative instrument. Additional findings regarding the pricing efficiency of bitcoin exchanges was made by Almudhaf (2018), who found a significant and persistent premium of an average of 44.0 per cent.

The second strand of the literature examines the diversification benefits of cryptocurrencies, such as bitcoin. A strong case for its hedging capabilities was shown in the work of Dyhrberg (2016), who posits that it could be used as a hedging instrument against risks, just like gold, in the Financial Times Stock Exchange Index. This was further extended by the work of Bouri et al. (2017) who investigated the hedging capacity of bitcoin beyond gold, to other assets, such as major world stock indices, bonds, oil, the general commodity index and the US dollar index. They found that Bitcoin was a poor hedge instrument, but suitable for diversification purposes only. They further opine that Bitcoin could only serve as a strong safe haven against weekly extreme down movements in Asian stocks. Corbet et al. (2014) find that announcement of quantitative easing by the Central Banks of the United Kingdom, the United States, Japan, and the European Union, significantly affect the return volatility of Bitcoin, as return volatility increases with quantitative easing.

Nguyen et al. (2019) examine the impact of cryptocurrency returns on monetary policy rates, in the United States and China. They find that increase in China monetary policy rate is positively associated with cryptocurrency returns but found no evidence of a significant relationship with cryptocurrency returns and changes in the US monetary policy rate. Corbet et al. (2020) argue that the response of Bitcoin to macroeconomic news differs from those of equity returns. Their study shows that positive news regarding durable goods and unemployment rates reduces Bitcoin returns, unlike the increase in equity returns generated by both news. Returns on Bitcoin increase following negative

news surrounding unemployment rate and durable goods announcement. Besides, Bitcoin returns are unaffected by the announcement of inflation and growth numbers. Thus, Lyócsa et al. (2020) argue that the release of macroeconomic variables by the United States does not generate volatility in Bitcoin prices, instead, the volatility in Bitcoin prices emanates from news on Bitcoin regulation, hacking attacks on cryptocurrency exchanges and positive investor sentiment.

A third strand in the cryptocurrency literature examines the predictors of cryptocurrency price growth. In achieving this, early works were done by Balcilar et al. (2017) who examine the causal relationship between Bitcoin return/volatility and traded volume. They found that traded volumes could predict returns but not its price volatility. Further contributions to this thought were done by Demir et al. (2018) who analysed the predictive power of the Economic Policy Uncertainty (EPU) index on daily Bitcoin returns. They found that Bitcoin returns were negatively associated with the EPU, although the effects were positive and significant at both lower and higher quantiles of Bitcoin returns and the effect of EPU.

There are evolving studies on the effects of??? announcements of monetary policy rates on the volume of cryptocurrencies. For instance, Marmora (2022) highlights, using event-study and concludes that monetary policy announcements increase bitcoin trade volume in 26 emerging market economies. The demand reaction is greater in countries not accustomed to inflation risk. Also, Ben Omrane et al. (2021) analysed the effect of macroeconomic news on the price of Bitcoin. Macroeconomic news in Germany, Japan and United States affect intraday price returns in Bitcoin and Ethereum. Relative to Bitcoin prices, they find that intraday price jumps in Ethereum were more frequent following increased sensitivity of Ethereum price to macroeconomic news relative to jumps in Bitcoin. The jumps in both digital currencies, were fueled, more by macroeconomic news from the U. S., the announcements from Japan and Germany. Luis et al. (2019) estimated a demand model for Bitcoin to explain what influences the demand for Bitcoin. Bitcoin transactions, price level, three-month US Treasury bill yield and

aggregate income were identified as drivers of demand for Bitcoin in the long-run. In the short-run, evidence suggested that none of the variables influences demand for Bitcoin. Wang et al. (2022) investigate the relationship between Bitcoin prices and money supply. Their findings show that Bitcoin prices respond negatively to economic policy uncertainty and money supply, and that Bitcoin could be used as a hedge against inflation.

The implications of continued and widespread use of cryptocurrencies and the implication for monetary policy constitute the last strand of the literature examined in this paper. A robust contribution to this strand was made by Narayan et al. (2019). They examine the relationship between bitcoin price growth (BPG) and Indonesia's monetary aggregates, such as, inflation, real exchange rate, and money velocity as well as its implications for monetary policy. They provided evidence of Bitcoin price growth influencing monetary aggregates. They found strong and robust evidence that BPG leads to inflation growth, currency appreciation, and a reduction in money velocity, especially in emerging economies, such as Indonesia. Similarly, the implications of widespread adoption of cryptocurrencies was analysed by Perkins (2020) who argue forcefully that the invention and proliferation of cryptocurrencies presented numerous risks and issues for policy. He observed that cryptocurrencies, because they are pseudonymous and decentralised, could facilitate money laundering and other crimes, especially in the midst of weak regulations regarding them. He, therefore posited that the widespread adoption of cryptocurrencies as a form of money could limit the ability of the Federal Reserve and other central banks to implement and transmit monetary policy effectively.

Pyo and Lee (2020) observe that the price of Bitcoin surges by 0.3 per cent in the absence of announcement by the United State Federal Open Market Committee (FOMC). On the day before the FOMC announcement, they observed a 0.96 per cent increase in Bitcoin price. The GARCH result showed that Bitcoin price plummets by 1.0 per cent on the announcement day. They, however, noticed that the announcement of macroeconomic variables such as producer price index, consumer price index, and unemployment rate

insignificantly affect Bitcoin prices. Ma et al. (2022) show that bitcoin prices respond strongly to monetary policy shocks, as an unexpected hike in the policy rate by one basis points result in fall in price of bitcoin by 0.3 percent. They report that, in the days following the FOMC meeting, the effect intensifies. The impulse response function reveals that the reaction of Bitcoin prices to monetary policy shocks is greater during market booms. Igoni et al. (2020) investigated how the market volume of cryptocurrency affect monetary policy rate in South Africa. They concluded that the monetary policy decision reflected by changes in monetary policy rate is not significantly influenced by the volume of digital currency and market capitalisation.

4.0 Data and Empirical Framework

4.1 Data

The dataset on cryptocurrencies covers the price of bitcoins (the most popular and largest in terms of market capitalisation), volume of bitcoins traded in Nigeria across three exchanges and the growth rate of the traded volume. The caveat on the cryptocurrency data sourced from *Statista* is that it was from only three exchanges, which do not account for a significant proportion of transactions carried out via other major exchanges, such as Binance, Luno and Roku. This suggests that the total volume of cryptocurrency transactions is under-reported and will be higher with data from all the major exchanges. The implication is that cryptocurrencies may have significant implications for the Nigerian monetary system, and consequently on monetary policy.

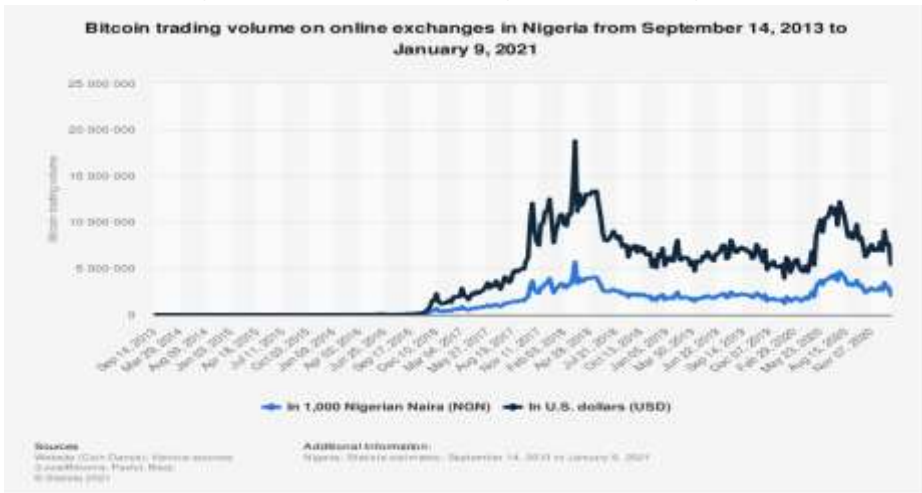
The macroeconomic indicators used include inflation rate, exchange rate, real GDP, output gap, imports, and treasury bills rate. Some variables used in the estimation of the models were computed, which includes real interest rate, interest rate differential, output gap, velocity of money (M2) and real exchange rate. Most of the series used were monthly variables; however, real GDP and index of industrial production (IIP) for Nigeria were originally quarterly and converted to monthly series. The dataset spanned the 2013M01 – 2021M01 period.

4.1.1 Stylised Facts on Bitcoin Trading in Nigeria

The weekly data on the volume of bitcoin transactions traded on online exchanges in Nigeria during the period from September 2013 – 2020 is presented in figure 4.1. The data series suggests evidence of heteroskedasticity in bitcoin. The increased transaction on bitcoin trading was evident in the period 2016-2020 with peaks in 2017 - 2018 and 2020. This was due to the Bank’s policy restricting individuals from participating in OMO bills at both the primary and secondary markets.

Consequently, investors sought alternative investment outlets with higher returns and resorted to transacting in cryptocurrencies, given its profitable returns. Although cryptocurrencies are highly volatile, they are used mainly for speculative transactions and a form of store of value. Increased trading in Bitcoin results in lower level of bank deposits, leading to contraction in bank deposits for intermediation and the erosion of credit creation potentials of banks and financial institutions.

Figure 4.1: Bitcoin Trading Volume in Nigeria

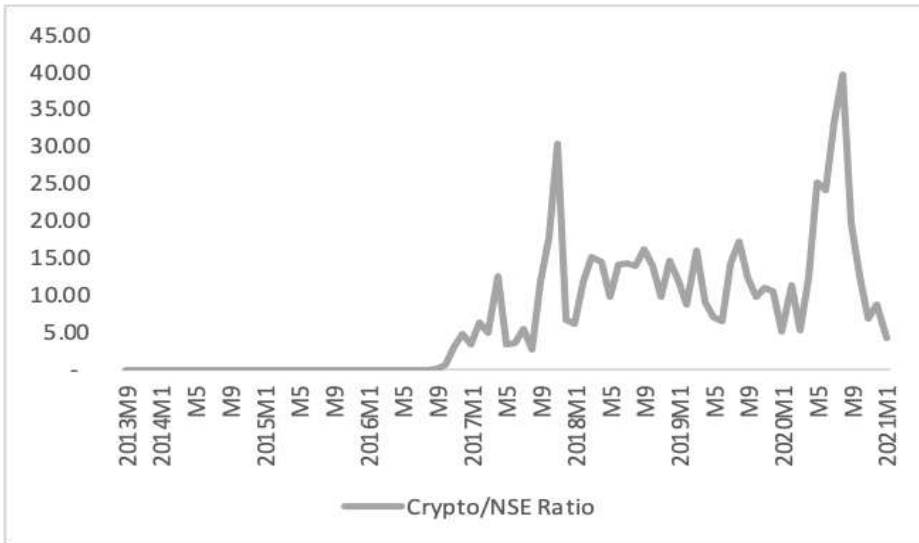


Source: Statista, 2021

The ratio of the volume of cryptocurrencies transaction on online exchanges to the volume of stocks traded on the Nigerian Stock Exchange (NSE) show a

significant increase from 0 per cent to over 39 per cent between 2013 and 2021, albeit with volatility because of the speculative nature of transactions.

Figure 4.2: Ratio of volume of cryptocurrencies transactions to NSE traded volume



Source: Authors' Computation

Figure 4.2 shows that during periods of economic uncertainty in Nigeria, higher transactions on cryptocurrency was recorded, for instance during the 2016 economic recession and COVID-19 pandemic of 2020. This aligns with the concept of cryptocurrency as a store of value where investors store their wealth to safeguard against loss of value in the domestic currency, Naira. Given the lull in economic activities, investors would channel their funds to assets with higher returns, where inflation would not erode their value. Cryptocurrency, especially bitcoin provided such higher returns and safety when compared to the domestic money and stock markets.

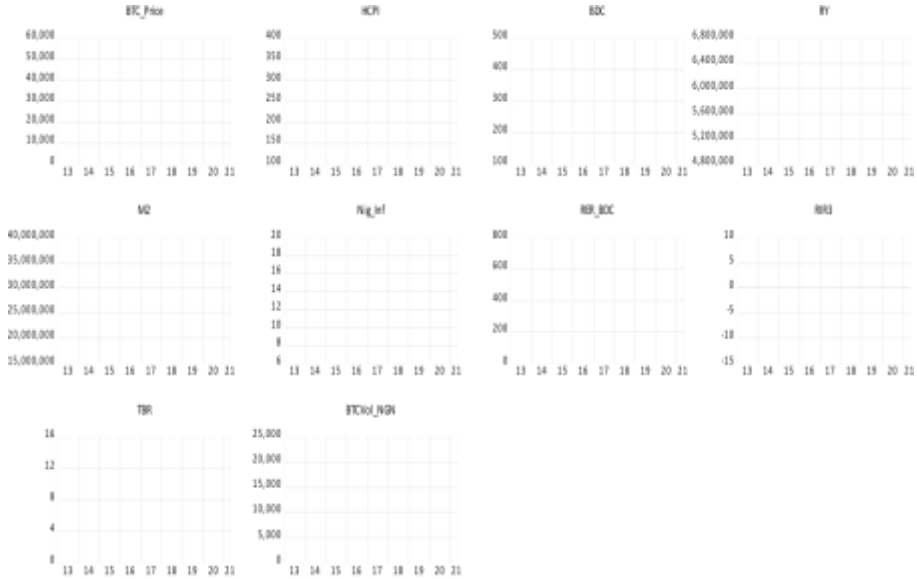
4.1.2 Preliminary features of the data used for the estimation

Table 4.1: Dataset Definitions and Sources

Panel A: Inflation Model			
Variable	Definitions	Description	Source
Bitcoin price (btc)	Price of bitcoins		Yahoo finance
Bitcoin Volume growth (dlbtc)	Growth rate of Bitcoin trading volume in Nigeria from three crypto exchanges (LocalBitcoins, Paxful, Bisq)	Difference(log(btcvol))	Statista
Inflation (inf)	Inflation rate	Year-on-year percentage change in headline CPI for Nigeria	CBN database
Crude Oil Price (cop)	Price of Bonny light		CBN database
Gap	Output gap	Computed using Hodrick-Prescott filters	

Panel B: Exchange Rate Model			
RER	Real exchange rate; expressed as the number of naira per US\$	$RER_t = (NGN/USD) * (CPI_{NGN}/CPI_{US})$	NGN/USD sourced from CBN database, CPI_{US} sourced from Fed Reserve Bank of St. Louis database (FRED)
RIR3	Difference between the US and Nigerian 3-month treasury bills rate	$RIR_{i,t} = TBR_{i,t} - inflation\ rate_{i,t}$, where i is the US or Nigeria; $RIR3 = RIR_{Nig} - RIR_{US}$	
DY	Difference of the logarithm of index of industrial production (IIP) of the US and Nigeria	$log(IIP_{NIG}) - log(IIP_{US})$	IIP_{US} , FRED; IIP_{NIG} , CBN Database; DY, author's calculations
Panel C: Velocity of money model			
V2	Velocity of M2	$V=PY/M$ where M is $M2$	
RY	Real GDP		CBN Database
TBR	3-month treasury bills rate		CBN Database

Figure 4.3: Time Series Plot of the Data



Source: Authors' Compilation

The preliminary analysis of the data revealed that most of the variables were not normally distributed as shown by the Jarque-Bera statistic and kurtosis. In relation to skewness, the variables were positively or negatively skewed, as none was perfectly symmetrical. The pictorial evidence in Figure 4.3 also points to the non-normal distribution of variables. In relation to the focus of this study, the price and volume of bitcoin transactions appear volatile and exhibit non-normality, which implies heteroskedasticity and has ramifications for the choice of modeling. Thus, to account for the heteroskedasticity observed in the data, we adopted the Generalised Autoregressive Conditional Heteroskedasticity (GARCH) modelling framework.

Table 4.2: Descriptive Statistics

	Mean	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
BTC	7,368.82	59,168.48	217.46	11,249.49	3.16	13.83	517.73	0.00
BTCVOL	5,333.36	20,736.57	0.01	5,754.32	0.67	2.31	8.50	0.01
V2	1.23	1.41	1.04	0.09	(0.12)	2.31	2.12	0.35
INF	11.86	18.72	7.71	3.30	0.51	2.06	7.82	0.02
TBR	9.48	14.93	0.03	3.80	(1.14)	3.32	21.56	0.00
COP	67.58	118.81	14.28	25.58	0.61	2.35	7.74	0.02
RER	301.81	650.74	-	160.33	0.20	2.13	3.71	0.16
DLBTC	0.14	3.15	(3.63)	0.88	0.09	7.89	87.74	0.00
DY	3.36	20.70	(15.27)	9.27	(0.16)	2.36	2.02	0.36
IMP	1,101,404.00	2,627,814.00	563,053.80	417,917.70	1.38	4.50	39.80	0.00
RIR3	(1.53)	5.70	(14.66)	4.81	(0.84)	3.25	12.02	0.00

Source: Authors' Computation

4.2 Empirical Framework – Transmission Channel

The widespread adoption of cryptocurrencies such as Bitcoin can have implications for the dynamics of macroeconomic variables such as velocity of money, exchange rates and interest rates. Within the theoretical framework of this study, the response of these macroeconomic variables to the dynamics of Bitcoin prices and volume would serve as the transmission channels through which the impact of cryptocurrency adoption would be assessed.

In line with the work of Narayan et al. (2019), the velocity of money, which measures the rate at which individuals and businesses collectively spend money in an economy, is determined under the Quantity Theory of Money framework (QTM). This framework states that the extent to which money circulates in an economy (MV) depends on aggregate demand for transactions in the economy (PY). The QTM is thus expressed as:

$$MV = PY \tag{1}$$

Where; M is the money supply, V is velocity of money; P is aggregate price level and Y is aggregate real output. Velocity is therefore calculated as $\frac{PY}{M}$.

Given the assumption of full employment of resources, the QTM, in its purest form, asserts that velocity of money is constant; implying that changes in nominal money supply would have a direct effect on aggregate price level. However, in line with the Keynesian view, a positive relationship exists between output, nominal interest rates and velocity of money in the short-run, under the condition that real interest rates and output (rather than prices) determines real money demand.

From the foregoing, we assume that the widespread adoption of cryptocurrency could weaken the ability of short-term interest rates and real output to influence the velocity of money. It could also lead to a reduction in the circulation of money and in its extreme case, lead to weakening of the QTM.

The second transmission channel for cryptocurrency adoption is the inflation channel, in line with the work of Narayan et al. (2019), an adapted version of the New Keynesian Phillips Curve (NKPC) framework is employed. The framework basically provides a theoretical appraisal for the determination of inflation using inflation expectations and unemployment rate or output gap. In this paper, inflation is determined as a function of the marginal cost of production; lag of inflation – to allow for inflation formation by expectations built using backward looking economic agents.

The model was adopted with some variations to account for some peculiarities in Nigerian economy. Thus, we introduced some exogeneous factors such as oil prices, and import prices relative to domestic prices, which could influence marginal costs in an open economy like Nigeria. The paper expects Bitcoin price dynamics and the volume of transactions to influence marginal costs indirectly. Since Bitcoin is mostly used as a store of value, its dynamics may influence inflation indirectly, through the marginal cost channel in the form of changes in wealth of residents. As wealth of residents increase, owing to increasing prices of cryptocurrency baskets invested in, increased demand for goods and services would put additional pressure on cost of inputs, leading to

inflationary pressures. On the flip side, the increased wealth from crypto holdings could also lead investments away from the goods market to the capital market with the effect of dampening inflationary pressures. This may create a justification for the regulation of cryptocurrency adoption by central banks.

Thirdly, the effect of Bitcoin on exchange rates of the Naira to the US dollar is observed. This is done using the uncovered interest rate parity framework to model the determinants of real exchange rate, such as, the real interest rate differential between the Nigeria and the US; and productivity differentials using the Paul-Samuelson model; and oil prices. This model is modified to account for Bitcoin prices as an addition. The behaviour of exchange rate in this model is uncertain as increase in the volume of Bitcoin transactions could lead to an appreciation or depreciation of exchange rate.

4.3 Methodology

To determine the impact of bitcoin trading volume on inflation, exchange rate and velocity of money in Nigeria, this study employed a GARCH framework similar to Narayan et al. (2019). This technique is adopted because of its ability to account for heteroskedasticity, which has been found to be inherent in the bitcoin series due to its volatile nature. To evaluate the impact of bitcoin transactions, two different sets of models are estimated. The first set of models do not include bitcoin volume, while the second set of models are augmented with the volume of Bitcoin transactions. The GARCH equation is presented as follows:

$$C_t = a_0 + uX_t + \varepsilon_t \quad (2)$$

$$C_t = a_0 + \beta BTCvol_t + uX_t + \varepsilon_t \quad (3)$$

Where C_t represents macro-indicators such as inflation rate (inf), real exchange rate (rer) and velocity of money (v2). $BTCvol$ refers to the total volume of bitcoin transactions in Nigeria and X_t is a vector of control variables. When C_t represents the inflation rate, the control variables include lagged inflation, output gap, crude oil price and imports. When C_t is real exchange rate, X_t refers to real interest rate differential, output differential and crude oil price. In relation to velocity of money, real GDP and treasury bills rate are the controls. The GARCH (1, 1) process applies to ε_t .

$$\varepsilon_t = \vartheta_t \sqrt{h_t}, \sigma_t^2 = \mu + \alpha \varepsilon_{t-1}^2 + \gamma \sigma_{t-1}^2 \quad (4)$$

Where $\mu > 0, \alpha \geq 0, \gamma \geq 0$, and ϑ_t represents a sequence of independent and identically distributed random variables with a variance of one (1) and an average mean of zero.

5.0 Results and Discussions

Our procedure for estimating the effect of Bitcoin on key macroeconomic variables in Nigeria are in two parts. First, we test, and report results for each of the models related to inflation, real exchange rate and the velocity of money. The determinants of the estimated conventional models of inflation real exchange rate and velocity of money and their respective macro-indicators (INF, RER and V2) are presented and explained without the volume of transaction of bitcoin. Second, we augment the theoretical models with the volume of Bitcoin transactions in Nigeria, to ascertain its effects on macroeconomic indicators. In sum, there is evidence that the volume of transactions in bitcoin affect macroeconomic indicators in Nigeria, especially the real exchange rate, but not inflation and velocity of money. A detailed analysis of the estimated results follows.

5.1 Inflation Models

Table 4.3: Inflation Models

Models		1		2		3		4		5	
Variable	Coef	Prob	Coef	Prob	Coef	Prob	Coef	Prob	Coef	Prob	
Panel A: Mean equation											
<i>C</i>	0.03	0.47	0.03	0.48	0.86	0.14	4.47	0.00	3.96	0.00	
<i>dinf_{t-1}</i>	0.73	0.00	0.73	0.00	0.68	0.00			0.73	0.00	
<i>dgap</i>			0.00	0.87	0.00	0.84	0.00	0.15	0.00	0.11	
<i>lcop</i>					-0.29	0.17	-0.43	0.00	-0.31	0.00	
<i>limp</i>							-0.19	0.04	-0.19	0.00	
Panel B: Variance equation											
<i>C</i>	0.03	0.19	0.03	0.22	0.03	0.2	0.04	0.01	0.00	0.38	

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<i>resid</i>	0.08	0.35	0.08	0.36	0.11	0.28	0.68	0.07	0.49	0.02
<i>garch</i>	0.63	0.02	0.62	0.03	0.62	0.01	0.3	0.09	0.6	0.00
<i>R</i> ²	0.35		0.34		0.37		0.1		0.32	

Source: Authors computations

Table 4.3 presents results related to inflation models without the volume of bitcoin transactions. Across all the inflation models, the lag of inflation, price of crude oil and import prices significantly explain the behavior of the conventional inflation model. The output gap variable was not statistically significant across the models. The lag of inflation has the correct sign and most statistically significant variable at 1 per cent, suggesting inflation persistence where previous prices are the most important consideration in current pricing. The price of crude oil was negatively signed and statistically significant at 1 per cent level in models 4 and 5. Augmenting the inflation model with the volume of bitcoin transactions in table 4 did not alter the results from the conventional models, as bitcoin was statistically insignificant in determining the price level, connoting that transaction in cryptocurrencies, such as bitcoin may not be among the underlying determinants of inflation in Nigeria. Studies on the drivers of inflation in Nigeria document this evidence (See, Adebisi et al., 2010; Mordi et al., 2012; Rapu et al., 2016; Adeleye et al., 2019; Olasunkanmi & Oladipo, 2020; Akande et al., 2022).

Table 4.4: Bitcoin Augmented Inflation Models

<i>Models</i>	<i>1</i>		<i>2</i>		<i>3</i>		<i>4</i>		<i>5</i>	
<i>Variable</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>
Panel A: Mean equation										
<i>C</i>	0.04	0.41	0.04	0.44	0.65	0.26	3.7	0.00	4.45	0.00
<i>dlnft-1</i>	0.74	0.00	0.74	0.00	0.72	0.00	0.76	0.00		
<i>dlbtc</i>	0.02	0.82	0.02	0.83	0.02	0.79	0.02	0.71	0.02	0.64
<i>dgap</i>			0.00	0.9	0.00	0.89	0.00	0.15	0.00	0.13

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<i>lcop</i>										
					-0.14	0.29	-0.28	0.00	-0.38	0.00
<i>limp</i>							-0.18	0.01	-0.2	0.00
Panel B: Variance equation										
<i>C</i>	0.01	0.2	0.01	0.23	0.01	0.24	0.00	0.55	0.00	0.46
<i>resid</i>	0.04	0.2	0.04	0.22	0.07	0.21	0.43	0.05	0.47	0.02
<i>garch</i>	0.86	0.00	0.86	0.00	0.84	0.00	0.68	0.00	0.66	0.00
<i>R2</i>	0.52		0.51		0.52		0.48		0.1	

Source: Authors' computations

5.2 Real Exchange Rate Models

Table 4.5: Real Exchange Rate Models

<i>Models</i>	<i>1</i>			<i>2</i>			<i>3</i>			<i>4</i>	
<i>Variable</i>	<i>Coef</i>	<i>Prob</i>		<i>Coef</i>	<i>Prob</i>		<i>Coef</i>	<i>Prob</i>		<i>Coef</i>	<i>Prob</i>
Panel A: Mean equation											
<i>C</i>	0.86	0.94		-0.89	0.79		1.7	0.00		22.26	0.00
<i>DRER_{t-1}</i>	0.3	0.25		0.77	0.01		0.48	0.00		0.18	0.15
<i>DRIR</i>				-32.47	0.00		-0.73	0.00		0.25	0.24
<i>DY</i>							-0.06	0.00		0.01	0.60
<i>LCOP</i>										-4.64	0.00
Panel B: Variance equation											
<i>C</i>	3784.81	0.29		46.68	0.34		-0.07	0.90		0.12	0.76
<i>resid</i>	-1.56	0.09		0.82	0.00		2.50	0.00		1.92	0.00
<i>garch</i>	0.24	0.74		0.52	0.00		0.24	0.00		0.28	0.00
<i>R²</i>	0.00			75.00			0.08			0.15	

Source: Authors computations

Table 4.5 presents the results of the estimations of the conventional real exchange rate model. Apart from its own lag, the most important determinant of the real exchange rate across the estimated models is the real interest rate (RIR). The output gap and price of crude oil variables are statistically significant at 1.0 per cent level in model 3 and 4, respectively. Although the introduction of the volume of bitcoin transactions did not alter the significant the relationship of the variables in the RER model, the variable was found to be significant, at the 5.0 per cent level, in models 3 - 5 of table 4.6. The volume of bitcoin transactions positively affects the real exchange rate, implying that, increase in the volume of bitcoin transactions is associated with a depreciation of the Naira vis-à-vis the US dollar. Growth in the volume of transactions of cryptocurrencies leads to a depreciation of the domestic currency. Transactions in cryptocurrencies is indexed to the US dollar, which is the benchmark currency for all its trading activities in Nigeria. Inadvertently, these transactions rely on the international financial system to fund its online trading and exchanges.

Table 4.6: Bitcoin Augmented RER Models

<i>Models</i>	<i>1</i>		<i>2</i>		<i>3</i>		<i>4</i>		<i>5</i>	
<i>Variable</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>
<i>Panel A: Mean equation</i>										
<i>C</i>	1.56	0.00	1.75	0.00	1.73	0.00	18	0.00	12.51	0.00
<i>RER_{t-1}</i>	0.45	0.00	0.45	0.00	0.48	0.00	0.38	0.00	0.36	0.00
<i>DRER_{t-2}</i>							-0.06	0.64		
<i>dlbtc</i>	0.38	0.05	0.20	0.22	0.28	0.02	0.29	0.04	0.31	0.01
<i>DRIR</i>			-1.47	0.00	-0.71	0.00	-0.75	0.03	-0.78	0.01
<i>DY</i>					-0.07	0.00	-0.01	0.56	-0.04	0.03
<i>LCOP</i>							-3.70	0.00	-2.42	0.01

Panel B: Variance equation

<i>C</i>	1.17	0.12	0.02	0.97	-0.19	0.76	0.56	0.32	0.25	0.58
<i>resid</i>	3.41	0.00	2.00	0.00	2.83	0.00	1.76	0.00	2.03	0.00
<i>garch</i>	0.1	0.07	0.29	0.00	0.21	0.00	0.27	0.00	0.27	0.00
<i>R</i> ²	0.08		0.09		0.08		16.00		0.13	

Source: Authors computations

5.3 Velocity of Money Models

Table 4.7: Velocity Models

<i>Models</i>	<i>1</i>		<i>2</i>		<i>3</i>	
<i>Variable</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>
Panel A: Mean equation						
<i>C</i>	0.16	0.05	-4.58	0.00	-4.63	0.00
<i>v</i> _{2,<i>t</i>-1}	0.86	0.00	0.77	0.00	0.74	0.00
<i>log</i> (<i>ry</i>)			0.31	0.00	0.32	0.00
<i>d</i> (<i>tbr</i>)					0.01	0.21
Panel B: Variance equation						
<i>C</i>	0.00	0.01	0.00	0.13	0.00	0.02
<i>resid</i>	-0.09	0.00	-0.09	0.01	-0.10	0.00
<i>garch</i>	0.76	0.00	0.85	0.00	0.87	0.00
<i>R</i> ²	0.61		0.65		0.66	

Source: Authors computations

Lastly, we examine the results of the estimations of the conventional model of the velocity of money as presented in table 4.7. Apart from the lag of the variable itself, the real GDP was the most important determinant of the velocity of money, as it was statistically significant at 1.0 per cent level in models 2 and

3. The positive and significant relationship between the real GDP and the velocity of money confirms the theoretical expectations. The 3-month Treasury bill rate was insignificant in determining the velocity of money. Augmenting the volume of bitcoin transactions to the velocity of money does not alter the already established relationship as found in the conventional model. However, it was observed that the 3-month Treasury bill rate was weakly significant at the 10.0 per cent level in model 3 of table 4.8.

Table 4.8: Bitcoin Augmented Velocity Models

<i>Models</i>	<i>1</i>		<i>2</i>		<i>3</i>	
<i>Variable</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>	<i>Coef</i>	<i>Prob</i>
<i>Panel A: Mean equation</i>						
<i>C</i>	0.22	0.00	-6.30	0.00	-6.37	0.00
<i>v2_{t-1}</i>	0.82	0.00	0.71	0.00	0.70	0.00
<i>dlbtc</i>	-0.01	0.18	0.00	0.66	0.00	0.56
<i>log(ry)</i>			0.43	0.00	0.43	0.00
<i>d(tbr)</i>					0.01	0.08
<i>Panel B: Variance equation</i>						
<i>C</i>	0.00	0.02	0.00	0.24	0.00	0.00
<i>resid</i>	-0.10	0.00	-0.12	0.02	-0.13	0.00
<i>garch</i>	0.67	0.00	0.87	0.00	0.92	0.00
<i>R²</i>	0.61		0.70		0.70	

Source: Authors computations

6.0 Conclusion

The study examined the impact of Bitcoins transactions on monetary policy in Nigeria, using data spanning the period 2013M9 – 2020M12. Following Narayan et al. (2019), some theoretical models were augmented with the volume of bitcoin transactions, using the GARCH estimation techniques to

estimate several models because of the evidence of heteroskedasticity found in the variables used. While we found no significant influence of Bitcoin on inflation and the velocity of money, we found evidence of its influence on the real exchange rate.

The implication of the findings is that the pace of adoption of cryptocurrencies should be of interest to monetary authorities and policy makers in general. Therefore, it becomes essential not to ignore developments in the volume of Bitcoin transactions and other cryptocurrencies in the forecasts of real exchange rate and perhaps that of inflation based on the findings of the study, as it might be costly since it exerts significant influence on the real exchange rate. It is based on these findings that our results support the policy stance of the Central Bank of Nigeria on banning transactions in cryptocurrencies by licensed banks and other financial institutions. Consequently, we recommend sustaining the current stance of the Bank on cryptocurrencies, with continued research on their impact on the Nigerian economy, as evolving empirical evidence points to the strong influence they exert on key macroeconomic variables, which could have a destabilising effect on Nigeria's monetary system, if not adequately addressed.

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PART 3

**FINANCIAL SYSTEM
STABILITY**



CHAPTER FIVE: ASSESSING THE IMPLICATIONS OF CENTRAL BANK DIGITAL CURRENCY ON FINANCIAL SYSTEM STABILITY: THE CASE OF THE eNAIRA

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Abstract

The study assesses the implications of the eNaira adoption on financial system stability in Nigeria. The outcomes of both descriptive and scenario analysis reflect the impact of the demand for eNaira on deposits and credit of financial institutions. The results show that the number of smaller savers will increase, reducing banks' dependence on 'non-core' financing sources and reducing pro-cyclicality risk in financial institutions. Also, cost of currency management incurred by financial institutions reduces, but bank non-interest income deteriorates. The scenario analysis shows that a small increase in the eNaira demand does not significantly reduce banks' credit supply. However, a substantial demand increase will constrain banks' credit supply; while the banking industry loan-to-deposit ratio improves marginally. As the demand increases, the study recommends continuous review of the tiered wallet structure of eNaira to mitigate the impact on deposits and credit supply.

Keywords: CBDC, eNaira, financial system stability

JEL Classification: C15, E5, E44

1.0 Introduction

The global economy is becoming increasingly digitalized, with global digital payments valued at US\$5.99 trillion in 2020 (Statista, 2020). The Nigerian digital payments alone in 2020 recorded 2.70 billion transactions valued at ₦162.90 trillion. In response to the development of the digital economy, a number of central banks are in the process of issuing Central Bank Digital Currencies (CBDCs), while a few have issued digital currencies. For example, the Bahamas in the West Indies was the first to launch its digital currency, the "Sand Dollar", in October 2020. In all, about ten countries have launched their digital currencies, with other countries such as China, the US, and UK are in the process.

In line with the global trend, the Central Bank of Nigeria (CBN) in 2017 commenced research on deploying a CBDC. This metamorphosed into a Project Plan that was launched in January 2021 and, eventually, the launch of the eNaira in October 2021. The policy objectives linked to the introduction of the eNaira include financial inclusion, cross-border payments, monetary policy implementation, (CBN, 2021). The eNaira is the digital equivalent of the physical naira, hence the slogan, ‘same Naira, more possibilities.’ It is the official legal tender of Nigeria, and it is a liability of the CBN. The eNaira is at par with the physical naira in terms of value.

The overriding objective for introducing the eNaira is that households and businesses would be able to make fast, efficient, and reliable payments and benefit from a resilient, inclusive, innovative, and competitive payments system. In addition, the eNaira is expected to foster greater inclusion, support cross-border payments, improve monetary policy effectiveness and payments system efficiency, reduce currency management costs, enhance government’s capacity to deploy targeted social interventions and stimulus spending, and provide a reliable channel for remittance inflows into the country. The eNaira primarily aims to promote financial and monetary stability and a resilient payments system in Nigeria.

There has been overwhelming interest and encouraging responses from Nigerians and other parties worldwide since the platform went live in October 2021. As of November 26, 2022, about a million consumer and merchant wallet downloads have been recorded, with these downloads occurring in over 160 countries (per Google Play store and Apple Store data). In addition, over 792,011 transactions, amounting to over ₦9.30 billion have been recorded. These numbers suggest the adoption rate has been successful.

The eNaira is relatively new, and the value of the liability is relatively small compared with total liabilities in the financial sector; its opportunities and risks over time might significantly impact financial system stability through the balance sheet of banks and their ability to lend to the real economy. Given this,

it becomes pertinent to critically examine the likely implications of its adoption on financial system stability in Nigeria.

Following this introduction, section two focuses on some conceptual issues of central bank digital currency. Section three deals with the relevant literature on central bank digital currency, while section four examines the implications of eNaira adoption for financial system stability. Section five contains the policy recommendations and the conclusion.

2.0 Conceptual Issues

2.1 Central Bank Digital Currency (CBDC)

Conceptually, three forms of money are widely used in most economies (Bank of England, 2020). These are bank notes, bank deposits, and central bank reserves. Bank notes are most of the physical currency used in an open economy. They are usually issued by a nation's monetary authority, such as the Naira notes issued by the Central Bank of Nigeria (CBN). Most of these notes are held by households and businesses as a means of payment or store of value. Commercial banks also hold banknotes to meet demand for deposit withdrawals. Bank deposits are created when commercial banks issue loans (Bank of England, 2020). They remain a liability of the banking system – banks stand ready to convert those deposits into central bank money in the form of physical cash. Central Bank Reserves are mainly commercial banks' deposits held at the central bank. These are assets used by commercial banks when payments are made to each other. Like banknotes, reserves are central bank liabilities and are risk-free.

Until recently, and in countries without monetary authority-issued digital currency, the public can hold money issued by the Central Bank in the form of banknotes, but only banks and certain other financial institutions can hold electronic central bank money in the form of 'reserves'. Where commercial banks require funds, the monetary authorities swap reserves for banknotes. Thus, both types of central bank money (reserves and banknotes) are directly convertible into one another. The public (households and businesses) can also convert their deposits into central bank money through physical cash.

CBDCs are forms of central bank money handled through electronic means, granting access to the broad public to make payments and store value. CBDCs are central bank monies that are safe and free of credit risk as they are not physical but electronic/digital and do not offer credit facilities. Additionally, CBDCs form part of the monetary base that is traded at par against fiat currency and reserves. They are thus issued or destroyed only by the central bank, are available 24/7, may be used in peer-to-peer transactions, and circulate on digital media that are at least partially different from existing media (Banque de France, 2020). Barrdear and Kumhof (2016) puts this differently, noting that by utilising CBDCs, a monetary authority grants universal, electronic, 24*7, national-currency-denominated, and interest-bearing access to its balance sheet.

There are two main types of CBDCs – retail and wholesale. Retail CBDCs are provided to the public via specially designated accounts at supervised commercial banks, which would hold the corresponding amount of funds in segregated reserve accounts at the central bank or via accounts held directly at the central bank (Bordo and Levin, 2017) with both having the same implications for financial intermediation (Fernández-Villaverde et al., 2020). Wholesale CBDCs are for financial institutions that hold reserve deposits with a central bank. They could be used to improve payments and securities settlement efficiency and reduce counterparty credit and liquidity risks.

In sum, CBDCs are generally accessible central bank e-money with their monetary value stored electronically (digitally or as an electronic token) that represents a central bank liability and can be used to make payments (Engert & Fung, 2017; Davoodalhosseini & Rivadeneyra, 2018).

2.2 Financial System Stability

The financial system encompasses financial markets, instruments, institutions (regulatory and non-regulatory), and infrastructure. Central Bank of Sri Lanka (2005) defines financial system stability as the financial system's resilience to internal and external shocks (economic, financial, and political, among others). It has also been described as the absence of macroeconomic costs of

disturbances in the system of financial exchanges between households, businesses, and financial institutions. Furthermore, financial system stability is a condition represented by a strong financial system capable of withstanding economic shocks, ensuring intermediary function, settlement of payments, and diversification of risk (Bank of Indonesia, 2022). Thus, the economic mechanisms of price formation, funds allocation, and risk management operate properly to support economic growth.

Schinasi notes that “a financial system is in a range of stability whenever it is capable of facilitating (rather than impeding) the performance of an economy” (Schinasi, 2004). Thus, financial system stability means that the financial system can allocate funds efficiently and absorb shocks as they arise, thereby preventing disruption of real sector activities and the financial system. In summary, financial stability is about building a financial system that can function in good times and bad, in any economy and at any moment. Consequently, monetary authorities work to identify threats to financial stability and develop effective policies to address those threats.

2.3 Balance Sheet Impact of a switch from cash or deposits to CBDCs

Banknotes and CBDCs are just two different types of central bank liability, so a switch from banknotes and deposits to CBDCs, and vice versa, affects the composition – but not the size – of households and central bank balance sheets (Bank of England, 2020).

Switching from cash to CBDC: The household swaps one asset (cash) for another asset (CBDC), and the central bank swaps one liability (cash) for another liability (CBDC). Although banks may facilitate this conversion from cash to CBDC, the process has no impact on the banking sector’s balance sheet size.

Switching from deposits to CBDC: A shift from deposits into CBDC has the same impact on bank balance sheets as a withdrawal of banknotes from an ATM or bank branch, reducing both the assets and liabilities of the commercial bank and shrinking the bank’s balance

sheet. This means that net shifts from deposits to CBDC (partially) disintermediate the banking sector.

A flow from deposits to CBDC results in commercial banks holding fewer reserves. They may wish to acquire more reserves from the central bank if they hold fewer reserves than they need to meet their own or assess supervisory liquidity risk measures. If the central bank chooses to meet this demand by issuing new reserves, then the central bank's balance sheet will expand by the amount of newly issued reserves.

3.0 Theoretical and Empirical Review

Theory suggests that commercial bank money is sufficient if it is safe. Specific measures, such as deposit insurance, lender of last resort, regulations and supervision, sound government finances, and macroeconomic policies make commercial bank money safe, in most cases, up to the limit of the deposit insurance guarantee. According to Armelius et al. (2020) neither cash nor CBDCs seems fundamental to the monetary systems in countries with these measures. Nevertheless, they opined that the ability of individuals to convert bank deposits into central bank money is fundamentally important for the monetary system. They stated that cash or CBDCs are essential because depositors need control, even in countries with strong measures safeguarding commercial bank money.

The CBDCs have several advantages over physical cash. Some of these include the possibility of holding a bank account with the monetary authorities directly (Fernández-Villaverde et al., 2020). Besides its potential role in eliminating physical cash, a CBDC allows the monetary authority to engage in large-scale intermediation by competing with private financial intermediaries for deposits (Fernández-Villaverde et al., 2020). Furthermore, Carapella and Flemming (2020) note that CBDCs have the potential to affect central banks' wider policy objectives, either by acting as a new monetary policy tool or through its effects on the portfolio choices of households and the probability of bank runs. In addition, the Bank of England (2020) notes that CBDCs could support the Bank's objective to maintain monetary and financial stability mainly by

providing a new form of money and a new payment infrastructure. Other opportunities include meeting future payment needs in a digital economy, improving the availability and usability of central bank money, addressing the risks of new forms of private money creation, and supporting competition, efficiency, and innovation in payments.

While focusing on the liquidity properties of CBDCs as a means of payment, Keister and Monnet (2020) study its effects on the set of feasible policies available to the government in periods of financial distress. Suppose the financial conditions of banks are private information to each bank and its depositors, the introduction of CBDCs as an alternative means of payment to bank deposits but immune from the risk of bank runs results in depositors withdrawing their funds from banks in times of stress and reallocating them into CBDCs. By observing a large and sudden inflow of funds into its digital currency, the central bank can infer banks' financial conditions.

The Bank for International Settlements in its (2021) report focuses primarily on potential risks to financial stability that could arise from introducing a CBDC. The report notes that CBDCs support a competitive and diverse financial system. It enables new opportunities for innovation, which may benefit banks and other non-financial providers of financial services, continuing change in payment methods, and the emergence of new forms of privately issued digital money. Also, the introduction of a CBDC prompts changes that affect the functioning of the financial system in ways like the introduction of new forms of private money. However, the impact is dependent on acceptance and use of the CBDC. To use CBDCs effectively, individuals must switch some of their funds out of banknotes and commercial bank deposits and into central bank money in the form of CBDC, thus a very large or rapid shift from deposits to CBDCs could have significant implications for the amount and cost of credit that the banking sector could provide to the economy, the structure of the banking system, and the way the Central Bank achieves its objectives of maintaining monetary and financial stability (Bank for International Settlements, 2021).

Carapella and Flemming (2020) note that with the issuance and increased use of CBDCs, the aggregate collateral stock can support more transactions as banks' collateral assets are still available to issue deposits. With at least some households switching to CBDCs, some of the transactions which were carried out with deposits and required banks to hold collateral are now carried out with CBDCs. This is obvious as, despite increasing the welfare of unbanked households, CBDCs decrease the welfare of banked households unless they also choose to hold CBDCs in their portfolios. Though the introduction of CBDCs would lead to some substitution away from existing forms of money, the scale of substitution and the implications for monetary and financial stability will depend greatly on functionality, remuneration, and other design features (Bank of England, 2020).

Research has shown that individuals who feel they are in control are more willing to take risks. Thus, in this sense, one of the roles of cash, and potential of CBDC, maybe to promote a sense of control for individuals (Armelius et al., 2020). Furthermore, this will support individuals' trust and confidence in their financial well-being and the financial sector.

4.0 Financial Stability Implications of the eNaira

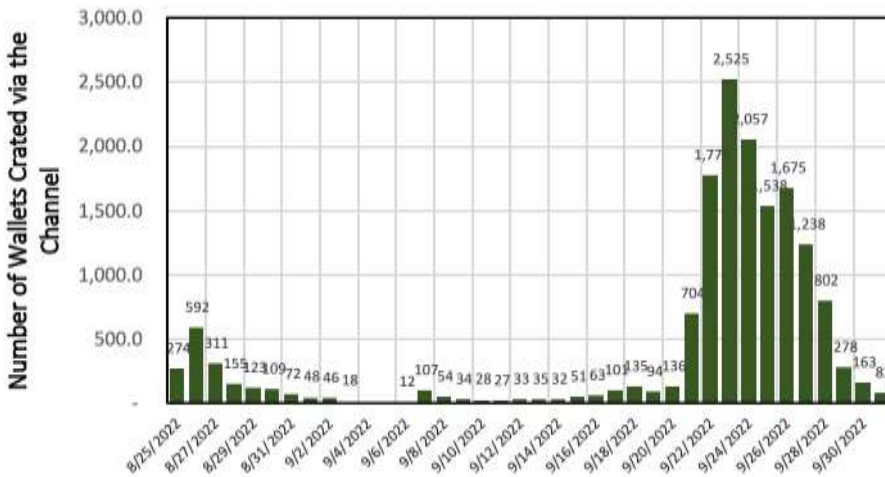
As stipulated in its design paper, the design considerations of the eNaira were hinged on a set of foundational principles, one of which is “do no harm”, which implies that CBDCs should support the already laid out public policy objectives and in no way impede the ability of central banks to carry out their mandate of monetary and financial stability. This principle is premised; on the one hand, on CBDCs having the potential to enhance the payment system as well as the resilience of the financial system. On the other hand, CBDCs can affect existing financial market structures and business models, thus, posing risks to financial stability, particularly via the disintermediation of banks.

4.1 Bank Funding/ Liquidity Risks

The eNaira possesses several benefits, which would come to bear as it becomes widespread and is premised on a robust regulatory system. However, it also has implications for the financial stability.

One of the benefits of eNaira is the improvement in bank funding through the diversification of the deposit base of banks by deepening financial inclusion by bringing more people into the financial space. Following the unveiling of the eNaira USSD code, *997#, on August 25, 2022, the coverage of the eNaira has expanded to individuals with mobile phones, even if they do not have bank accounts. Such individuals are onboard using unique identifiers such as National Identification Number (NIN) and/or their validated phone numbers. This functionality also leverages offline payment channels like agent networks, USSD, wearables, cards, and near-field communication technology, thus, giving access to financial services to underserved and unbanked segments of the population. Since the launch of USSD in August 2022, 15,997 users have been onboarded, with total volume and value of transactions of 11,464 and ₦2.74 million as of October 3, 2022.

Figure 5.1: eNaira USSD Onboarding



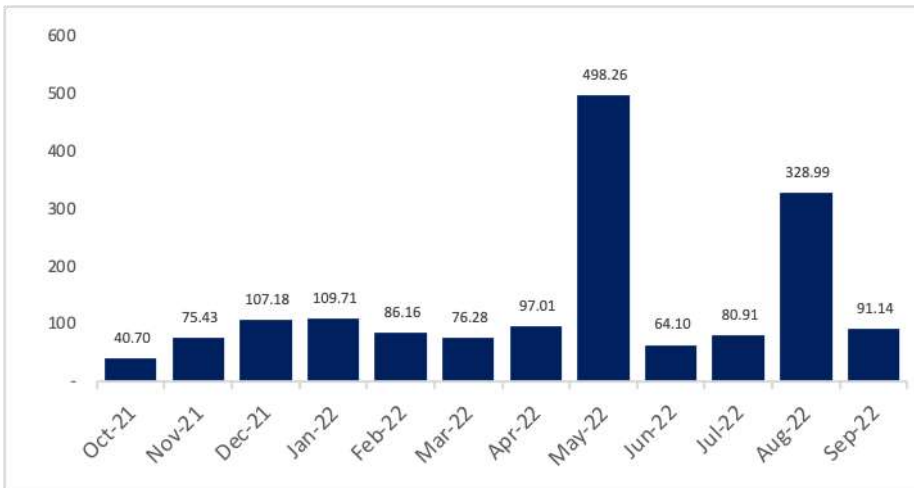
Source: Staff Compilation using data from Redash

From the financial stability perspective, this development will widen the size and stability of banks’ deposit base, increasing the number of smaller savers. This, in turn, reduces each bank’s dependence on ‘non-core’ financing, which is subject to volatility in times of crises, hence, the reduction in pro-cyclicality risk. Furthermore, the eNaira would concomitantly improve Nigeria’s financial

inclusion rate from 64.1 per cent recorded in 2021⁸ to the 95.0 per cent target for 2024.

Despite the financial inclusion benefit of the eNaira, risks emanating from deposit substitution exist. Liquidity risk on the part of banks, arising from deposit conversion to eNaira poses a financial stability risk to the banking system. Since its inception, bank deposit conversion to eNaira has exhibited an average monthly growth of 78.3 per cent and totalled about ₦1.66 billion. Furthermore, eNaira in circulation as a ratio of average banking system liquidity has averaged 0.1 per cent, reaching highs of 0.2 per cent in each of the months of May and August 2022.

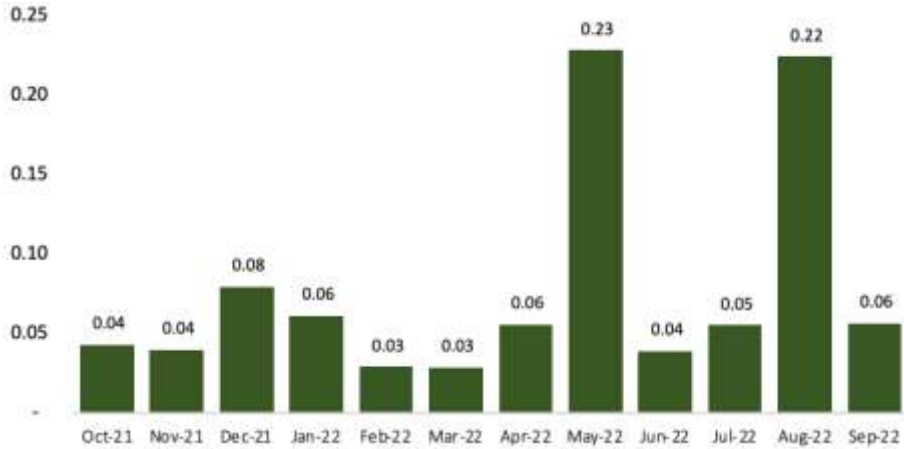
Figure 5.2: Bank Deposit Conversion to eNaira



Source: Authors' Compilation using data from CBN

⁸2021 Survey of Access to Financial Services published by EFInA

Figure 5.3: eNaira-Avg. Banking System Liquidity (%)



Source: Authors Compilation using data from CBN

Adopting a 2-tiered and Account-Based CBDC model for the eNaira, however, mitigated disintermediation. Hence, financial institutions play a key role in the distribution of eNaira to the public. Furthermore, the eNaira is built on a tiered wallet structure in which most individual wallets with full KYC requirements have a transaction and cumulative balance limit of ₦200,000.00 and ₦500,000.00 respectively. This mitigant douses the impact the eNaira has on bank deposits as the volume of transactions that individuals can conduct using their bank accounts with higher transaction limits of up to ₦5.00 million in some cases. In addition, balances in eNaira merchant wallets, which have unlimited transaction and cumulative balance limits, are automatically swept back to their bank accounts (deposits) the following day. Tables 5.1 and 25. below provide a schematic picture of the tiered wallet with their respective transaction limits.

Table 5.1: Individual Wallet Tiers & Transaction Limits

Tiers	Category	Requirement	Daily Transaction Limit	Daily Cumulative Balance
Tier 0	Non-Bank Account Holders	Telephone number (awaiting NIN verification)	20,000	120,000
Tier 1	Non-Bank Account Holders	Telephone number (NIN verified)	50,000	300,000
Tier 2	Bank Account Holders	BVN	200,000	500,000
Tier 3	Bank Account Holders	BVN	500,000	5,000,000

Source: CBN (2021)

Table 5.2: Merchant Wallet Tiers & Transaction Limits

Tiers	Category	Requirement	Daily Transaction Limit	Daily Cumulative Balance
Not Applicable	Account Holders	Full KYC as stipulated in CBN AML/CFT Regulations	No Limit	No Limit

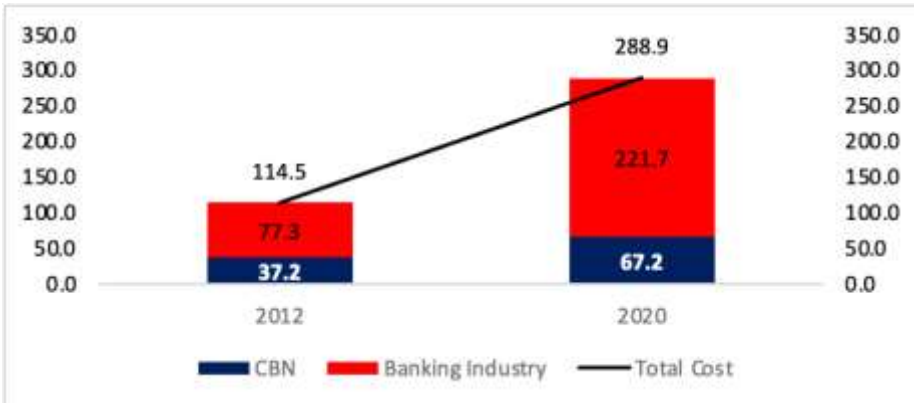
Source: CBN (2021)

4.2 Bank Profitability

The eNaira also positively impacts bank profitability from the cost side, given that it leads to lower cash usage; thus, banks can reduce the costs associated with cash handling and overall profitability. The cost of currency management incurred by the CBN has increased from ₦23.90 billion in 2012 to ₦69.90 billion in 2021, reflecting a 193.1 per cent increase (CBN, 2021). The introduction of the eNaira would reduce this cost of currency management across the entire currency lifecycle on the issuer's part, i.e., the Central Bank

of Nigeria and the financial institutions involved in the distribution of the currency.

Figure 5.4: Cost of Currency Management (₦ 'Billion)



Source: Staff Compilation using data from CBN

Conversely, the eNaira would negatively affect banks' profitability from the revenue angle, particularly the non-interest income component. This is premised on the fact that charges for transactions that originate from the eNaira platform are free as against the electronic levies, charges, and commissions existent on the digital banking channels.

4.3 Cybersecurity Risks

Financial stability has recently been closely tied to cybersecurity given the increased reliance on digital banking and payments. Attacks on Domestic Systemically Important Banks (DSIBs), or a core system or service used by many, could quickly spread through the entire financial system causing widespread disruption and loss of confidence. Transactions could fail as liquidity is trapped, and households and companies could lose access to deposits and payments. Under extreme scenarios, investors and depositors may demand their funds or try to cancel their accounts or other services and products they regularly use. Federal Reserve Chair Jerome Powell recently listed cyber risk as his number one worry relating to financial stability.

Analysts have described cybersecurity and privacy risks as potential reasons not to develop a CBDC.

To mitigate cybersecurity risk, the choice of distributed ledger technology (DLT) - The Hyperledger Fabric for the eNaira stems from its modular architecture, which has a robust security architecture, is configurable, versatile, optimisable, scalable, and open to innovation. In addition, regulatory mechanisms such as auditing requirements, two-factor authentication for wallets, and stringent breach disclosure requirements on the part of the third-party provider, Bitt Inc., and the operators (banks) have been put in place to ensure financial stability.

4.4 Scenario Analysis

To further explore the likely impact of the eNaira on bank funding, cash reserve ratio and loan-to-deposit ratio, a simple framework was used in analysing three scenarios to explore the effect eNaira may have on banks funding in the future under certain assumptions. The study employed financial data on total credit, total bank deposits, total currency in circulation comprising bank notes and coins as well as eNaira as of August 2022. The scope was limited due to unavailability of data and the need to reflect developments around the eNaira following its launch in October 2021. The underlying assumptions include:

- i.** The baseline period for the analysis is August 2022;
- ii.** The volume of eNaira in circulation is deducted from the corresponding value of bank deposits; and
- iii.** An outstanding credit is constrained by 52.0 per cent of eNaira demand and changes in the cash reserve ratio.

Three (3) scenarios were constructed to examine this relationship. They include:

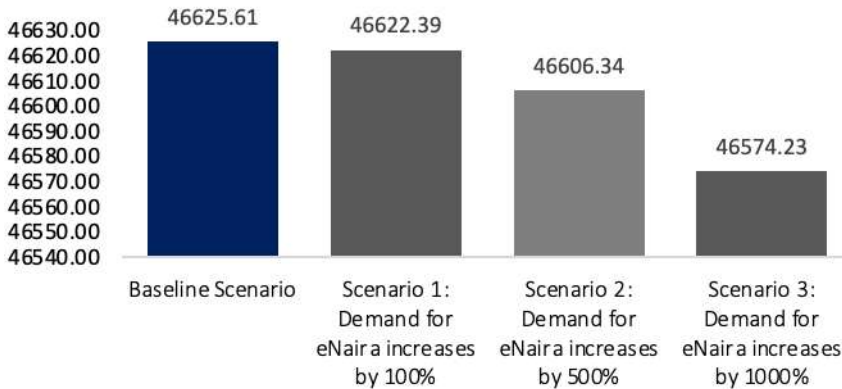
- i. Scenario 1:** bank deposit conversion to eNaira is assumed to follow its average growth rate of 100 per cent since its launch in October 2021 under the above-mentioned assumptions.

- ii. **Scenario 2:** Demand for eNaira is assumed to grow by 500 per cent given the introduction of eNaira incentive and rewards programmes.
- iii. **Scenario 3:** Demand for eNaira is assumed to grow by 1000 per cent due to financial products by FinTechs in Nigeria, which are interest-bearing coupled with the use of eNaira for social investment programmes by the Government such as Conditional Cash Transfers.

4.4.1 Scenario Results

The simulation results show that the impact of increased eNaira demand on bank deposits was negative relative to the baseline scenario. Specifically, the increase in eNaira demand by 100, 500, and 1000 per cent will reduce bank deposits by 0.01, 0.03 and 0.1 per cent, respectively. Notably, the impact was instantaneous but is adjudged very low (insignificant) given that the third scenario with the extreme impact on the deposit is ₦32.11 billion, representing 0.11 per cent of the total deposit.

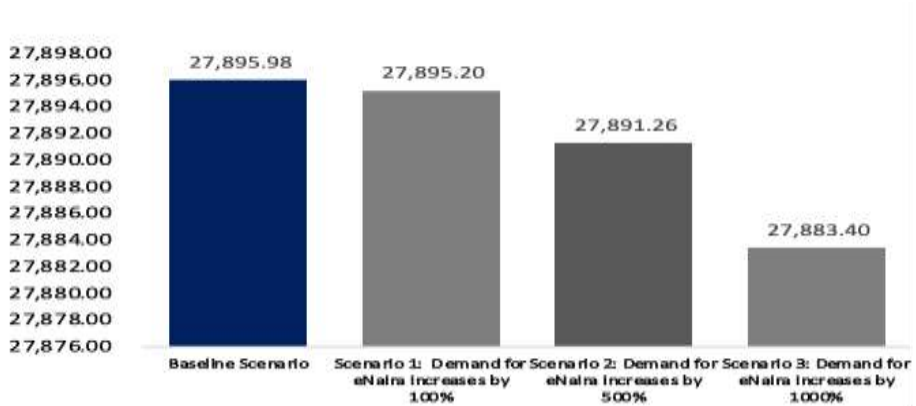
Figure 5.5: Impact of eNaira demand on Deposit (₦ billion)



Source: Estimation Output

Demand for eNaira across the three scenarios was found to reduce credit supply. Specifically, gross credit declined by ₦0.79 billion, ₦4.72 billion and ₦12.59 billion, respectively, given a 100%, 500% and 1000% increase in demand.

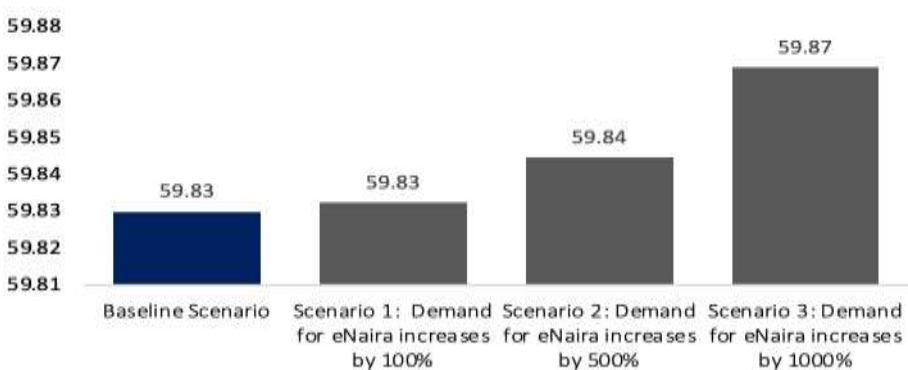
Figure 5.6: Impact on Credit (₦ billion)



Source: Estimation Output

The increase in the demand for eNaira also led to a rise in banking industry loan-to-deposit ratio from 59.8 per cent in the baseline to 59.9 per cent in scenario 3, which is the most extreme scenario of a 1000 per cent increase in eNaira demand. This outcome reflects the dynamic impact that the demand for eNaira has on deposits on the one hand and on credit on the other hand.

Figure 5.7: Impact on LDR (%)



Source: Estimation Output

5.0 Conclusion and Recommendations

The study assessed the implications of the eNaira adoption on financial system stability in Nigeria. It examined the literature on CBDCs and the implications for financial stability in Nigeria. Existing data on deposits and credits of financial institutions was used to construct a scenario analysis on the likely effects of the eNaira on financial system stability. The results showed that the number of small savers would increase, and banks' dependence on 'non-core' financing sources and pro-cyclicality risk in financial institutions would reduce, with the increase in the eNaira. The findings also showed that the costs of handling cash by financial institutions and bank non-interest income would decline. Also, marginal increases in the eNaira demand would not significantly reduce banks' credit supply, while a substantial increase constrains banks' credit supply. However, the paper showed that the banking industry loan-to-deposit ratio would improve marginally. Given these findings, the study recommends the continuous review of the tiered wallet structure to mitigate the impact on deposit and credit supply as the demand for the eNaira increases.

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CHAPTER SIX: CBDC AND THE RISK OF DISINTERMEDIATION: EVIDENCE FROM NIGERIA

Adamgbe, E. T., Evbuomwan, O. and Kanu, L. O.

Abstract

The benefits of deploying central bank digital currencies such as promoting financial inclusion, enhancing efficiency in the payments system and cross-border transactions, reducing cash handling costs, are well-documented in the literature. However, there are rising concerns about the potential pitfalls as regards bank funding and intermediation. The study, therefore, investigated the possibility of a crowding out effect of the eNaira on bank deposits. Employing generalisable payment portfolio model and stylised balance sheet analysis on data generated from the Monetary Survey and analytical balance sheet, the study found that the risks of disintermediation may arise as liquidity conditions of banks are impacted when economic agents exchange bank deposits for eNaira. Therefore, it is imperative for authorities to systematically consider the pace of the adoption of the eNaira to mitigate associated risks.

Keywords: CBDC, disintermediation, Nigeria

JEL Classification: E41, E58, G20

1.0 Introduction

Renewed interest in central bank digital currencies (CBDCs) has emerged, engendered by advancement in payment technologies and the rise of cryptocurrencies as potential competitors to fiat currencies. A report from the Federal Reserve (2022) suggests that among other benefits, a CBDC could provide households and businesses a convenient, electronic form of central bank money, with the safety and liquidity that it would entail, and expand consumer access to the financial system. Furthermore, CBDCs could allow a broad range of non-bank players to hold digital and interest-bearing central bank liabilities, which are currently and exclusively held by banks and some other selected players in the form of reserves. These qualities present CBDCs as an alternative to the conventional bank reserves held by central banks. In

principle, CBDCs could also improve the sensitivity of non-banks to the changing stance of policy.

The Central Bank of Nigeria blazed the trail by launching the eNaira in October 2021. The eNaira is the digital equivalent and it is valued at par with the physical naira. Associated with the eNaira are policy objectives, including promoting financial inclusion, reducing the cost of currency management, improving efficiency in cross-border payments, enhancing effectiveness of monetary policy and smoothening the delivery of government's social investment programmes.

As of November 26, 2022, about a million consumer and merchant wallet downloads have been recorded, with these downloads occurring in over 160 countries (per Google Play store and Apple Store data). In addition, over 792,011 transactions, amounting to over ₦9.30 billion have been recorded. However, despite the above identified benefits and achievements of the eNaira, there is a rising concern on the potential pitfalls with respect to bank funding and intermediation. In this regard, it is important to ask the question whether the deployment of the eNaira would engender disintermediation in the banking system. To answer this, this chapter examines the issuance of CBDCs and the possible risks of disintermediation in the Nigerian context.

To achieve the set objectives, stylised balance sheet analysis is utilised to examine the likely impact the adoption of the eNaira might have on the banking system. Following this introduction, Section two presents a review of relevant literature while Section three discusses the analytical framework, data and methodology employed. Section four presents the results while Section five concludes the paper.

2.0 Literature Review

Several contributions have continued to trail the theoretical expositions on the implications of introducing central bank digital currencies (CBDCs) for monetary policy, disintermediation and financial system stability (Bordo & Levin, 2017; Andolfatto, 2019; Bindseil, 2019; Chiu et al., 2019; Keister &

Sanches, 2021; Fernández-Villaverde et al., 2020; Schilling et al., 2020 and Garratt & Zhu, 2021). As a major component of the financial system, the intermediation role of banks in allocating funds from surplus spending units to deficit spending units cannot be overemphasized. Other studies in the area include Andolfatto (2021), Chiu et al. (2019), Agur et al. (2022), Wenker (2022) and Eren et al. (2022). Andolfatto (2021), claims that CBDC does not necessarily impact on bank lending operation, thus banks are not disintermediated. To him, the main consequences are to be felt by banks in the form of lower monopoly profits.

For CBDC to promote bank intermediation, a regulatory framework for CBDC should have a standard that places restrictions and caps to its operations (Chiu et al., 2019; Chang et al., 2022; Wenker, 2022). An interest-bearing CBDC engenders more competition, which leads to more deposits and lending, and a lower loan rate. However, greater intermediation arises only if the interest rate on the CBDC lies in some intermediate range. If the CBDC rate is too low, then the CBDC does not affect the equilibrium. If the CBDC rate is too high, disintermediation occurs (Chiu et al, 2019).

Sanches and Keister (2021) suggest that by choosing a proper interest rate on CBDC, policymakers can ensure that CBDC introduction never decreases welfare. Barrdear and Kumhof (2016) introduce CBDC in a DSGE model with competitive but regulated banking sector. They find that CBDC always spurs economic activity, lowers the policy and deposit rates, and increases bank lending. Garratt et al. (2022) consider a model with banks that have heterogenous market shares and analyse how an interest-bearing CBDC can affect concentration in the banking system. In sum, the impact crucially depends on the design of CBDC. Wang and Hu (2022) study the link between CBDC and financial development and argue that in less financially developed economies, retail CBDCs can be useful for promoting financial inclusion, while in countries with high levels of financial development, CBDC can enhance financial stability by substituting out riskier non-bank e-money.

The Bank for International Settlements survey on CBDCs suggests that domestic payments efficiency is a major motivation for issuing a retail CBDC in both advanced and emerging market economies (Boar & Wehrli, 2020). As the economy enters an increasingly cashless digital world, the role of cash weakens, and a CBDC offers the public an outside option for conducting electronic payments (Chiu et al., 2019). While the Central Bank of Nigeria has introduced the eNaira, it will not be out of place to conduct an experiment on available data on the risks of disintermediation in a known case where digital transactions are gaining momentum. The literature is not lacking on the theoretical aspect but using a stylised balance sheet approach to simulate likely outcomes appears scanty in the extant literature. This chapter, therefore, seeks to examine CBDC and the risk of disintermediation, evidence from Nigeria.

3.0 Data and Methodology

3.1 Analytical Framework

The study employs the generalisable payment portfolio model utilised by Bian et al. (2021) and stylised balance sheet analysis by Malloy et al. (2022) to examine the potential risk of disintermediation associated with the eNaira. Focus would be on the payment assets that provide liquidity for transactions. As a result, a payment portfolio, consisting of three (3) payment assets - Cash, Deposits and CBDC, is constructed for economic agents to satisfy the payment needs and to maximise utility, U . Thus, this may be algebraically denoted as:

$$\begin{array}{ll} \underset{\substack{\text{max} \\ \text{(Cash, Deposit, CBDC)}}}{\text{S.I.}} & U = U(\text{Cash}, \text{Deposit}, \text{CBDC}) \\ & \text{Cash} + \text{Deposit} + \text{CBDC} = P. \end{array} \quad (1)$$

Four utility-contributing features were considered for the various payment assets following the work of Boronovo et al. (2018), including: legal tender, anonymity, interest bearing and digitalisation. Analytical solutions could, therefore, be obtained using the Constant Elasticity of Substitution (CES) utility function within the unique specification below:

$$U(P_L, P_A, P_R, P_D) = (\alpha_L P_L^{-\gamma} + \alpha_A P_A^{-\gamma} + \alpha_R P_R^{-\gamma} + \alpha_D P_D^{-\gamma})^{-\frac{1}{\gamma}}. \quad (2)$$

Where parameters $\{\alpha_L, \alpha_A, \alpha_R, \alpha_D\}$ indicate the varying preferences economic agents have for the different utility-contributing features. A zero-

substitution elasticity was assumed, given that the different features are not substitutes. In addition, the sum of all the parameters is normalised to 1 and assumed to be positive such that:

$$\alpha_L + \alpha_A + \alpha_R + \alpha_D = 1, \min\{\alpha_L, \alpha_A, \alpha_R, \alpha_D\} > 0 \text{ and } \max\{\alpha_L, \alpha_A, \alpha_R, \alpha_D\} < 1$$

(3)

The payment options of cash, deposits and CBDC are then categorised into the various features as depicted in Table 6.1. For instance, cash and CBDCs are legal tender, given that they are both issued by the central bank. In addition, cash is categorised as anonymity, given its ability to meet the demand for privacy in transactions. Furthermore, deposits, being interest bearing payment options yield returns under certain agreed conditions. Lastly, both deposits and CBDC are categorised as digital, given their digital form which aids cash handling costs.

Table 6.1: Utility Contributing Features of Cash, Deposits and CBDC

	Legal Tender	Digital	Anonymity	Interest Bearing
Cash	√		√	
Deposits		√		√
CBDC	√	√		

Source: Adapted from Bian et al. (2021).

Following this categorisation, the optimal payment portfolio problem could be specified as the following equation system:

$$\begin{aligned}
 & \underset{\{Cash, Deposit, CBDC\}}{\text{MAX}} \quad U(P_L, P_A, P_R, P_D) = (\alpha_L P_L^{-\alpha_L} + \alpha_A P_A^{-\alpha_A} + \alpha_R P_R^{-\alpha_R} + \alpha_D P_D^{-\alpha_D})^{-\frac{1}{\alpha}} \\
 & \text{s.t.} \quad \begin{cases} P_L = CBDC + Cash \\ P_A = Cash \\ P_R = Deposit \\ P_D = CBDC + Deposit \\ CBDC + Cash + Deposit = P \end{cases}
 \end{aligned} \tag{4}$$

From this above, some inferences regarding the demand for CBDC as well as its ability to crowd out deposits could be made as follows:

Inference 1: the demand for CBDC exists if and only if $\alpha_L \alpha_D > \alpha_R \alpha_A$, that is, households' preferences for legal tender and digital payments dominate the preferences for interest bearing and anonymity. Otherwise, the demand for CBDC would be zero. Therefore:

$$\begin{cases} CBDC^* > 0 & \text{if } \alpha_L \alpha_D > \alpha_R \alpha_A \\ CBDC^* = 0 & \text{if } \alpha_L \alpha_D \leq \alpha_R \alpha_A \end{cases} \tag{5}$$

Inference 2: The risk of disintermediation arises during demand for CBDC if the following condition occurs:

$$\frac{\Delta Deposit}{P} = \alpha_D + \alpha_R - \frac{\alpha_R}{\alpha_L + \alpha_R} = \alpha_D \frac{\alpha_L / \alpha_R}{\alpha_L / \alpha_R + 1} - \alpha_A \frac{1}{\alpha_L / \alpha_R + 1} \tag{6}$$

Overall, the risk of disintermediation occurs when economic agent prefers the legal tender and digitalisation feature of the payment options rather than the interest rate feature of the payment options available to him. While this is highly theoretical, stylised balance sheets would be used to examine this empirically and in the context of data.

3.2 Methodology

A stylised balance sheet approach is utilised for this analysis because it has been proven to be a simple and potent method for simulating likely outcomes of policy actions (Malloy et al., 2022). The focus of this paper would be on the balance sheets of the central bank, the banking system, and the household.

Specific to the eNaira framework, the central bank is viewed as the issuer of the digital currency while the banking system plays a distributional role in the CBDC framework.

Furthermore, the household is seen to be user of the CBDC under the demand, acceptance framework of the eNaira. As stipulated in the eNaira design paper, we assume that eNaira is exchangeable at parity with the following: bank notes or electronic money (i.e., bank deposits) as regards individuals and businesses, or bank reserves as regards banks. In addition, we assume that the eNaira is non-interest bearing⁹ and as such that commercial banks' aggregate demand does not change during our simulation.

3.3 Data

Data generated from the Monetary Survey for the month of June 2021 was used to construct stylised balance sheets. The choice of the data was to have a baseline prior to the introduction of the eNaira. These aggregates include monetary base, currency in circulation, disaggregated into bank notes and coins, eNaira stock and liabilities to ODCs used for the baseline and scenario-based analysis. These balance sheets of the banking system and households were also designed to capture major categories of assets and liabilities. The data were sourced from the Central Bank of Nigeria database.

4.0 Scenario-based Analysis

A baseline scenario is developed, capturing the individual balance sheets of the central bank, the deposit money banks and Nigerian households, to situate the argument for or against the potential risk of disintermediation, given the momentum in eNaira adoption. These balance sheets were designed to capture major categories of assets and liabilities. Thus, in the case of the baseline scenario, retail CBDC balances were not included under the financial assets of households or the liabilities of banks and the central bank. The demand for retail CBDC by households is assumed to be through holdings of banknotes and coins or through bank deposits.

⁹Understanding the dynamics of remunerated CBDC is an important area for further research.

Consequently, two scenarios are simulated? to gauge the potential risk of disintermediation that might arise from the adoption of the central bank digital currency, the eNaira. The intuition behind these scenarios emanated from the implementation roadmap of the eNaira which details the phased approach of the project. Specifically, phase one of the eNaira project is focused on onboarding users that have bank accounts, using their bank verification number (BVN) as a unique identifier. In this case, households can request or demand eNaira in exchange for their existing bank deposits.

The objective of the second phase of the project is onboarding users that do not have bank accounts using their national identity number (NIN) as unique identifiers. In this regard, households are assumed to demand for eNaira in exchange for cash. Thus, the simulated? scenarios include:

- i. **Scenario 1:** 25.0 per cent of Total Bank notes are exchanged for the retail CBDC (eNaira); and
- ii. **Scenario 2:** 25.0 per cent of Total Bank deposits are exchanged for the retail CBDC (eNaira)

4.1 Baseline Balance Sheet Scenario

Tables 6.2 depict the initial balance sheet positions of the central bank, the banking system, and households prior to the introduction of the retail CBDC, the eNaira.

Table 6.2: Central of Nigeria Balance Sheet

Assets	₦ Billion	Liabilities	₦ Billion
Net Foreign Assets	8,064.51	Bank Notes and Coins	2,741.26
Claims on other Depository Corporations	3,300.32	Reserve Balances	9,592.59
Net Claims on Government	8,875.63	Other Liabilities	9,543.79
Claims on other Sectors	9,458.65	Deposits and Securities other than Shares	3,988.59
		Shares and other equity	269.02
		Other Items (Net)	3,563.86
	29,699.11		29,699.11

Table 6.3: Deposit Money Banks Balance Sheet

Assets	N' Billion	Liabilities	N' Billion
Net Foreign Assets	-766.92	Liabilities to the Central Bank	1,576.69
Claims on Central Bank		Transferable Deposits	11,754.99
Currency	471.03	Other Deposits	21,940.59
Reserve Deposits and Securities other than shares	11,921.69	Securities other than Shares	0.078
Others	9,147.95	Loans	1,298.84
Net Claims on Central Government	2,611.28	Others	8,830.92
Claims on other Sectors	22,017.08		
	45,402.11		45,402.11

Table 6.4: Households Balance Sheet

Assets	N' Billion	Liabilities	N' Billion
Non-Financial	8,023.56	Credit	17,400.01
Financial		Others	4,350.00
Bank Notes and Coins	2,248.19		
Deposits at Bank	11,478.26		
	21,750.01		21,750.01

4.2 Scenario 1: 25.0 per cent of Total Bank notes are exchanged for the retail CBDC (eNaira)

Under this scenario, Nigerian households demand for the eNaira in exchange for physical cash (bank notes). This is premised on the objective of the second phase of the eNaira project which is focused on onboarding the unbanked users. Thus, it is assumed that 25.0 per cent of total bank notes and coins, i.e., ₦562.05 billion, would be exchanged for eNaira by households.

The results indicate that the composition of the central bank's liabilities is observed to change as bank notes and coins reduced from an original level of

₦2,741.26 billion to ₦2,179.21 billion, however, the sum of the liabilities remains unchanged. Similar dynamics are observed on the asset side of the balance sheets of household as notes and coins decrease to ₦1686.14 billion, from ₦2,248.19 billion, while the stock of eNaira stood at ₦562.05 billion. Furthermore, the balance sheet of banks is observed to change positively as transferable deposits increased to ₦12,317.04 billion from the baseline, given that this process is assumed to be facilitated by agents of banks which have bank accounts or the banks themselves such that households either walk up to agents or go into the banks to demand eNaira. Resultantly, financial inclusion is achieved and there appears to be no risk of disintermediation.

Table 6.5: Impact of Scenario 1 on Central Bank of Nigeria Balance Sheet

Assets	₦ Billion	Liabilities	₦ Billion
Net Foreign Assets	8,064.51	Bank Notes and Coins	2,179.21
Claims on other Depository Corporations	3,300.32	Retail CBDC – eNaira	562.05
Net Claims on Government	8,875.63	Reserve Balances	9,592.59
Claims on other Sectors	9,458.65	Other Liabilities	9,543.79
		Deposits and Securities other than Shares	3,988.59
		Shares and other equity	269.02
		Other Items (Net)	3,563.86
	29,699.11		29,699.11

Table 6.6: Impact of Scenario 1 on Deposit Money Banks Balance Sheet

Assets	₦' Billion	Liabilities	₦' Billion
Net Foreign Assets	-766.92	Liabilities to the Central Bank	1,576.69
Claims on Central Bank		Transferable Deposits	12,317.04
Currency	471.03	Other Deposits	21,940.59
Reserve Deposits and Securities other than shares	12,483.74	Securities other than Shares	0.078
Others	9,147.95	Loans	1,298.84
Net Claims on Central Government	2,611.28	Others	8,830.92
Claims on other Sectors	22,017.08		
	45,964.16		45,964.16

Table 6.7: Impact of Scenario 1 on Households Balance Sheet

Assets	₦' Billion	Liabilities	₦' Billion
Non-Financial	8,023.56	Credit	16,950.37
Financial		Others	4,237.59
Bank Notes and Coins	1,686.14		
Retail CBDC - eNaira	562.05		
Deposits at Bank	11,478.26		
	21,187.96		21,187.96

4.3 Scenario 2: 25.0 per cent of Total Bank deposits are exchanged for (eNaira)

Under this scenario, Nigerian households exchange eNaira for private digital money backed up by their bank deposits. Reiteratively, this is premised on the objective of the first phase which is onboarding of bank customers using their

bank verification number (BVN) as unique identifiers. In this regard, 25.0 per cent of transferable deposits, i.e., ₦2,938.75 billion is assumed to be exchanged for eNaira.

The simulation results reveals that the balance sheet of the central bank is not impacted. However, the composition changes modestly as the introduction of the retail CBDC (eNaira) on the liability side is offset by the decrease in bank reserve balances, thus, suggesting a liability substitution effect. This phenomenon negatively affected the balance sheet of the deposit money banks as reserve deposits on the asset side and transferable deposits on the liabilities decline by ₦2,938.75 billion, thus impacting the liquidity conditions of the banks in Nigeria.

This result, therefore, signals the risk of disintermediation, given the money demand decisions of the households. It is, therefore, imperative to monitor the liquidity positions of the banks as the eNaira is adopted so as to mitigate the eventuality of financial instability through the liquidity channel.

Table 6.8: Impact of Scenario 2 on Central Bank of Nigeria Balance Sheet

Assets	₦' Billion	Liabilities	₦' Billion
Net Foreign Assets	8,064.51	Bank Notes and Coins	2,741.26
Claims on other Depository Corporations	3,300.32	Retail CBDC - eNaira	2,938.75
Net Claims on Government	8,875.63	Reserve Balances	6,653.84
Claims on other Sectors	9,458.65	Other Liabilities	9,543.79
		Deposits and Securities other than Shares	3,988.59
		Shares and other equity	269.02
		Other Items (Net)	3,563.86
	29,699.11		29,699.11
			1

Table 6.9: Impact of Scenario 2 on Deposit Money Banks Balance Sheet

Assets	N' Billion	Liabilities	N' Billion
Net Foreign Assets	-766.92	Liabilities to the Central Bank	1,576.69
Claims on Central Bank		Transferable Deposits	8,816.24
Currency	471.03	Other Deposits	21,940.59
Reserve Deposits and Securities other than shares	8,982.94	Securities other than Shares	0.078
Others	9,147.95	Loans	1,298.84
Net Claims on Central Government	2,611.28	Others	8,830.92
Claims on other Sectors	22,017.08		
	42,463.36		42,463.36

Table 6.10: Impact of Scenario 2 on Households Balance Sheet

Assets	N' Billion	Liabilities	N' Billion
Non-Financial	8,023.56	Credit	15,049.01
Financial		Others	3,762.25
Bank Notes and Coins	2,248.19		
Deposits at Bank	8,539.51		
Retail CBDc- eNaira	2,938.75		
	18,811.26		18,811.26

5.0 Summary and Conclusion

The study investigated the potential risk of disintermediation with the adoption of the eNaira, using generalisable payment portfolio model and stylised balance sheet approaches on data sourced from the Monetary Survey. Two scenarios around the demand for the eNaira in exchange for part of transferable deposits or the demand for the eNaira in exchange for cash were simulated using the above-mentioned approach.

The study found that the risks of disintermediation may arise because of the money demand decisions of the households. Particularly, liquidity conditions of banks were observed to be impacted when households demand for the eNaira in exchange for bank deposits. However, the mitigation measures which have been put in place by the authorities, including the adoption of a 2-tiered model and KYC-enabled-wallet structure which defines daily transaction and balance limits, would help in stemming this risk. Nonetheless, it is imperative for authorities to monitor progress made with respect to eNaira adoption to contain this risk.

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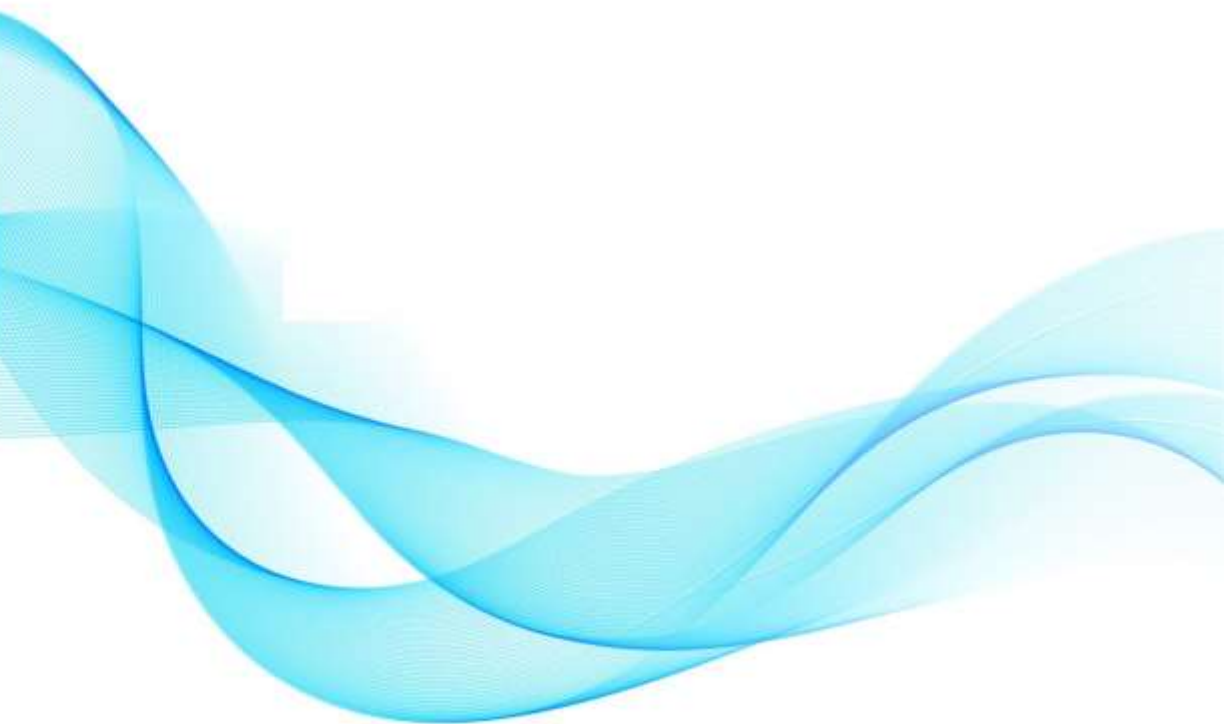
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PART 4

PAYMENTS SYSTEM AND FINANCIAL INCLUSION



CHAPTER SEVEN: THE eNAIRA AS A TOOL FOR FINANCIAL INCLUSION IN NIGERIA

Ozili, P. K.

Abstract

The launch of the eNaira in Nigeria has drawn substantial interest from observers around the world including central banks. The eNaira is envisaged to bring many benefits, and financial inclusion is one of such benefits. This paper uses Google trends to explore the eNaira's potential to increase financial inclusion in Nigeria. The results show that the eNaira can increase financial inclusion by (i) offering an easy account opening process for greater financial inclusion (ii) enabling digital access to diverse financial services in the financial system, (iii) offering low-cost financial products and services, (iv) avoiding unexplained bank charges that could cause financial exclusion, (v) attracting people who have lost confidence in banks, (vi) introducing interest-bearing eNaira, and (vii) using offline channels to access the eNaira.

Keywords: eNaira, central bank digital currency, financial inclusion.

JEL classification: G21, G28, E42.

1.0 Introduction

This Chapter explores how the eNaira could increase financial inclusion in Nigeria. A central bank digital currency (CBDC) is defined as fiat digital money (Jia, 2020; Lee et al., 2021; Inozemtsev & Nektov, 2022). It is the digital equivalent of its physical counterpart (Cunha et al., 2021; Bordo & Levin, 2017; Barontini & Holden, 2019). Some countries such as Nigeria and the Bahamas have issued a CBDC, while others are still at the research stage to determine best use cases.

Central banks are interested in CBDCs for different reasons. Some central banks plan to issue the CBDC for the purpose of broadening financial inclusion and improving payments efficiency (Zhang & Huang, 2022; Sethaput & Innet, 2021; Calle & Eidan, 2020). Other central banks plan to issue a CBDC to enhance the conduct of monetary policy, control banking system liquidity,

increase government revenue and provide a legal tender that is relevant to the digital payment ecosystem (Piazzesi & Schneider, 2020; Davoodalhosseini et al, 2020; Ozili, 2022a).

There are many benefits of issuing a CBDC. Arguably, the most important benefit of issuing a CBDC in developing countries is to increase financial inclusion since many developing countries have a large unbanked population (Banet & Lebeau, 2022; Ozili, 2022b). Financial inclusion ensures that all individuals and businesses have access to affordable formal financial services which they can use to improve their welfare (Liu & Walheer, 2022; Liu et al., 2022; Ozili, 2021).

In Nigeria, financial exclusion is an important issue, and the Central Bank of Nigeria believes that the eNaira could play a significant role in tackling it. Nigeria launched the eNaira at a time when there was heated global debate about the risks of private digital currencies and the need for a government controlled digital currency (Brunnermeier & Niepelt, 2019; Ozili, 2022c). Prior to launching the eNaira, the central bank of Nigeria, in February 2021, barred regulated deposit money banks from aiding or facilitating cryptocurrency transactions because fraudsters used cryptocurrencies to hide illicit financial dealings (Ozili, 2022d). Such practices undermined the integrity of the Nigerian banking system. The implication of the restriction is that cryptocurrency transactions were no longer permitted in the Nigerian banking system. Soon after the restrictions were imposed, the central bank launched the eNaira.

The eNaira has the same features as the paper naira and offers more payment possibilities for Nigerians.¹⁰ The eNaira is designed to act as an efficient payment tool. It will compete with existing payment channels. The eNaira offers many potential benefits. It can help to (i) increase financial inclusion, (ii) enhance the efficiency of payments, (iii) encourage broad digitization in the Nigerian society, (iv) increase cross-border trade, (v) improve monetary

¹⁰Extensive details about the eNaira design features and structure can be found in the article: *Ozili (2022d)*

policy effectiveness, (vi) improve tax collection, (vii) implement targeted social interventions, and (viii) facilitate cheaper and faster remittance inflows.

This study contributes to the existing CBDC literature on the potential benefits of a central bank digital currency (Baronchelli et al., 2022; Hayashi & Toh, 2022; Ozili, 2020a; Dakila Jr, 2022; Maniff, 2020; Babin et al., 2022). In the literature, financial inclusion is widely acknowledged to be a major reason for adopting a CBDC in developing countries. But it is not a reason for issuing a CBDC in developed countries (Maniff, 2020).

The remainder of the paper is organised in the following way. The literature review is shown in Section 2. Analysis of trend data is presented in Section 3. Section 4 identifies how the eNaira could increase financial inclusion. Section 5 suggests some important considerations for the future. Section 6 concludes.

2.0 Literature review

2.1 Theories

Several theories have emerged in explaining the reason for using instruments or tools to achieve high levels of financial inclusion. The most notable theories are the '*theories of financial inclusion*' developed by (Ozili, 2020). For instance, the public good theory of financial inclusion argues that the State should treat 'financial inclusion' as a public good that should benefit everybody. When this happens, the government will use any relevant tool at its disposal to increase the level of financial inclusion as a public good. The government has a compelling reason to use one of its tools, such as a CBDC, to broaden financial inclusion for the benefit of all citizens so that nobody is left out. The government may also have to subsidise the cost of offering financial services through CBDC payments to encourage more people to own a CBDC account for greater financial inclusion.

Another theory is the dissatisfaction theory of financial inclusion. The theory proposes that financial exclusion occurs when people become dissatisfied with the actions of financial institutions to their customers. The customers become frustrated, and their frustration led them to exit the financial system, preferring

to return to the informal sector because they have lost confidence in financial institutions and can no longer trust financial institutions. The affected customers would rather trust a central bank than trust financial institutions. A central bank can take advantage of people's dissatisfaction with financial institutions by providing them with an alternative way to access the financial system without dealing directly with financial institutions. One of such alternative ways is through the issuance of a CBDC such as the eNaira. Another theory is the public money theory of financial inclusion which emphasized that public money (e.g., CBDC) should be used to fund financial inclusion programs. Other theoretical perspectives have been explored by (Simatele et al., 2021; Kling et al., 2022; Ahmad Malik & Yadav, 2022).

2.2. Empirical review

Several studies on the benefits and use-case of CBDC in developing and developed countries exist. For example, (Ozili, 2022d) argued in support of the view that central bank digital currency can increase financial inclusion in Nigeria. The author argued that a central bank digital currency will lead to the digitization of value chains in Nigeria. It will improve access to essential digital financial services, enlarge the growing digital economy in Nigeria, enhance the efficiency of digital payments, and offer low transaction costs for users of CBDC in Nigeria.

Maniff (2020) argues that central bank digital currency that is created for financial inclusion purposes would complement cash and thereby modernise payment systems through new, more efficient technologies that provide additional functionality. The author also noted that central bank digital currency can also increase financial inclusion by offering a viable solution to the frictions in cross-border (international) payments. He, however, stated that central bank digital currency may experience some difficulty in increasing financial inclusion if the design of the central bank digital currency conflicts with the other objectives for creating a central bank digital currency. Murakami et al. (2022) argued that central bank digital currencies can increase financial inclusion of underserved adults and the unbanked population, improve cross-border payments and facilitate fiscal transfers. However, they noted that there

are still many unresolved issues in the design of a central bank digital currency. The researchers used a two-agent framework to show that central bank digital currencies can increase financial inclusion if households use it as a savings vehicle to smooth consumption. They also revealed that retail central bank digital currencies are more useful and beneficial in economies that have low levels of financial inclusion.

Engert and Fung (2017) suggest that even though central bank digital currency might improve financial inclusion, financial inclusion is not a major problem in most advanced economies, and for this reason, financial inclusion is not a compelling motivation for issuing a central bank digital currency in most advanced economies, including Canada. They infer that financial inclusion is most likely an important concern in some emerging and developing economies. Armas et al. (2022) explores the potential role of CBDC implementation in promoting financial inclusion in Peru. They argued that central bank digital currency can increase financial inclusion by allowing the unbanked population to access digital payment instruments. They argued that this can happen by (i) funds transfers where the banking network is not present, (ii) payments on public transportation, (iii) payment of wages in the informal sector and rural areas, (iv) payments to small merchants' suppliers (v) programs to promote social inclusion among the unbanked population (government to person), (vi) extend accessibility of digital payments to the government. However, they argued that the development of the domestic payment system is limited by low financial inclusion.

Barr et al. (2020) argued that central bank digital currency can increase financial inclusion by expanding access to financial services, using a central bank digital currency. Allen et al. (2022) pointed out that central bank digital currency will increase financial inclusion by reducing transaction fees and the cost of financial services, thereby improving access to capital. Ozili (2022b) argued that central bank digital currency can increase financial inclusion because consumers do not need to own a bank account to hold a CBDC. Ozili (2022a), in a review of the literature, maintained that the need to increase the level of financial inclusion is a motivation for issuing a central bank digital

currency in emerging and developing countries. The author argues that central bank digital currency can increase financial inclusion by giving people access to payments through central bank digital currency.

Morales-Resendiz et al. (2021) argued that financial inclusion is a major concern in Latin America and the Caribbean (LAC) countries, and the issuance of a central bank digital currency is being considered in these countries to expand access to financial services. Banet and Lebeau (2022) analyzed the impact of introducing a central bank digital currency on financial inclusion. They acknowledged that there has been a growing interest in investigating the potential of a central bank digital currency to support financial inclusion because of the low-cost payments it offers. Gopane (2019) showed that one advantage of a central bank digital currency is that it can be used to broaden financial inclusion, and that central bank digital currency is positively correlated with financial inclusion but is negatively affected by digital inequalities among various segments of the population especially older people.

Zuluaga (2021) argued that central banks always cite financial inclusion as a justification for issuing a central bank digital currency because it helps to reduce high fees which make them very appealing to unbanked adults. But the success of CBDC for financial inclusion will depend on whether central banks will rely on private firms to competitively deliver user interfaces such as digital wallets, mobile applications, and customer service. The author further maintained that even if central bank digital currency becomes attractive to many unbanked households, there will be some unbanked adults whose needs CBDCs cannot satisfy. He emphasised that even though technology is helping to increase financial inclusion through CBDC, progress in this area is not automatic and it may take many years to achieve. Maryaningsih et al. (2022) showed that a retail CBDC is more prevalent in countries that have low financial inclusion and a large informal economy because it offers easier access to the financial system.

Negrea and Scarlat (2022) pointed out that CBDC issuance can help to increase financial inclusion and create a very competitive market for private sector

payment solutions. In addition, they show that CBDC can create a digital solution that can help to increase financial inclusion for the 1.7 billion people globally who are not banked or do not have access to essential financial services. It can also be used to serve unbanked adults living in areas where traditional banking or financial infrastructure does not exist. Therefore, CBDC can help to achieve a meaningful level of financial inclusion in such areas.

3.0 Trend Behaviour in eNaira Adoption and Financial Inclusion in Nigeria

3.1. Local interest over time in the eNaira and financial inclusion

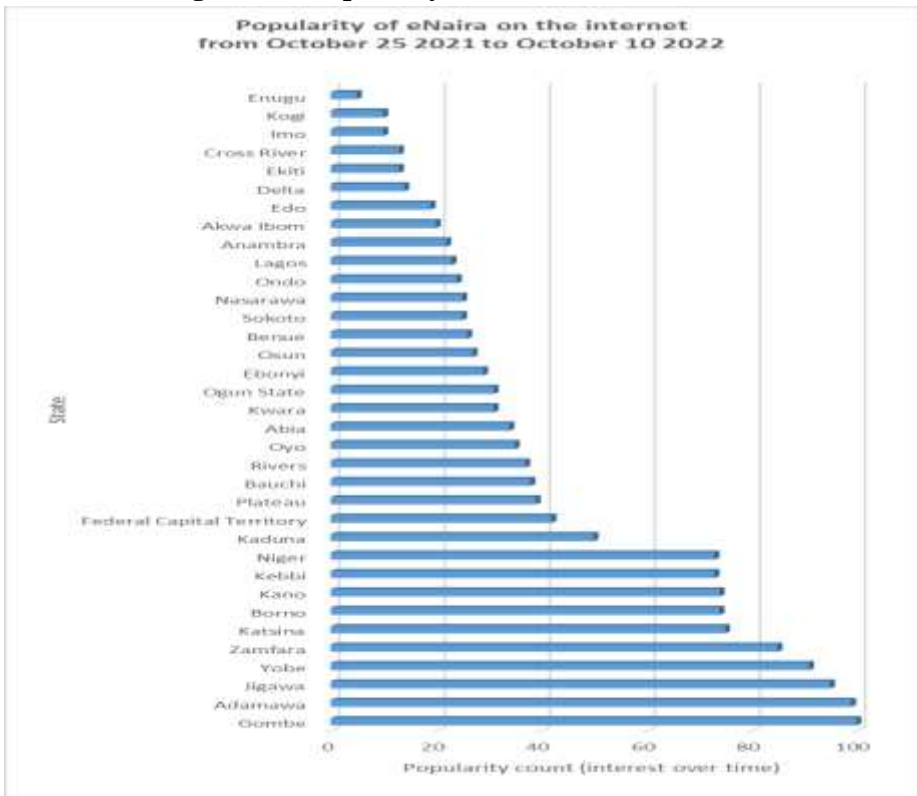
Data showing interest overtime, on eNaira adoption and financial inclusion in Nigeria were collected from Google Trends database from September 25 to October 10 of 2022 (see Table 7.A1 in the Appendix). The interest over time data measures the popularity of the ‘eNaira’ and ‘financial inclusion’ on the internet. The numbers represent search interest relative to the highest point on the chart for the given region and time. A value of 100 is the peak popularity for the term. A value of 50 means that the term is half as popular. A score of 0 means there was not enough data for this term. Table 7.A1 (see appendix) shows that the highest interest in eNaira on the internet was recorded on the day the eNaira was launched while interest in financial inclusion reached its highest point in May 2022. Table 7.A2 (see appendix) shows that the Northern states in Nigeria particularly in Gombe, Adamawa, Jigawa and Yobe, had greater interest in eNaira than the Southern states.

Figure 7.1: Local interest over time in eNaira and financial inclusion



Source: Google Trends database

Figure 7.2: Popularity of eNaira on the internet



Source: Google Trends database

4.0 eNaira for financial inclusion

One important benefit of the eNaira is that it can increase financial inclusion in several ways. Below are examples of how the eNaira can increase financial inclusion in Nigeria.

i. eNaira offers an easy account opening process for greater financial inclusion

The eNaira central bank digital currency has a simplified account opening process. Individuals do not need to produce any burdensome documentation to open an eNaira account. The easy account opening process will motivate more citizens to open an eNaira account to avoid the burdensome account opening documentation required by the deposit money banks.

ii. eNaira enables digital access to diverse financial services in the financial system

The eNaira central bank digital currency will be accessible to Nigerians through the eNaira speed wallet and USSD code so that they can access the eNaira both online and offline. With the eNaira, Nigerians will be able to access available digital financial services at the comfort of their homes without the hassle of visiting a bank branch to make or receive payments. They will also be able to make eNaira payments at check-out when making purchases.

iii. eNaira offers lower cost of financial products and services

The eNaira offers a low transaction cost when making payments. This will make the eNaira become a cheaper payment alternative compared to existing payment channels. The eNaira will also help to reduce the cost of remittance and make it cheaper for Nigerians in the diaspora to send money back home by obtaining eNaira from international money transfer operators (IMTOs) and transferring the remitted funds to the recipients or beneficiaries living in Nigeria by wallet-to-wallet transfers free of charge.

iv. No more unexplained bank charges that causes financial exclusion

One reason why people voluntarily exit the formal financial system is because of unexplained bank charges. The charges affect the poor severely and they react by exiting the formal financial system. The introduction of the eNaira will bring an end to unexplained bank charges. Users of the eNaira will pay low transaction cost, and they will understand the purpose of the transaction cost. They will be clearly informed and notified about a change in transaction cost or the introduction of new charges. This will increase transparency, increase trust in the government and make more unbanked adults willing to enter the formal financial system by opening an eNaira account.

v. eNaira will be used to attract people who have lost confidence in banks.

People may lose confidence in commercial banks when they become victims of fraud or victims of unauthorised access to bank accounts that could lead to loss of their savings. Such experience leads to dissatisfaction and can make people exit the financial system (Ozili, 2020)¹¹. The eNaira can accommodate the needs of this category of people. People who have lost confidence in commercial banks will trust the eNaira since the eNaira is a direct liability of the central bank not commercial banks. They can be confident that if they keep their money with the central bank through the eNaira, their savings will be protected and secured, and the central bank will bear liability for any loss of customers' money that is not a customer's fault.

vi. Interest-bearing eNaira can increase financial inclusion

An interest-bearing eNaira will increase financial inclusion. The interest earned on eNaira deposits will be attractive to unbanked adults and will give unbanked adults a motivation to enter the financial system through the eNaira so that they can take advantage of the interest that is payable on the eNaira deposit. They will bring their savings to the formal financial system through the eNaira. They will also have access to a wide range of financial services that can be accessed through the eNaira.

¹¹This is consistent with the propositions of the 'dissatisfaction theory of financial inclusion' As proposed by Peterson Ozili in his work 'Theories of financial inclusion'.

vii. eNaira can increase financial inclusion using offline channels

The eNaira can increase financial inclusion by using a USSD code to onboard the unbanked and underserved users that do not have access to internet connectivity or a smart phone.

5.0 Important Considerations for the Future

Some important considerations to increase the potential of the eNaira to increase financial inclusion include the following.

- i. eNaira adoption should be gradual.** Enough time should be given to citizens and businesses to adopt the eNaira. This is important because it will ensure that citizens and businesses use the eNaira because they see a clear benefit of using the eNaira and not because they are compelled to adopt it. People should be allowed to compare the benefits of the eNaira with the benefits of other payment alternatives. This will encourage them to choose the eNaira if it offers superior benefits.
- ii. Widespread digital literacy among the rural population is essential for greater eNaira adoption and usage.** There is significant digital illiteracy in some communities in Nigeria. Digital illiteracy is highly undesirable today. It is a cause of digital exclusion and social exclusion. Digital illiteracy affects vulnerable people, especially those living in rural and remote areas. When people are unable to use digital tools daily, it prevents them from accessing basic resources that can only be accessed digitally. They won't be able to access financial services remotely because they don't know how to, and they won't be able to teach their family and peers how to use digital tools.
- iii.** Some causes of digital illiteracy in Nigeria are lack of education, improper education, lack of access to internet connectivity and lack of access to mobile phones (Ekoh et al., 2021; Ani et al., 2007). The rural population need basic digital literacy to enable them to fully integrate in the digital society (Tayo et al., 2016). They should learn how to

download an app, update an app, login into an app, transfer money on the app and check transaction history on the app. They should also learn how to use a USSD code to perform financial transactions.

- iv. **The eNaira should not replace cash completely.** The eNaira should co-exist with its physical counterpart because cash remains the dominant form of transaction in Nigeria, especially among the financially excluded groups. People need time to adjust to using the eNaira.
- v. **eNaira deposits should be interest-bearing to attract the unbanked savers.** Unbanked savers will be motivated to bring their savings into the formal financial system through the eNaira because they trust the central bank. The interest earned on eNaira deposits should be lower than the interest on bank deposits to avoid disorderly bank disintermediation.
- vi. **The eNaira should be non-disruptive.** The phased introduction of eNaira should not significantly disrupt the financial and banking system.
- vii. **The eNaira may not be well-perceived or welcomed in the informal economy.** The central bank needs to find a way to make the eNaira accepted in the informal economy in Nigeria.

6.0 Conclusion

This paper explored how the eNaira could enhance financial inclusion in Nigeria. It was argued that the eNaira could increase financial inclusion by (i) simplifying account opening processes, (ii) enabling digital access to diverse financial services, (iii) offering low-cost financial products and services, (iv) avoiding unexplained bank charges that could cause financial exclusion, (v) attracting people who have lost confidence in banks, (vi) introducing interest-bearing eNaira, and (vii) using offline channels to access the eNaira.

The implication of the findings is that there is a clear channel through which eNaira could increase financial inclusion, and policy makers should explore more innovative ways through which eNaira could be deployed for that purpose.

Although there is a clear link between eNaira usage and financial inclusion, several considerations need to be considered, including embarking on a national digital literacy program to increase awareness of the eNaira. There is also a need to watch out for risks related to cyber-attacks and user protection.

Future studies should examine how the eNaira affects economic growth. Such studies should focus on how the eNaira affects business activities in specific sectors of the Nigerian economy. Future studies can also compare the Nigeria eNaira with other CBDC in Africa, if any. Such comparison will provide insight into understanding the local modifications in CBDC design.

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Appendix

Table 7.A1: Interest over time data

Week	eNaira: (Nigeria)	financial inclusion: (Nigeria)
31/10/2021	100	0
07/11/2021	76	79
14/11/2021	48	38
21/11/2021	31	0
28/11/2021	24	39
05/12/2021	43	56
12/12/2021	22	0
19/12/2021	33	0
26/12/2021	30	0
02/01/2022	20	65
09/01/2022	10	80
16/01/2022	8	74
23/01/2022	23	68
30/01/2022	18	60
06/02/2022	15	54
13/02/2022	21	22
20/02/2022	11	27
27/02/2022	9	19
06/03/2022	12	51
13/03/2022	13	46
20/03/2022	12	26
27/03/2022	3	48
03/04/2022	9	0
10/04/2022	5	0

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17/04/2022	6	53
24/04/2022	0	57
01/05/2022	5	20
08/05/2022	5	100
15/05/2022	14	0
22/05/2022	15	60
29/05/2022	8	42
05/06/2022	6	32
12/06/2022	14	44
19/06/2022	0	75
26/06/2022	5	0
03/07/2022	5	74
10/07/2022	13	61
17/07/2022	9	47
24/07/2022	7	31
31/07/2022	8	22
07/08/2022	16	0
14/08/2022	16	0
21/08/2022	20	64
28/08/2022	14	62
04/09/2022	36	0
11/09/2022	16	20
18/09/2022	22	0
25/09/2022	17	0
02/10/2022	10	24

Source: Google Trends database

Table 7.A2: Interest over time according to region

Region	eNaira: (from 10/25/2021 to 10/10/2022)
Gombe	100
Adamawa	99
Jigawa	95
Yobe	91
Zamfara	85
Katsina	75
Borno	74
Kano	74
Kebbi	73
Niger	73
Kaduna	50
Federal Capital Territory	42
Plateau	39
Bauchi	38
Rivers	37
Oyo	35
Abia	34
Kwara	31
Ogun State	31
Ebonyi	29
Osun	27
Benue	26
Sokoto	25

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Nasarawa	25
Ondo	24
Lagos	23
Anambra	22
Akwa Ibom	20
Edo	19
Delta	14
Ekiti	13
Cross River	13
Imo	10
Kogi	10
Enugu	5

Source: Google Trends database

PART 5

**FISCAL POLICY AND
THE REAL ECONOMY**



CHAPTER EIGHT: MITIGATING REVENUE LEAKAGES IN NIGERIA: THE ROLE OF THE eNAIRA

Achua, J. K., Tule, J. M. and Offum, P. F.

Abstract

Revenue leakages have become an albatross to Nigeria's fiscal sustainability. This study explores the possibility of leveraging on the Nigerian Central Bank Digital Currency (CBDC), known as the eNaira, to effectively mitigate these leakages. The paper simulates a framework that seals up loopholes in revenue collection using the eNaira. First, inherent weaknesses in the existing revenue remittances framework, which encourage leakages, engender corruption and raise the cost of collection, are identified. Subsequently, a simple framework of revenue remittances incorporating the eNaira is developed to circumvent leakages and minimise other costs associated with revenue generation, collection, and administration. The framework suggests that the eNaira has enormous potential for optimising revenue collection through cost reduction, real time transactions, transparency, traceability, and accountability.

Keywords: Revenue leakages, central bank digital currency; eNaira,

JEL Classification: D02, E42, E58, H27, M48

1.0 Introduction

Nigeria is endowed with abundant human and natural resources that offer enormous potentials for revenue generation, economic growth and development. However, the country's fiscal space has continued to be limited by low revenue generation, as evidenced by the widening fiscal deficit and high level of public debt. The poor revenue generation despite the country's huge natural resource endowment could be attributed to several factors including inefficiencies in collection, remittance, and administrative processes. A plethora of fiscal reforms have been introduced in the past to address the perennial challenges of revenue leakage through constitutional provisions, legislations, and administrative fiscal policies in Nigeria without discernible success. Specifically, Section 80 of the Nigerian 1999 Constitution, as amended stipulates that all moneys receivable by the Federation shall be paid

into and form one Consolidated Revenue Fund of the Federation. Section 22 (1 & 2) of the Fiscal Responsibility Act (FRA) 2007 provides for prudent and transparent fiscal operations; Section 38 of the Finance Act 2021, and Finance (Control and Management) Act of 2021 also have relevant provisions on revenue generation, treatment, and allocation consistent with Nigeria's fiscal federalism. This is in addition to several reforms aimed at plugging revenue loopholes, including the Integrated Payroll and Personnel Information System (IPPIS) that was put in place in 2006 to foster transparency and accountability in the Payroll System (Folorunso & Simeon, 2021). The Government Integrated Financial Management Information System (GIFMIS) was also introduced in 2012 to address key sources of economic inefficiencies (Ajao et al., 2022). One of the latest reforms in public financial management was the introduction of the Treasury Single Account (TSA) in 2015 to enhance government revenue generation and engender transparency and accountability in revenue management. Specifically, the TSA was conceived to minimise the problem of revenue leakages which has been a major challenge to the growth and development of the Nigerian economy (Adetula et al., 2017). Despite these reforms and subsisting laws, revenue leakage remains a major problem in the economy. Eme et al. (2015) reveal that corruption, stealing and lack of political will to block revenue leakages are the bane of these reforms, contending that "blocking leakages is a more viable option to boost tax revenues, rather than raising the tax rates". Consequently, the persistence of revenue leakages necessitates the search for complementary strategies to plug the leakages.

The Central Bank of Nigeria (CBN) issued the Central Bank Digital Currency (CBDC), called the eNaira, in October 2021. The eNaira is a legal tender and a liability of the CBN. By its design and features, the eNaira is expected to boost financial inclusion, support a resilient payment ecosystem, facilitate tax payments, enhance diaspora remittances, and drive revenue collection. Conceptually, the eNaira offers several possibilities, several of which are yet to be tested. This study explores a framework that leverages on some of the eNaira possibilities to mitigate revenue losses by minimising revenue leakages to the barest minimum. The paper proposes a framework that could seal revenue collection gaps through the instrumentality of the eNaira. The rationale

for the framework is that an efficient tax administration that maintains a sustainable revenue flow is the most crucial aspect of fiscal system in an economy. Unfortunately, Nigeria is a far cry from the threshold for tax revenue-to-GDP of 15.0 per cent for developing economies (Akitoby, 2018) due to inefficient fiscal operations. Where there is inefficiency in revenue collection, the government bears the loss and, in most cases, there may be tax burden part of which the collection is usually unaccounted for. This has persisted as the defining feature of the Nigerian economy.

Following this introductory Section, Section two contains the literature review. Section three focuses on the legal basis of the eNaira in government revenue collection, while Section four dwells on the eNaira revenue collection model. Section five concludes the study.

2.0 Revenue and Leakages in Nigeria

Government revenue refers to public receipts which the government collects from all sources, except loans and borrowing (Ihimodu, 1995). The sources of government revenue are broadly classified as tax and non-tax. However, due to the peculiarities of the Nigerian economy, revenue sources could also be classified as oil and non-oil. It is important to note that a large proportion of both oil and non-oil revenue are taxes (Obiechina, 2010). Although declining in recent times, crude oil remains a substantial source of revenue in Nigeria, despite volatility in its price. The various sources of oil revenue include crude oil and gas sales (domestic and export), petroleum profit tax (PPT), royalties from oil and gas companies, penalties for gas flared, rents, etc. Nigeria is abundantly blessed with both revenue sources. The country, has, however, continued to suffer from growing fiscal deficits due mainly to revenue leakages. In simple terms, public revenue leakage is any undetected or unplanned loss of publicly available funds that belong to the government.

Revenue leaks can occur on the expenditure side when some or all the intended government revenue does not reach the targeted recipients or is not delivered to the recipients for the goods and services provided. Revenue leaks can also occur on the revenue side such as non-billing, under-billing, or loss of earned

revenue along remittance channels. In essence, a weak revenue structure leaves public funds unaccounted for. These kinds of unintentional losses consequently have a big impact on the development and expansion of the economy. The reduction of revenue-side leakages is the focus of this article. Leakages deprive the economy of earned capital, or income, without accountability. Revenue loss represents a leakage from the circular flow of income model (Eme & Chukwurah, 2015).

The inability to keep up with modernisation's complexity and reliance on outmoded or inadequate processing systems are two common causes of revenue leakage. Any processing system that relies heavily on manual labour is more prone to human error, which increases the chances of money being lost. For instance, in a manually controlled system, income leakage may also happen because of the incapability to track and bill for various usage precisely and efficiently. Due to the complexity of the shifting lifecycles in the system, when the system is not correctly set up to record, track, accurately bill, and receive accumulated money, it runs the risk of revenue leakages on several levels. The main effect is an increase in the frequency of unintentional lost income and opportunities. As a result, maintaining revenue flow to the treasury and preventing it from leaking out before it can be counted depends on the ability to adjust and account for every change.

In nutshell, it can be stated that erroneous pricing, inaccurate invoicing, operational inefficiencies, omitting transactions, uncollected revenues, tax credits, and tax exemptions are all drivers of revenue leakages. Both the public and commercial sectors are involved in the misallocation of funds and the development of revenue gaps. However, the issue here is about leaks in public revenue. Revenue leakages mainly refer to the outcome of or premediated corrupt tendencies, taking advantage of existing loopholes in the system. It is, therefore, not enough to think that policies and programmes will always work as intended. There is a need to institute a framework that is designed to incorporate constant analysis and feedback; track actual progress; identify deviations; and get back to the drawing board as the need arises.

There is no one-size-fits-all remedy for revenue leaks; instead, there are several different options that could work, each of which depends on the cause. The solution may consequently vary, but typical methods include better data validation, efficient laws and policies, suitable process workflows, and enhanced use of automation. To ensure that everyone is easily informed about the next actions, it is possible to ensure that everyone is informed by building up a more integrated internal and external knowledge management system that gives end users fingertip access to policies and revenue management systems.

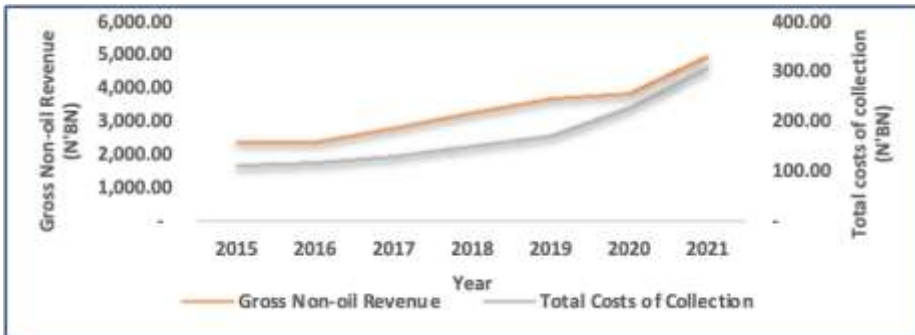
Thus, identifying the sources of revenue losses is critical to addressing them. As argued by Otusanya et al. (2013), this may involve introducing structural reforms to work processes to minimise the leakages in government revenue. Automation fastens the processes and eliminates human error, hence, the need to automate wherever it is necessary. While automation may not be an assurance to completely prevent leakages, it could massively decrease the potential of human error. Process automation is a data analytics approach which has the advantage of real-time visibility and insights. This helps to monitor and track processes on a real time basis to find anomalies or detect delinquent transactions. Real-time visibility also helps in tracking accurate resource utilisation and efficiency of the process.

Automation to mitigate is becoming an increasing imperative because revenue leakage has been institutionalised in many developing democracies, including Nigeria, and it is a major source of fiscal stress. Revenue leakages are noticeable discrepancies between expected revenue and realised revenue. The consequences of revenue leaks in Nigeria are, without doubt, getting out of hand. For example, the House of Representative Committee on Finance's investigation on revenue infraction reported that Nigeria lost \$30.00 billion annually from revenue leakage between 2005 and 2019 (Nwabughio, 2022). The Committee also found that the country had over ₦1.00 trillion idle balances in Nigerian banks but chose to borrow. These leakages were specifically traced to illegal activities of companies in the banking sector, oil industry, engineering, marine transportation, manufacturing, and telecommunications, among others (Nwabughio, 2021). Recently, the House

of Representatives ad-hoc Committee Chairman reported the uncovering of ₦300.00 billion unclaimed fund in Nigerian banks (Idem, 2022). The uncovered leakages might just be a drop in the ocean amidst weak public finance management mechanisms.

A statistical analysis of non-oil revenue and its associated costs of collection from 2015 to 2021 is depicted in Figure 8.1. While non-oil revenue rose from ₦2,353.75 billion in 2015, to ₦4,953.47 billion in 2021, the costs of collection increased from ₦110.96 billion to ₦306.49 billion. This indicates that non-oil revenue increased by 110.5 per cent while the costs of collection increased more than proportionately by 176.2 per cent for the same revenue over the same period. The major components of non-oil revenue include collections by Customs (Import, Excise & Fees, Special Levies, etc); FIRS (Company Income Tax, Capital Gains Tax, Stamp Duties, etc.); and Value-Added Tax (VAT) which is collected by both Customs and FIRS. Figure 8.1 confirms that the slope of costs of collection eventually became steeper than that of the revenue collected. It is interesting to note that the analysed costs exclude Remita which attracts about 1 per cent of all monies transmitted through the platform.

Figure 8.1: Gross Non-oil Revenue and Costs of Collection



Source: CBN Quarterly Statistical Bulletin (2021Q4)

In the case of tax revenue leakage, Rakhe (2003) asserts that the loss from tax leakage is substantial enough to correct the primary account balance and achieve fiscal sustainability. It is in line with this argument that the use of the

eNaira would be considered pertinent in engendering transparency in the payment process and help in blocking??? leakages.

The major identifiable cause of revenue leakage is inefficient operations arising from suboptimal processes. The issue of revenue accruals, especially who collects what, has always ignited heated argument with passion among feuding parties due to the dwindling financial position of all the three tiers of governments in the country and each entity often tried to advance superior reasons to justify its position. The multiplicity of Ministries, Departments and Agencies (MDAs) collecting revenue on behalf of the Federal Government has given rise to several challenges, partly due to high cost of cash management in Nigeria's economy, leading to operation of multiple accounts. MDAs have been operating multiple accounts for revenue collection and they spend the monies contrary to the provision of the Nigerian constitution, which stipulates that all government revenue must be remitted into a single account, the federation account. The collecting agencies have the latitude to spend part of it since they only need to remit only a portion of the declared amount.

In addition to the foregoing, there is usually misalignment between teams when several agencies are involved in public revenue collection. As a remedial action, the Central Bank of Nigeria (CBN) was directed to open a consolidated revenue account where all government revenue, incomes and inflows were pulled into one single account maintained by the apex bank, known as Treasury Single Account (TSA). Arguably, the introduction of TSA has put a stop to the MDAs managing their finances like independent entities, which only remit revenue to government treasuries at will. The TSA has been acknowledged as one of the most successful Public Financial Management reforms in Nigeria, but Oranefo (2022) notes that much needs to be done to achieve the desired outcome. Even with the introduction of TSA, the collection process is unnecessarily prolonged with introduction of several avoidable cost centres that account for avoidable costs, delays in revenue delivery to the TSA, and incentives for teeming and lading (a booking fraud, where one customer's payment is allocated to another customer's account with a view to balancing the books to hide a theft or shortfall). It is widely held that the reign of revenue

leakages is foisted by regulatory lapses (Ehiedu et al, 2022). This makes an automated system to efficiently track billing cycles and minimise losing revenue a potential upsells.

This study proposes that features of the eNaira can be adapted to attain a better control of the inefficiencies in the money collection processes by bypassing the processes that are amenable to revenue leakages. This will substantially plug the identified loopholes that accentuate revenue leakages and enhance transparency in the system. A framework could be designed in such a way as to employ the eNaira to provide a means of monitoring, assessing, enforcing and recovering government revenue. This would be particularly useful in the operations of Federal Inland Revenue (FIRS) for the collection of taxes. The eNaira can also be employed by the Nigerian Customs Service (NCS) in the collection of customs and excise duties, VAT and other levies. Thus, the leakages associated with costs of collections such as excess commissions, bank charges, pilferages, misappropriations and other corrupt practices would be mitigated using the eNaira. The use of the eNaira in mitigating revenue leakages will also consolidate the role of CBN as banker and adviser to the Federal Government in consonance with Section 4 (2a) of the CBN Act 2007,

3.0 The eNaira and Revenue Collection in Nigeria

3.1 Adoption of the eNaira by Government Agencies

The adoption of the eNaira ensures sustained progress in the digitalisation of the Nigerian economy. The Federal Government can expedite this process by adopting eNaira platforms in its transaction. The eNaira also has the advantage of availing relevant information for tax and Anti-Money Laundry/ Combating the Financing of Terrorism (AML/CFT) policies. The eNaira could enable seamless fiscal operations, through greater efficiency in tax collection, payment of pensions and disbursement of social intervention funds. This will block leakages, increase government revenue and savings, which will in turn, reduce fiscal deficit and public borrowing. The adoption of eNaira for government transactions is expedient for effectiveness transparency and accountability in the fiscal operations of government.

Government can encourage adoption of the eNaira for government-to-citizens, (G2C), government-to-businesses (G2B) and government-to-government (G2G) transactions, through targeted incentives. For instance, in South Korea and Argentina, there are incentives on reduced VAT and turnover rates to encourage the use of digital payments. In the Euro Area, business owners are mandated to use Point-of-Sale (PoS) for card payments. Other countries limit the use of cash for purchases (Scarcella, 2020).

3.2 Remittances

The use of eNaira for government payments may increase its reputation and encourage Nigerian migrants to use it for the payment of remittances. This could reduce money mule activities and the cost of sending remittances. This could support the country in achieving the target of the United Nations Sustainable Development Goal 10.c which states that governments and financial institution should reduce the cost of remittances to less 3 per cent of migrant remittances and eliminate remittance corridors with cost higher than 5 per cent by 2030. The use of CBDC for cross-border payment is expected to improve the process and cost associated with remittances. Due to the cost effectiveness, CBDC can be deployed for remittance payments while the use of remittances for household consumption can stimulate economic activities and generate tax revenue.

3.3 The eNaira: Digitalisation of Finance and Tax Visibility

Tax evasion and avoidance are very common in Nigeria due to the structure of the economy which is characterised by a large informal sector. The FIRS estimates the country's loss from tax evasion and avoidance to be as high as \$15 billion (Okwe, 2019). A digitalized economy can reduce the incidence of tax evasion as it enhances the auditability of transactions. Some businesses in the country, for example, under report sales and over report purchases, making tax evasion an issue of national concern. The eNaira does not only serve as a medium of exchange and store of value, but its salient feature of traceability also allows for tracking of transactions by the central bank, as it allows for direct connectivity between the government and individuals through the CBN. The eNaira enables the onboarding of more Nigerians on the digital space,

servicing to make transactions visible and thus giving tax authorities access to transactions, enhancing thereby the potential of tax revenue.

4.0 The Legal Basis for Government Revenue Collection

Section 80 of the 1999 Constitution as amended provides that “All revenues or other moneys raised or received by the Federation (not being revenues or other moneys payable under this Constitution or any Act of the National Assembly into any other public fund of the Federation established for a specific purpose) shall be paid into and form one Consolidated Revenue Fund of the Federation”. Also, Section 38 of the Finance Act 2021 and Section 3 of the Public Finance (Control and Management) Act lays emphasis on the provision of the Constitution. Section 22 (1 & 2) of the Fiscal Responsibility Act 2007 provides for the payment of four-fifth of the operating surplus of corporations into the CRF. Specifically, Section 22 (2) states that “The balance of the operating surplus shall be paid to the Consolidated Revenue Fund of the Federal Government, not later than one month following the statutory deadline for publishing each corporation's accounts”. The law clearly establishes the specific time within which the operating surplus must be paid into the CRF.

Some government agencies violate the provisions of the Constitution and the extant laws by delaying in remitting their surpluses and other revenue. In addition, the existing mode of revenue collection elongates the process of payment into the CRF. Financial institutions and revenue generating agencies tend to receive commission as cost of collection. It is germane to note that some of the agencies receive funding from the government while others generate and spend their revenue without accountability.

To circumvent this challenge, the government can leverage on the interoperability feature of the eNaira to incorporate the revenue collection technologies of public corporations. The design of an eNaira framework for public revenue collection could facilitate seamless transactions such that government revenue could be routed to the destination account in real-time to cut transaction charges. This will improve transparency and achieve efficiency in cost management, while maximising revenue collection.

5.0 eNaira and Revenue Collection Framework in Nigeria

5.1 One eNaira with Several Possibilities

The eNaira, as designed, has several possibilities. As shown in Figure 8.2, these include a range that runs through individual consumers, merchant transactions, MDA transactions, and financial institutions' transactions on the eNaira platform. The highlighted possibilities in Figure 8.2, which are designed to transmit money to and from government, could be exploited to establish a framework that mitigates revenue leakages. These are the person to government (P2G)/government to person (G2P), financial institutions to government/government to financial institutions, and MDAs to CBN-/CBN to MDAs. This interoperability has potential for direct transmission of moneys from individuals, businesses, financial institutions, and MDAs to the CBN on behalf of the government.

Figure 8.2: Possibilities on the eNaira Platform



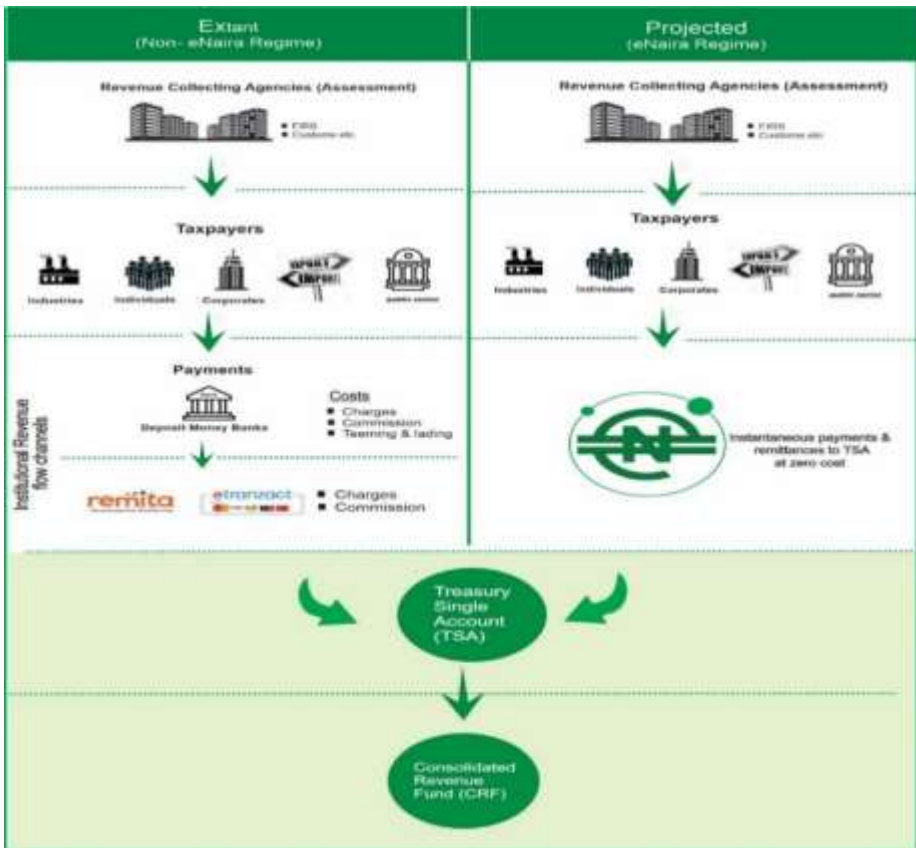
Source: Authors' Illustration

5.2 The Proposed eNaira Framework

To optimise revenue collection and remittance to government using the eNaira platform, the framework presented in Figure 8.3 is proposed. The framework utilises the features of the eNaira in such a way that the transmission of money

gets to the government instantaneously from those responsible for the remittances.

Figure 8.3: The eNaira Revenue Collection Model



Source: Authors' model

The framework entails a simulation of revenue flow and cost centres to buttress the role of the eNaira in mitigating revenue leakages associated with agencies' costs of collections, bank charges, commissions, teeming and lading, and so on. The left-hand side of the diagram shows the existing flow of revenue, while the right-hand side depicts the proposed flow, using the eNaira. The efficacy of the eNaira Revenue Collection Model hinges on the fact that revenue collections through the eNaira bypasses two essential cost centres whose

operations consume much of the generated revenue through substantial charges and commissions, as shown in Figure 8.3. In addition, shadow costs, such as teeming and lading which entails delay in the processing of remittances between financial institutions along the chain constitutes some costs to the government, compelling it to borrow even when it has idle, unremitted revenue or positive balances.

Consequently, the present model of revenue collection (left-hand side of Figure 8.3) is apparently inefficient in mitigating revenue leakages, in view of inherent corruption, weak supervision, and multiple intermediating institutions between the point of collection and remittance to the CRF. The different segments of the framework are discussed in detail:

A. Collecting Agencies: As shown on the left-hand side of Figure 8.3, the flow of government revenue begins with revenue generating agencies. The agencies include the Nigeria Immigration Service (NIS), Nigerian Customs Service (NCS), Federal Inland Revenue Service (FIRS), Federal Road Safety Corps (FRSC), Nigerian Ports Authority (NPA), National Agency for Food and Drug Administration and Control (NAFDAC), Nigerian Maritime Administration and Safety Agency (NIMASA), among others. The model identifies two sources of revenue flow to the government; These include payments originating from individuals to government and payments from private institutions to the government. Although a more complex model would include flows from government agencies as well, the present model allows for individual payments into Remita, domiciled with domestic banks for onward transfer to the Treasury Single Account (TSA), consisting of sub-accounts that are interlinked and flow into the Consolidated Revenue Fund (CRF) account. Remita is the electronic platform for the TSA. Participants include all banks, debit and credit card processors, PoS terminal providers, and Switch platforms and Mobile Money providers.

The 2019 CBN Revised Regulations on Electronic Payments and Collections for Public and Private Sectors provides that public revenue collecting agencies should maintain accounts with banks using the Payment Support Service

Providers (PSSPs) such as the Payment Terminals Service Providers (PTSP), Mobile Payment Operators (MPO), Card Scheme Operators, among others. Under the extant framework, payments are made into various accounts from sources and cumulative revenues are transferred to the CRF. This process denies the government real-time information about its financial position. In some cases, there are incidences of unremitted funds, indicating revenue leakages. The process of collection is not seamless and bank charges vary with the kind of revenue or services rendered by PSSPs or banks. These charges lower the net collections to the government.

B. Banks: Banks are major players in revenue collection and banking services. Banks are the intermediaries between individuals, private institutions, and the government. They receive charges and commissions on every transaction, be it private or government, on digital payments. Charges may be small but cumulative effect of these charges and commission amounts to huge cost. In addition, there are incidences of teeming and lading in the banking system amidst delayed transfer of government revenue to the CRF. Teeming and lading are short banking techniques where banks delay payments to beneficiaries by using the funds to make profits. This practice works on the assumption that funds will be available at the request of the customer or beneficiaries (Jayasinghe et al., 2015). Unfortunately, delay in remittances and paucity of funds often push the government into borrowing from the same banks withholding government's monies in the banking system. In the proposed model, the issue of teeming and lading associated with delayed accounting and bank charges could be circumvented since collections would be real time at cheap or no cost (see figure 8.3). Though it could impact banks' profitability negatively, the model is premised on the need to promote banks' traditional role of money creation and gingering them to compete for deposits by customers, instead of playing the role of commissioned agents in the collection of revenues for the governments to enhance their profitability. To maintain profitability, banks must increase deposit rates to attract deposits.

C. Remita: It is the gateway to the TSA. To make payments to the government, an institution or individual must log into the Remita platform,

generate a code which has been assigned to an MDA account and the purpose of payment (such as fine, fees, and refund). Remita also requires the name of the payer, email, and phone number. After obtaining the printout, an individual can proceed to make payment on the web, using debit card. However, online payment poses a challenge to most users' due technical issues from the service providers and network coverage. The second option is to present the printout-slip to a bank for payment into Remita. It costs about 1.5 per cent on bill payment for any transaction above ₦2,000.00. However, payments to educational institutions attract ₦300.00 per transaction (Remita, 2022). In June 2022, Remita Payment Services Limited deployed the eNaira as an alternative for Remita payments. The success of this experimental model is indicative of the capabilities of the eNaira as a veritable platform for revenue remittances to the TSA. The proposed model could circumvent Remita through direct payment into the CRF on a real time basis. This allows the CBN, the banker to the government to track the flow of funds.

The proposed framework could be designed to bypass routing government revenue through DMBs and the Remita, thereby eliminating the wasteful chain which leads to revenue leakages. The assumption is that taxpayers can pay directly into the TSA, using specially designed eNaira features. The features may include, among others, those currently contained in Remita such as codes for MDAs, instant generation of payment receipts, and possibly alerts to the relevant revenue collecting agencies. In this way, the relevant collecting agencies will have real time data on payments by their clients and facilitates reconciliation, thereby, enabling them to concentrate on defaulters' compliance. This will enable revenue collecting agencies to focus on assessments and compliance activities and become more efficient. Monies saved from bogus revenue leakages could be deployed in more sophisticated automation of the agencies' services for enhanced revenue assessment and compliance.

6.0 Conclusion

Revenue leakages in the light of unfavourable fiscal conditions in Nigeria has become worrisome and demands urgent policy attention. It is in this regard that the potential of the eNaira in curbing the inefficiencies in the revenue collecting and remitting system is discussed. This study presents a framework that incorporates the eNaira in the revenue collection mechanism by side-stepping traditional intermediaries that pose humongous costs and enhancing transparency and visibility. The framework minimises cost centres in the collection process, and enables real time, transparent and accountable operating system.

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PART 6

eNAIRA ADOPTION: OPPORTUNITIES, CHALLENGES AND PROSPECTS



CHAPTER NINE: THE eNAIRA: LEVERAGING JURISDICTIONAL EXPERIENCES IN ADVANCING SOCIAL WELFARE IN NIGERIA

Akpan, D. B., Opiah, D.C. and Abubakar S.

Abstract

The study assesses how the use of Central Bank Digital Currency (CBDC) can improve the implementation of social welfare programmes. The ongoing digital finance revolution in Nigeria, including the recent launch of the eNaira could be used to help the government achieve its social and economic inclusion goals. The government has implemented several reforms to improve the efficiency and effectiveness of its interventions for reduction in poverty and inequality, as various social and financial programs are being expanded to address welfare. This article also surveys Nigerian social transfer programs, citing jurisdictional experiences and the possibility of incorporating the eNaira into current and future Nigerian social transfer programs. We conclude that the eNaira could provide a medium for both on-boarding the poor and financially excluded, as well as facilitating the payment of social transfers to intended beneficiaries, with accompanying cost-savings and efficiency gains.

Keywords: CBDC, eNaira, social welfare programmes.

JEL Classification: E41, E58, G21, C72

1.0 Introduction

The changing socio-economic landscape requires the continuous adaptation of governance and the mechanisms for realizing its objectives. The proliferation of digital finance products and solutions, anchored on increased penetration of ICT in both corporate and private spheres, has become a veritable platform in delivering public services and enhancing citizens' welfare. Social intervention programmes, which focus on human development, employment generation and salvaging vulnerable groups have largely been administered through direct physical cash transfer to beneficiaries. There are obvious disadvantages of cash-based transfer programmes, including cash-handling cost, fraud and leakages, theft, and inconvenience, among others.

With the onset of digital finance services, the possibility of achieving poverty-reduction, alongside financial inclusion, is increasing. Electronic payment channels are becoming increasingly integrated in the social cash transfer architecture. This has popularized the use of limited-purpose instruments and mainstream financial accounts as channels of social cash transfer payments. In recent times, the research, pilot, and adoption of Central Bank Digital Currencies (CBDCs) globally have further widened the scope and possibility of reaching social transfers' targets via a government-to-people (G2P) model that reduces leakages and promotes efficiency. Three main benefits of integrating CBDC and digital inclusive platforms (that facilitate G2P) into social cash transfer programmes, have been identified to include affordability, acceptability, and profitability; as they relate to the government, recipients and service providers, respectively (Pickens et al., 2009).

The ongoing digital finance revolution in Nigeria, including the recent launch of the eNaira, could be leveraged in achieving the social and economic inclusion objectives of the government. The eNaira provides a medium for onboarding the poor and financially excluded, as well as facilitating the payment of social transfers to intended beneficiaries, with some accompanying cost-savings and efficiency gains. This article surveys social transfer programmes in Nigeria, citing jurisdictional experiences and the possibility of integrating the eNaira into current and future social transfer programmes in the country.

2.0 Social Cash Transfers and Mechanisms

2.1 What are Social Transfers?

As a component of government spending, social transfers refer to government expenditure that is dedicated to social protection programmes and emergency responses (Bracco et al., 2021). Social transfers as 'social protection programme' are categorized as 'automatic stabilizers' because they are products of legislation, incorporated into the annual spending plan, with specified requirements (by law) for qualifying beneficiaries. This sort of social spending, which is intrinsically countercyclical, includes social security (retirement benefits), unemployment insurance (transfers to the unemployed) and family support programmes (including conditional cash transfers to the

poor and vulnerable households). The cyclicity of social protection spending implies that it declines when the economy is booming, as people gain employment and income and no longer require handouts, transfers, or unemployment benefits. On the contrary, in a downturn or recession, many slip into unemployment and poverty, and ‘automatically’ government spending on social welfare adjusts upwards.

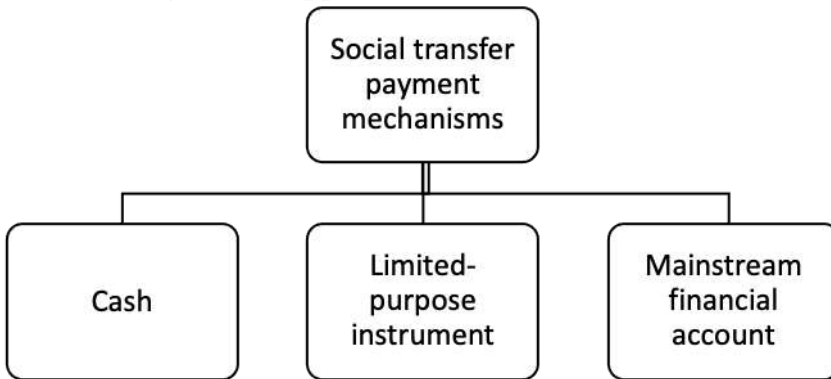
On the other hand, social transfers as ‘emergency responses’ refer to shock-absorbing or mitigating social programmes, such as the emergency COVID-19 relief in most countries to ease the impact of the pandemic (or associated shock) on vulnerable people, households or small businesses. This is different from a lump-sum advancement by a particular government to medium-to-large-scale businesses (otherwise known as economic stimulus) to prevent their collapse, in view of their strategic importance in the economy, specifically for production and employment generation. This form of social expenditure is classified under discretionary fiscal policy, and it is more nuanced and subject to political coloration.

Social transfers constitute a significant part of government expenditure, accounting for 50.0 and 40.0 per cent of primary government expenditure in developed countries and emerging economies, respectively (Galeano et al., 2021). When effectively deployed, social transfers could serve as a viable mechanism for advancing welfare and equality in any given society. The transmission mechanism of social transfers to welfare improvement is household consumption, more importantly, by individuals with a high marginal propensity to consume (Romer & Romer, 2016; Alesina et al., 2017; Parraga-Rodriguez, 2018; Gechert et al., 2020; Pennings, 2020). This explains why social transfers are largely targeted at the poor, who are also financially excluded. It is critical to note that the focus, design, and scale of social transfer programmes differ across countries depending on the peculiarities of each country's challenges, among other considerations.

2.2 Social Transfer Payments Mechanism

There are three main approaches to making social transfer payments: cash, limited purpose instruments and mainstream financial accounts. Social investment programme administrators adopt different payment strategies guided by trade-offs between the objectives of broader inclusion and the specific requirements for social cash transfer programmes (Bold et al., 2012).

Figure 9.1: Approaches to Social Transfer Payment



Source: Bold et al., (2012).

i. Cash

Cash is the traditional means of making social transfer payments to recipients, hence the common coinage ‘Cash Transfer Scheme¹²’. Program agents meet recipients in their homes or designated locations to physically hand over financial support.

¹²Given development in electronic payments system and digital currencies, the means of disbursing Cash Transfer Schemes may not necessarily be disbursed as physical cash.

Figure 9.2: Social Transfer by ‘Physical Cash’



Source: Adapted from Wujuola, (2020).

This approach is still critical in places where recipients are too poor to afford mobile phones and/or when it is not economically viable to install some ICT presence. The process of cash transfer is, however, tortuous and expensive for both the programme and its targets, and there is no creation of store of value (no savings).

ii. Limited-purpose instruments

The limited-purpose instruments, on the other hand, transfer the grant to the recipient through a notional account, with at least a restriction on: (1) no indefinite storage of the fund (2) withdrawal can be done only at a dedicated infrastructure (e.g., agent or cashpoint); and (3) only payments from the programme can be deposited into the account.

iii. Mainstream financial accounts

This is the regular bank account where none of the enumerated restrictions on the limited-purpose instruments apply. An individual or household does not have to be a programme beneficiary to operate this form of account, as the benefits are similar for both recipients and non-recipients.

Figure 9.3: e-Transfers Mechanisms

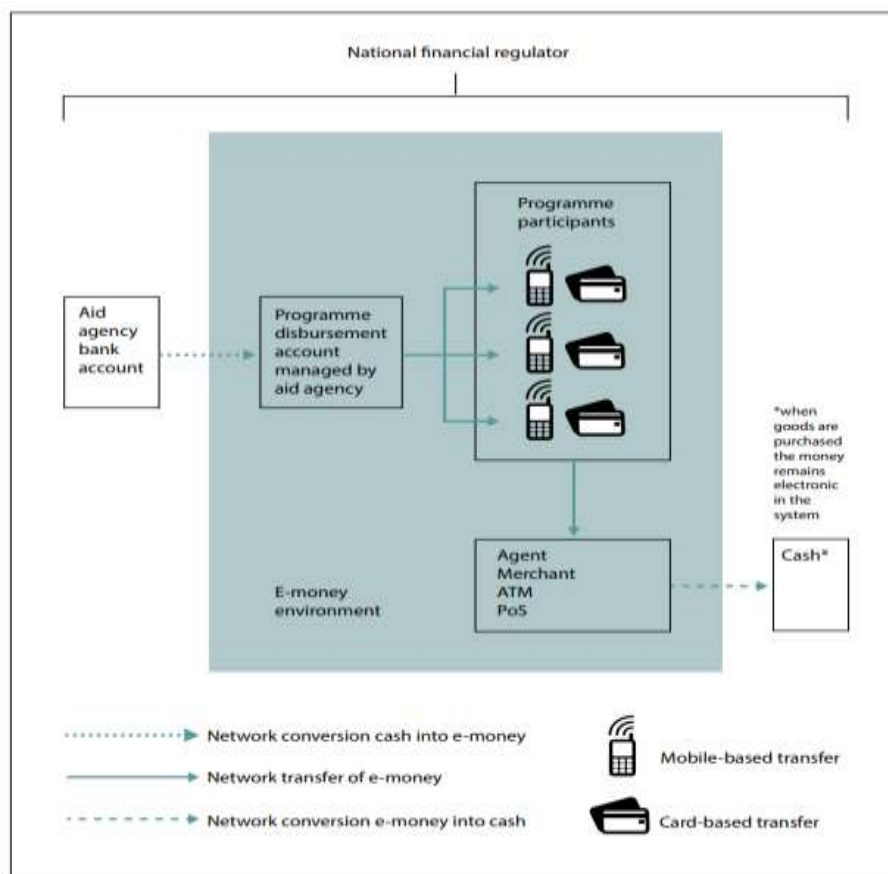
E-transfer mechanism		Beneficiary equipment	Infrastructure at the transaction point	Application
Cards	Magnetic stripe card	Card + signature (+ PIN at ATMs)	Merchant with PoS or ATM	Goods/services + cash
	Smart card	Card + PIN, signature or biometrics	Merchant with PoS or ATM	Goods/services + cash
	Contactless card	Card + PIN, signature or biometrics	Merchant with NFC PoS or ATM	Goods/services + cash
Mobile transfers	Mobile token	SIM + PIN	Agent with basic phone	Cash
	Mobile voucher	SIM* + Voucher number + PIN	Merchant with basic phone	Goods/services
	Mobile money	Phone + SIM + PIN	Agent/merchant with basic phone	Goods/services + cash
E-vouchers	E-vouchers	Voucher number + PIN	Merchant with smartphone or computer	Goods/services

Source: Adapted from Sossouvi (2013)

The trend in social transfers resource distribution is gradually shifting from cash to electronic transfers (e-transfers) that are either linked to an account (mainstream financial account) or restricted (limited-purposes). According to Sossouvi, K. (2013) over the last five years (2008 – 2012), the CaLP Cash Atlas recorded 41 humanitarian electronic transfer programmes in 17 countries targeting 3.3 million beneficiaries were in e-transfer, generally riding on digital payment systems. The e-transfers are facilitated through mechanisms (Figure 9.3) including card-based transfers, mobile transfers, and e-vouchers, and generally require a secure personal identification number (PIN) or signature and/or biometrics for participation. It rides on a strong payments system infrastructure and coordinates digital identity campaign to succeed. A typical e-transfers ecosystem for social transfers facilitation is shown in Figure 9.4. The aid agency credits its programme disbursement account, from where payments are made directly into the wallets or phones of beneficiaries who withdraw cash from merchants, agents or through the ATM. Rather than

withdraw, beneficiary can save or digitally effect a purchase, leaving the money in the electronic system.

Figure 9.4: Electronic Transfer Ecosystem



Source: Adapted from Sossouvi (2013)

3.0 Country Experience on E-Payment and Social Cash Transfer

Jurisdictional experiences provide some insight into possible challenges and benefits of adopting specific mechanisms in transferring payments to recipients of a social transfer programme. The transfer mechanisms for countries discussed is a function of the depth of their financial systems and the advancement in payments system infrastructure.

i. Kenya's Cash for Assets (CFA) Programme

Kenya had over 28 million mobile cellular subscriptions, with mobile penetration of about 69.0 percent in 2012. Launched in 2003, the Cash for Assets (CFA) is a joint World Food Programme (WFP) and Kenyan government conditional cash transfer scheme to food insecure households in seven counties in Kenya. Financial inclusion is part of its core programme objective. Hence, from inception, mainstream financial accounts were used as the distribution mechanism rather than physical cash. Through a competitive process, the Cooperative Bank was selected as its new payment service provider (PSP) for 2013–2015, following the completion of the pilot phase in 2009.

Experience from the pre-pilot phase showed that:

- i.** The M-KESHO product of Equity Bank (the pre-programme pilot) which was linked to Safaricom's M-PESA, the network was not strong enough to process payments, thus; informing a migration to a new debit card-based system, which provided recipients with an Equity account and debit card.
- ii.** Recognised the need for a more advanced Management Information System (MIS) given the volume of data that needed to be processed.
- iii.** About 20.0 per cent of the programme recipients had no means of identification for account opening. To address this, a solution was designed where the recipient could 'designate' a trusted person with the required documentation to withdraw the payment on their behalf.
- iv.** The programme benefited from stiff competition among financial institutions for Kenya's unbanked market. Equity Bank, on its own, expanded its agent presence, equipment, training, and program management.
- v.** The pilot indicated a strong business case for the distribution of food-aid via e-payments as it was found to be 15.0 per cent cheaper than in-kind food assistance, in addition to:
 1. increasing economic activity in local markets
 2. reducing leakage, and
 3. improving transparency

vi. Challenges

Equity Bank listed its major concerns as (i.) client enrolment and use of the service (ii) inadequate agent liquidity; and (iii) technology failures. Also, the majority of the recipients withdraw the full payment and do not use their accounts for transactions outside the programme, despite the financial inclusion objective. There was a need for a stronger e-payment scheme, and stakeholder value chain; a dispute resolution and user support mechanism to address users' concerns; flexibility in procurement to fit program needs; and continuous adaptations to realities.

vii. Ugandan Social Assistance Grants for Empowerment (SAGE) program

The SAGE is Uganda's first major cash transfer initiative that focuses on the elderly or senior citizens and vulnerable families. Its pilot run, on which this evaluation is based was between 2011 and 2015. The core objectives of the design include reliability, cost-effectiveness, transparency, scalability, and financial inclusion. Among other considerations for the design is the fact that e-payments options in the country are limited and the cost of financial sector infrastructure is high. The programme had two components – Senior Citizens Grant (SCG) and Vulnerable Families Grant (VFG). With time, the focus of the programme shifted to SCG.

- MTN was the major carrier, and its connectivity was limited in rural SAGE areas, hence it deployed both electronic and manual payment means, depending on connectivity. E-payments were made through a SIM-embedded card that beneficiaries present to MTN agents, and this is inserted into a pay phone. Agents had to travel to the rural areas where mobile networks are not available to effect manual payments.
- Recipients are required to present a national or resident ID alongside the SIM card to the MTN agent. Effecting the payment also requires the provision of PIN which the senior citizens often do not remember. Although the programme trained new beneficiaries, it was only at the time of enrolment. MTN's weak

network and limited mobile money agent presence were cited as major challenges in the pilot districts.

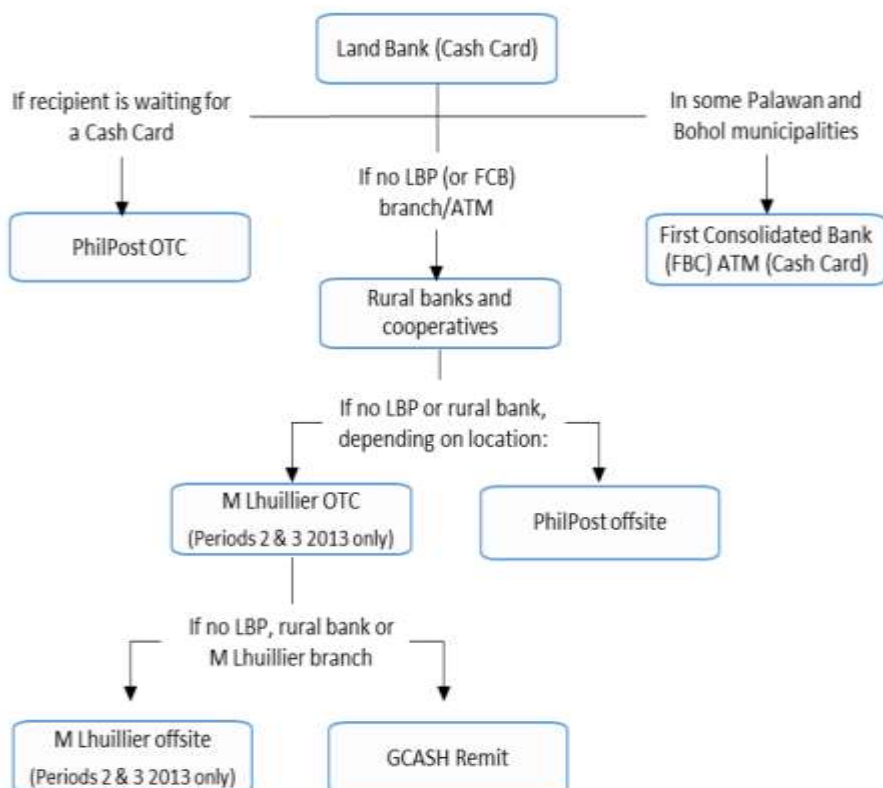
- Changes in MTN management, triggered by some unrelated scandals, saw improvement in the administration of the programme. Recipients received payments on time into the limited-purpose SIM-linked accounts.
- The field staff recorded that manual payments were faster than e-payments as monies were traceable, and it excluded the SIM and PIN verification processes.
- To achieve the establishment objective of the programme designers, the government expects to have a limited-purpose instrument, a mobile money wallet that would allow recipients to initiate transactions from any part of the country but evaluates the infrastructural and operational cost to be substantial. The programme is preparing to scale up significantly.

viii. Philippines' Pantawid Pamilyang Pilipino Program (4Ps)

The Pantawid Pamilyang Pilipino Program (4Ps) is a conditional cash transfer (CCT) poverty alleviation programme that targets poor households with a pregnant mother and/or children between 0-14 years old. 40.0 per cent of the 3.90 million recipients of the programme are paid using a card linked to a limited-purpose account. The Land Bank of the Philippines (LBP), a government-owned bank, is the primary Payment Service Provider (PSP).

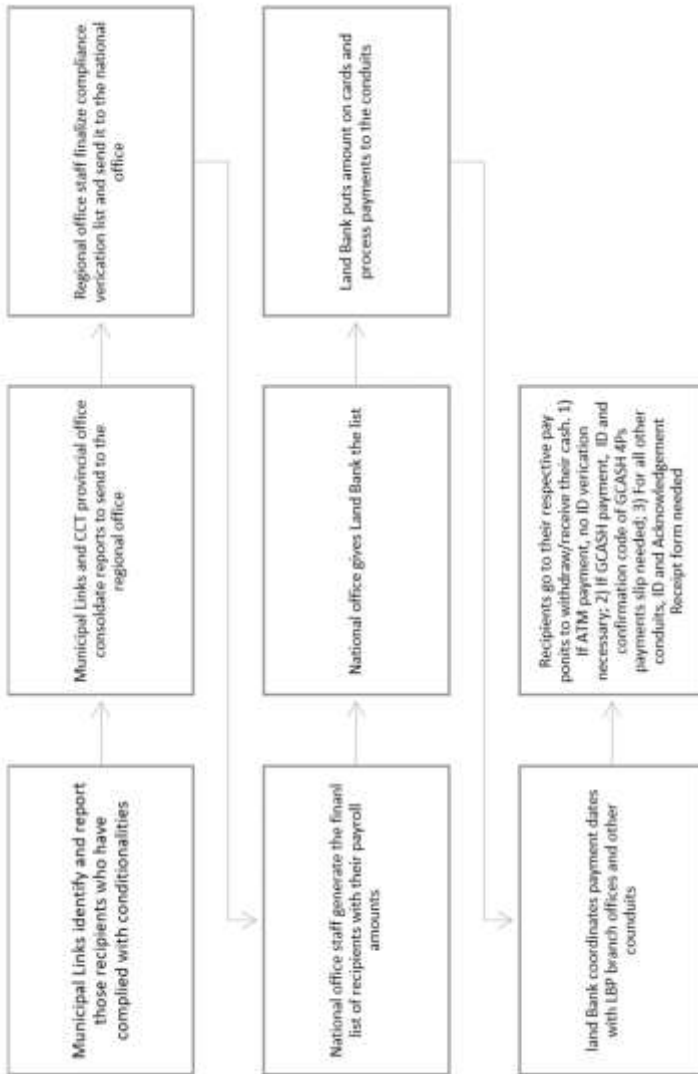
Originally intended for 20,000 recipients for a 5-year duration, it was expanded by volume and geography, growing from 6,000 to 4 million, with more than 10,000 programme staff. Payments are made bimonthly to cut processing costs. Six PSPs were engaged, ranging from the postal service to a mobile network operator (MNO)/mobile money provider, with payments coordinated by the LBP. A major innovation in the 4Ps model is its adoption of multi-level payments channels to meet the distinct needs of participants. Figures 9.4 and 9.5 illustrate the operational modalities and hierarchy of payments of the 4Ps Program.

Figure 9.4: Hierarchy of Payments Conduits



Source: CGAP/World Bank (2013)

Figure 9.5: 4Ps Payment Process in the Philippines



Source: Acosta et al., (2019)

ix. The Haitian Ti Manman Cheri (TMC)

The Ti Manman Cheri (TMC) is Haiti’s first government-led conditional cash transfer programme, with an initial target of 100,000 mothers in the Port au Prince area of Haiti. The programme was part of the country’s response designed to mitigate the sufferings of the people, following the 2010 Haiti

earthquake, with funding from international donors. The distribution of payments was designed to be facilitated by a mobile network operator, Digicel, through its Tcho Tcho mobile product. Digicel charged the government 2.5 percent of each transfer amount, plus a flat fee of US\$0.125 per transfer. Mobile money was selected as the transfer medium, given that it minimized the time and cost for recipients to receive payments and the time required to expand the programme nation-wide. Mobile penetration in Haiti was estimated at 35.0 percent in 2010, up from 5.0 percent in 2006; with 85 percent of Haitians having access to a mobile phone (CGAP, 2013). From its unveiling on 27 May 2012, recipients received cash, using the Tcho Tcho mobile platform. Digicel, on its own, provided free mobile phones, which were distributed to recipients who had no mobile phones through TMC staff. The programme attracted larger crowds than could be accommodated, as the government later expanded the programme beyond the Port au Prince area. Stretching the already low TchoTcho Mobile's costing model and revenue projections, which were based on the original plan.

A lot of time was dedicated by TMC staff to teaching recipients how to use a phone, obtain a PIN and how to use their phones to withdraw money. Digicel rejected at least between 15.0-25.0 percent of payments in each payment cycle, due to data errors. By January 2013 only 36.5 per cent of TMC recipients were fully registered on the Tcho Tcho mobile platform. In view of the objective of getting money across to the people, a second PSP, Unitransfer, an international remittance company, was enlisted in early 2013 to operate a payroll for recipients that were invalidated by the TchoTcho Mobile platform for information inconsistency and data errors. Unitransfer operates by cashing vouchers at designated branches or kiosks in rural remote areas.

TCM recipients who had a national ID but were rejected for want of other documentation in the Tcho Tcho mobile platform, received a voucher at their child's school to present for cash withdrawal at the Unitransfer branch. Recipients are required to withdraw all the money at once, unlike in Tcho Tcho, where recipients are not bound to withdraw all the money but must draw down

a portion within three months of receiving payment. However, only the first withdrawal on Tcho Tcho platform is exempted from withdrawal fees.

Following its introduction, Unitransfer facilitated 52,000 cash payments; while Tcho Tcho Mobile enabled 23,000, in 2013. Thus, the ease of registration and identification is key to the success of social cash transfer programmes.

Some of the major challenges of the programme include:

- i.** Logistics: the transportation of cash is done in armoured cars and needs to be done discreetly, with an associated high cash-handling cost. The PSP had to supply mobile generators to their agents for electric power and other operational purposes. The sudden and unplanned request for payment mobilization compounds the burden on the PSP and administrators.
- ii.** Weak mobile infrastructure – the rapid geographical expansion of the programme strained the capacity of Digicel to deliver.
- iii.** Security: Substantial number of payments in isolated locations with limited number of policemen.
- iv.** Staff Integrity and Capacity: The necessity to mobilize a large team for payments creates concern about ensuring the honesty and integrity of PSP staff.
- v.** Identification: Difficulty in verifying the recipient with a valid ID during pay-outs.
- vi.** Cost – The government was not prepared for the level of participation, agents, and associated project budget. Mobilising remote agents into rural areas was noted to be costly.
- vii.** Recipients' capacity, training, and resistance - Managing individuals yet to receive payment, helping those with the issue of lost phones, forgotten PIN, incorrect information etc. There were issues of recipients' resistance requiring the presence of security operatives.
- viii.** Tracking and returning unused funds – several mobile-paid recipients were not cashing out in the three-month stipulated period. When

contacted by Digicel by phone – they are either unaware of the payments, changed phone number or simply would not take the call.

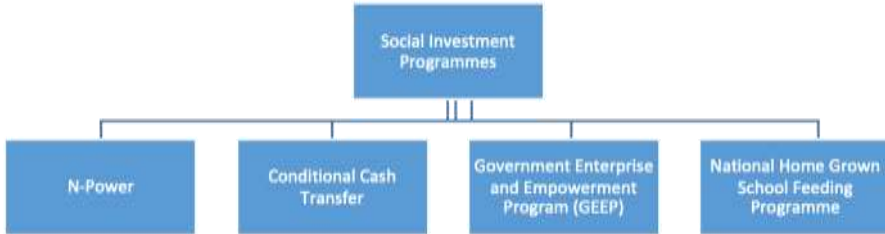
- ix. Bureaucratic bottlenecks prevented the timely release of funds.

First, electronic and digital payment platforms would lower the cost of social transfer payments by the government and make the process of receipt for beneficiaries more convenient, as against a cash-based approach. Besides, electronic payment systems are fully integrated in the formal financial system, thus furthering the goals of financial inclusion. This has the potential of exposing targets to financial services. Evidence shows that social transfer recipients save from the grant using informal means (Bold et al., 2012). Thus, integration into the formal financial system via a digitalized payments approach would enhance and encourage savings among the poor.

4.0 Social Investment Programmes in Nigeria

Social investment programmes in Nigeria are coordinated by the Federal Ministry of Humanitarian Affairs, Disaster Management and Social Development, using the National Social Investment Management System (NASIMS) as its central coordination platform. Although social welfare programmes in Nigeria are as old as governance itself, in recent times four (4) main ones (including the N-power programme, Conditional Cash Transfer (CCT) programme, Government Enterprise and Empowerment Programme (GEEP) and the Home-Grown School Feeding Programme (HGSF)) could be identified under the National Social Investment Program (NSIP). The NSIP was established in 2016 with a focus on ensuring a more equitable distribution of resources to vulnerable populations, including children, youth, and women. In 2016 and 2022, the government budgeted ₦500.00 billion and ₦400.00 billion, respectively, for the funding of the four programmes under NSIP.

Figure 9.6: Social Investment Programme

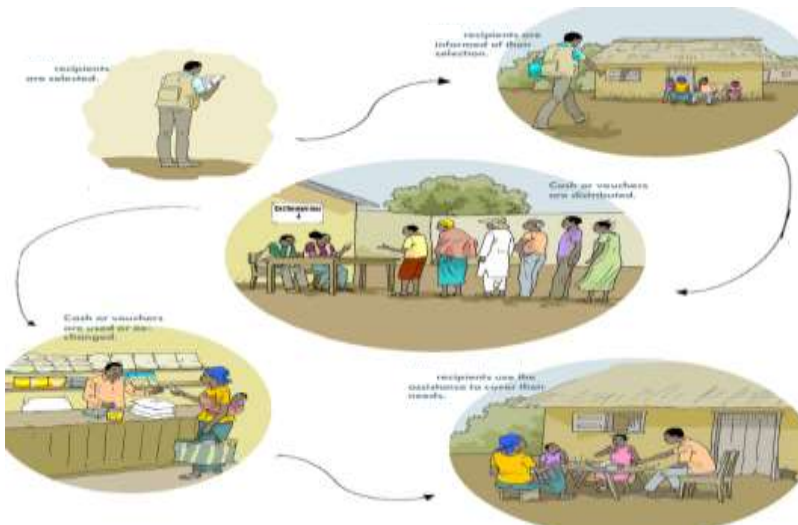


Source: Author's Illustration

i. Conditional Cash Transfer

The Conditional Cash Transfer (CCT) program provides targeted cash transfers to the most vulnerable households with the long-term goal of lifting millions out of poverty. It offers a monthly stipend of N5,000.00 to targeted households with an additional N5,000.00 for families designated as priority or extremely poor. A major qualification requirement is that households with school-age children enroll them in school. The idea is to promote school enrolment, while alleviating poverty.

Figure 9.7: Typical Conditional Cash Transfer Model



Source: Illustration by Kassai, 2021, in Cash Barometer (2022)

The determination of beneficiaries of the Conditional Cash Transfer (CCT) Programme in Nigeria is the National Social Safety Nets Coordinating Office (NASSCO), which employs a community-based targeting (CBT) model to determine the poor. In the model, the community defines what poverty is and identifies the poor in the community, who make up the national social register. In achieving this, the community is divided into three clusters of men, women and youth and the information is collected and aggregated for the purposes of constructing the social register and potential beneficiaries. The list provided by groups is signed-off by a male and a female nominated by the community. The NASSCO CBT team runs off with this list and carries out a 'Proxy Means Test' that enables the ranking of households by potential income using information on households' size and age range of members, education levels, enrolment, housing condition, ownership of durable goods, such as televisions, fridges, etc. Households that fall below the 6th decile are considered the poorest of the poor and go into the payment register. According to NASSCO, as of July 31, 2020, the programme covered over 64,403 communities in 595 local governments, including over 4 million households and 19 million individuals, in Nigeria. A major argument for why 'physical cash' is the only form of payment is that the extremely poor do not have bank accounts and cash payment is usually more convenient for them.

ii. N-Power Programme

The programme targets young Nigerians between the ages of 18 and 35, with the goal of promoting youth employment to advancing social development in Nigeria. N-Power is a community-sourced social investment programme that aims to equip youths with the requisite skills and certifications for the global market. It is categorized into graduate and non-graduate programmes. The graduate programmes are in the agriculture, education and health sectors, while the non-graduate programmes are knowledge and vocational based. Graduate beneficiaries receive a monthly stipend of ₦30,000.00 while non-graduate beneficiaries receive a ₦10,000.00 monthly stipend, considering numbers supplied by the beneficiaries. The programmes target 500,000 beneficiaries in its first stream and another 500,000 in its second.

iii. Government Enterprise and Empowerment Programme (GEEP)

The GEEP program was launched in 2016 to provide access for Nigerian entrepreneurs who would otherwise struggle to raise funds. It has three main components – MarketMoni, FarmerMoni and TraderMoni with the Bank of Industry (BoI) as the coordination institution. MarketMoni is a 6-month interest- and collateral-free loan ranging between ₦50,000.00 and ₦100,000.00 for small businesses under the auspices of their cooperative societies or associations and about 350,000 traders have benefitted.

Figure 9.8: GEEP Implementation



Source: Extracted from Ripples Nigeria

FarmerMoni loans are designed for different planting seasons and farming requirements, and advance a minimum of ₦250,000.00 to beneficiaries. About 5,000 farmers had benefitted as of June 2019 (Federal Ministry of Information and Culture, 2019). Over 1.7 million petty traders were reported to have benefitted from the TraderMoni scheme, designed for petty traders and artisans nationwide. GEEP beneficiaries are required to open a bank account or operate a mobile wallet to receive the loan directly into their accounts.

iv. Home Grown School Feeding Programme (HGSFP)

The Home-Grown School Feeding Programme (NHGSFP) is a government-led school feeding programme that aims to improve the health and educational outcomes of public primary school pupils, encourage agricultural production, create jobs and improve family and state economies. It uses farm produce locally grown by smallholder farmers to provide children with nutritious mid-day meals on every school day.

Figure 9.9: Home Grown School Feeding Programme (HGSFP)



Source: Extracted from Nigeria Home Grown School Feeding Strategic Plan 2016-2020 document, www.fao.org

Although the programme holds huge potential for welfare enhancement and poverty reduction, it is not a cash transfer programme and does not directly fit into our value proposition for the integration of eNaira into the social cash transfer system in Nigeria. However, CCT, GEEP and N-Power, can be leveraged to deepen financial inclusion, while advancing the original objectives of the programme.

5.0 Integration of the eNaira in the Social Cash Transfer Architecture

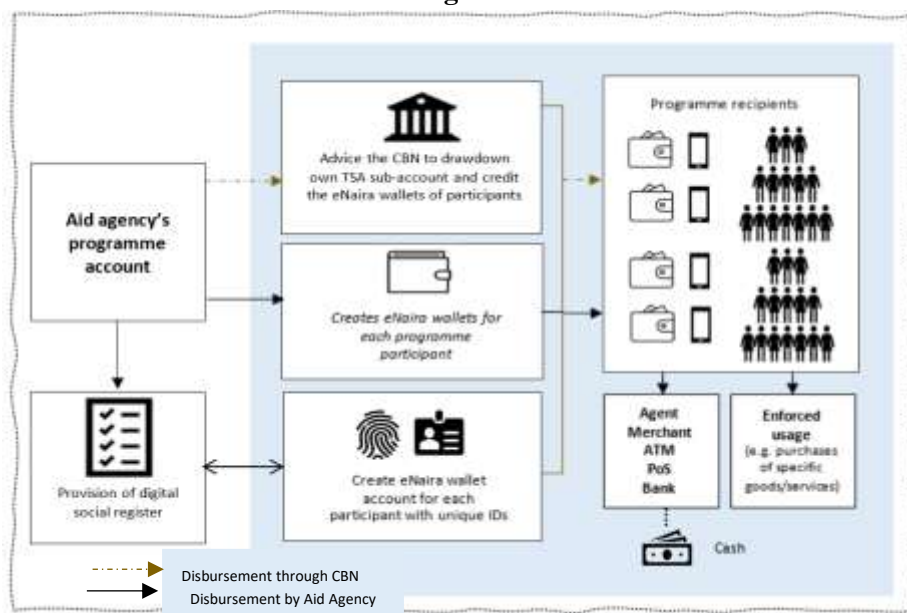
In view of the potential benefits of digital and electronic cash transfers in expanding the reach of social transfer programmes and financial inclusion drive, this section explores the possibility of incorporating eNaira into social cash transfer models in Nigeria. Although this dimension of the eNaira has been mooted as one of the future applications of the eNaira in Nigeria, it has not been fully conceptualized and integrated. The payment of social transfers to programme targets can be actualised using two approaches. The first is social-aid-agency-led for the social aid agency or coordinating body to facilitate direct transfer of eNaira into the wallets of participants of the programme. The agency would have to create eNaira accounts for all participants in the programme. This process can be easily integrated into the framework for developing the social register, such that relevant information and registration of participants are carried out using the same number of field staff.

Collaboration between the programme coordinator and the CBN is needed to cascade and simplify the identification requirements for operating the eNaira wallet, to ensure that the vulnerable poor, who are unlikely to meet the standard documentation, participate in the programme. Beneficiaries, especially the elderly, should be allowed to have a ‘designee’, a trusted person whose credentials can be inputted against the details of the beneficiary, for the purposes of receiving payments. Mechanisms, such as routine physical verification of beneficiaries, should be put in place to check possible abuse. Having created the eNaira wallets for participants, the agency proceeds to advise the CBN to drawdown its account with the CBN¹³, by a certain amount and credit its institutional eNaira wallet by the same amount. The CBN can facilitate the creation of an institutional wallet for the agency, on request. With their wallet funded with the designated amount, the recipients can choose to withdraw cash through kiosks or agent banking networks, merchants, bank or

¹³Recall the CBN maintains the Treasury Single Account (TSA) of government and MDAs.

the PoS and ATM channels. They may also decide to save the money in their wallets, transfer to their bank accounts or shop online.

Figure 9.10: eNaira and the Social Cash Transfer Payment Ecosystem in Nigeria



Source: Authors' Illustration

The other channel for disbursing social transfers through the eNaira is on the CBN network. Having facilitated the opening of eNaira wallets for participants, the social aid agency sends a mandate/advice to the CBN to drawdown its TSA sub-account by an amount, and credit the individual wallets of participants. The medium has the advantage of timesaving, transparency and potentially being cheaper relative to cash payments, as the CBN could facilitate the eNaira transfers without extra charges.

An important feature of the eNaira-enabled transfer is the possibility of restricting the use of the payments received, in the case of a limited-purpose instrument. A 'smart contract' can be programmed on participants' wallets to monitor usage, restrict usage (e.g., to purchase a good or service from a

designated store or merchant) or enforce recovery (in the case of loan advancement), depending on the form and objective of the programme.

Preconditions for eNaira Adoption for Social Transfers

While the successful implementation of an eNaira-enabled social transfer payment would require elaborate details, however, there are certain preconditions for its success. First is the reliability of the payment system, in this case the smooth functioning of the eNaira infrastructure and interfaces. Second is the establishment of sufficient communication channels with recipients, for the purposes of educating them on the eNaira model, what it is meant to achieve, how to open a wallet and process transactions, and how to resolve complaints. It is also important to have a contingency plan, particularly at the early stages of implementation, so that the programme does not shutdown because of some system glitch. In addition, there must be a willingness to invest. This might entail additional funding, at the initial stage, to develop a reliable digital identification data governance, registration and capturing of participants in difficult-to-reach areas. Issues of digital poverty would arise, e.g., inability to afford phones, SIM cards, data; poor connectivity, digital apathy and conservatism, among other challenges. The stakeholders must be willing to absorb the substantial initial cost of developing a sustainable framework that would serve the dual purposes of poverty reduction, social participation, and financial inclusion, at a minimum long-run average cost.

6.0 Conclusion

With remarkable advancements in payments system infrastructure in Nigeria and the introduction of the eNaira, the potential for leveraging e-transfers mediums to facilitate social transfers to vulnerable groups in society, as well as fast-track financial inclusion, is enormous. This would, however, require close collaboration among the Ministry of Humanitarian Affairs, Disaster Management and Social Development (FMHDS), the CBN and the National Identification Management Commission (on digital identification). Besides the presence of a relatively well-developed payments system infrastructure in Nigeria as a precondition for digital-enabled social transfers, a strong digital data governance is critical for the digitization of social transfer programmes.

With a proper identification management system, beneficiaries should be able to enroll and verify themselves in a social cash transfer programme without having to go through any lengthy process, which is the major challenge in most social cash transfer schemes.

This study, therefore, recommends further research on the concerns of stakeholders to unlock the potential of the eNaira in facilitating poverty alleviation and financial inclusion, through its adoption in social cash transfer programmes in Nigeria.

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CHAPTER TEN: SENTIMENT ANALYSIS OF THE ADOPTION OF THE eNAIRA

Adamu, Y. and Aminu, U. and Odu, T. O.

Abstract

Innovations and new ideas always come with challenges regarding people's willingness to adopt them. Usually, the adoption of such innovations or ideas could, among others, depend on the extent to which the authorities concerned ties people to their workability and benefits, and this is not different with the introduction of the eNaira. This study analyses sentiments on the eNaira adoption, using information from 26,884 tweets out of which 3,573 sentiments were gotten. The study finds that 39.3 per cent and 12.4 per cent of the tweets expressed positive and negative sentiments, respectively, while 48.3 per cent was neutral. The large percentage of neutral sentiments could be attributed to the fact that the eNaira is relatively new. The paper, therefore, recommends the need for the Central Bank of Nigeria to increase its sensitisation and public enlightenment, particularly in the rural areas with large numbers of the unbanked and underserved people.

Keywords: central bank, eNaira, innovation, sentiment analysis

JEL Classification: C31, E58, O31, O32

1.0 Introduction

The computational study of people's thoughts, feelings, and attitudes toward an entity or phenomenon has taken a centre stage in modern data analytics. Sentiment analysis is now being used more frequently to describe and forecast economic performance. This is because of the availability of big unstructured data and the fact that consumer expectations of future economic conditions play a significant role in influencing macroeconomic outcomes. Thus, the study of consumer opinion is crucial in the field of economics (Cotsomitis & Kwan, 2006). Several empirical studies including Carroll et al. (1994) have noted that decreased consumer confidence was one of the principal factors that caused the economic slowdown in the 1990s. Similarly, Kelly (2009) attributed the Great Depression of the 1930s to consumer pessimism, following the 1929

stock market crash. This suggests that sentiment should be an integral factor to be considered in decision-making, especially when it is analysed on a new policy or innovation.

The introduction of the central bank's digital currency, the eNaira by the Central Bank of Nigeria, is a landmark innovation that requires the gauge of consumers' opinion in determining subsequent policy that will ensure its sustainability. The quest for formidable alternative means of transaction, lower cost of transactions, and the rising case of financial fraud amid the increasing electronic payment channels are likely to create consumer apathy. This belief could encourage consumers to embrace new alternatives such as the eNaira, which is a liability of the Central Bank. Consumers are likely to have confidence and trust when a product is from a monetary authority. However, since this statement is hypothetical and presumptive, an empirical analysis is required to validate it. This is all the more so, given that time series data are usually sketchy at the introduction phase of a new policy or product, a veritable alternative method of evaluating its adoption is a sentiment analysis, using a machine learning framework with the ability to obtain big data from social networks. When executed properly, sentiment analysis of customer or client feedback information/data can be used to identify the strengths and weaknesses of the eNaira, as well as aid in the development of crucial action plans for improving its adaptation or performance.

Modern analysis of sentiments involves the use of either of the three different levels of analysis namely, Document level, sentence level, and aspect level. The document level considers the entire manuscript as a single unit, and it is examined as one. Since users typically express both positive and negative opinions about an object and its different features in opinionated texts, document-level opinion mining is more of a generic mining technique. A document with a positive opinion about an entity does not necessarily mean that the user has only positive things to say about all its features. In a similar vein, a review with a negative opinion about an entity does not necessarily mean that the user has only negative things to say about all its features. As a result, the outcome of this technique is not precise. At the sentence level, the

document is broken into sentences and each sentence is treated as a single entity and analysed separately. The aspect level on the other hand finds the attitudes regarding various characteristics, as a user may have varying perspectives regarding various features of items. This strategy creates a completely new way to assess the data by determining the polarity for each aspect. The characteristics of each entity that are used for reflecting the sentiments are determined by aspect-based opinion mining (Pahwa et al., 2018).

In this study, comments on the eNaira on the social media app, Twitter, were mined, beginning from when the eNaira was launched on October 25th, 2021. Data from Twitter were selected as they capture both news and individual perceptions in addition to the ease of interaction with the Twitter Application Programming Interface (API) relative to other social media platforms (CBN, 2022). A Livestream crawler was used to extract 26,884 tweets, referencing the eNaira over the 25-10-2021 to 20-09-2022 period. The dataset covers both tweets and replies. Personal information about the source of the tweets was excluded to address privacy concerns.

In terms of contribution to the literature, to the best of our knowledge little or no attention has been given, so far, to the area of using sentiment analysis to determine the adoption and acceptance of the eNaira as a digital currency in Nigeria. This study, accordingly, sets out to fill the gap by examining the willingness to adopt the eNaira through social media channels such as Twitter, using sentiment analysis.

Following this introduction, the chapter has four more Sections. The second Section presents a brief overview of the literature. Section 3 discusses the method of analysis and data extraction process. The presentation and discussion of the results are done in Section 4, while Section five concludes with some options for policy.

2.0 Literature Review

2.1 Conceptual Literature

2.1.1 Sentiment Analysis

Sentiment means human feelings or opinions on a particular object, product, or service. Sentiment analysis, otherwise known as opinion mining, is, therefore, the analysis of human feelings on a particular product of interest. It can be a process of detecting positive or negative sentiments on products, services, and ideas or innovations in a text. Sentiment analysis is often used by businesses, financial institutions (banks) and researchers to detect, analyse and understand human feelings (sentiments) on a particular product, service, idea, or innovation from social media data such as the Twitter, Facebook, newspapers, internet publications, etc.

Sentiment analysis (SA) focuses on the polarity of a text - the manifestation of two opposite tendencies, such as positive, negative, or neutral. It also goes beyond polarity to analyse and detect specific feelings and emotions regarding new ideas or innovations. These emotions could be 'angry', 'happy', or 'sad', which can be used to analyse the acceptance or otherwise of new ideas.

2.1.2 Types of Sentiment Analysis

SA can be used to understand the intentions of people regarding the acceptance and adoption of innovations in an economy. There are different types of SA, and their usage depends on how one wants to interpret feedback from the people. These are:

- i. Graded sentiment analysis:** This is used when a polarity precision is important to a business. In a graded sentiment analysis, people's decisions and sentiments are graded. This could be either very positive, positive, neutral, negative, very negative or strongly agree, agree, undecided, disagree and strongly disagree, with numbers allocated for each response in a Likert-type scale.

- ii. **Aspect-based sentiment analysis:** This is a situation where sentiments about a text are analysed to understand which aspect of people are mentioned in the positive, neutral or negative.
- iii. **Multilingual sentiment analysis:** The multilingual sentiment analysis involves the use of codes and algorithms to analyse sentiments on products. This involves the use of sentiment lexicons, translated corpora or noise detection algorithms to analyse feelings about a product. Lexicons are applied to assess polarity using a dictionary that contains both positive and negative terms.

This brings to the fore the question of how the SA works. SA works effectively using Natural Language Processing (NLP) and Machine Learning Algorithms (MLA) to automatically determine peoples' feeling, emotion, and interest in online conversations. There are three forms of SA algorithm namely:

Rule-based: This performs SA automatically based on some manually crafted rules.

Automatic algorithm: This form of algorithm uses machine learning techniques to learn and analyse data on peoples' sentiments.

Hybrid algorithm: This system combines rule-based and automatic algorithms approach in the analysis of peoples' sentiments on a given idea or innovation.

2.1.3 Benefits of Sentiment Analysis

The benefits of SA include the following:

- i. **Sorting large data:** SA can help businesses and organisations to process large amounts of unstructured data from thousands of social media conversations.

- ii. **Real-time Analysis:** SA can help businesses immediately identify peoples' desires and feelings on a particular product or innovation to take the right decision and action in real-time.
- iii. **Consistent criteria:** By using a centralised SA system, businesses can apply the same criteria to all their data (structured and unstructured), which could help them improve the accuracy of their analysis and have better insights into the problem at hand.

2.2 Theoretical literature

Various theories and models of adoption and acceptance of innovation have been widely used in the literature to explain the adoption of innovations. These include the diffusion of innovation theory by Rogers (1995), reasoned action theory by Fishbein and Ajzen (1975), social cognitive theory by Bandura (1986), technical acceptance model by Davis (1989), planned behavior theory by Ajzen (1991), the Personal Computer utilisation model by Thompson et al. (1991), the motivation model by Davis et al. (1992), extended technology acceptance model (TAM2) by Venkatesh and Davis (2000), and the unified theory of acceptance and use of technology by Venkatesh et al. (2003).

The diffusion of innovation theory by Rogers (1995) opined that the spread and adoption of innovation and new ideas are influenced by four elements. These are the innovation itself, the communication channels used in disseminating information relating to the new idea, the time it takes for people to adopt and the social system of the people. He also identified five processes of diffusion of innovation as knowledge, persuasion, decision, implementation, and confirmation of the new idea. He further classifies users of innovation into the following: innovators who bring the idea, early adopters, early majority, the laggards, and the leap-froggers.

Fishbein and Ajzen (1975) theory of reasoned action proposes three general constructs to analyse peoples' sentiments on technology adoption. To them, people's sentiment depends on their behavioural intention, attitude and subjective norm. They further noted that behavioural intention (BI) of the

people depends on their attitude (A) and subjective norms (SN). Hence, mathematically, $BI = A + SN$. To further explain this theory, Ajzen's (1991) theory of planned behavior was propounded. The theory adds the concept of perceived behavioural control to the theory of reasoned action. This holds that peoples' perception of the ease or difficulty of performing an action influences their decision on innovation adoption. In another development, the social cognitive theory argued that expectations of outcomes and performance-related benefits influence users' decisions to adopt new ideas or innovations. The technical adoption model of Davis (1989) posits that technology adoption depends on the perceived usefulness of the technology and the perceived ease of use of the new idea or technology.

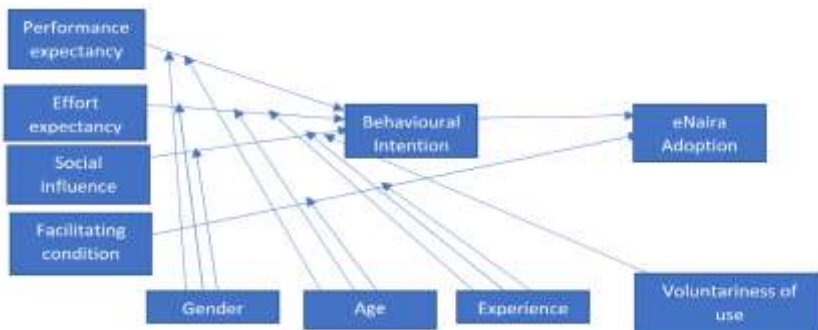
The model of PC utilisation by Thompson et al. (1991) posits that technology adoption depends on peoples' behavior, which is determined by what they would like to do, what they think they should do, what they have usually done and the expected consequences of their actions. The theory is concerned with the extent to which workers used computers in an organisation, taking into cognisance their opinion. The motivation model by Davis et al. (1992) viewed technology adoption in terms of individual motivation to adopt. They argued that motivation can shape peoples' behavior toward the adoption of a new idea or innovation. This depends on whether the innovation is instrumental to achieving a distinct outcome from the activity they do, or it can lead to enhanced pleasure and satisfaction of the users.

Venkatesh and Davis (2000) extended the technology acceptance model to include voluntariness, image, job relevance, output quality, result demonstrability and perceived ease of use of new ideas and innovations as determinants of peoples' behavior toward the adoption of new ideas and innovations. Finally, a unified theory of acceptance and use of technology was developed by Venkatesh et al. (2003) where he argued that the intention of people to use information technology is influenced by four constructs namely: performance expectation, effort expectations, social influence and facilitating conditions. This theory was believed to be comprehensive and has wider applications.

This study, therefore, adopts the unified theory of acceptance and use of technology by Venkatesh et al. (2003) to analyse sentiment on the eNaira. This is because it links behavioural intention to performance and effort expectancy, social influence and facilitating conditions, which could be the major determinants of the eNaira adoption.

Figure 10.1 provides a simple illustration of the theory. First, it shows that performance and effort expectancies, as well as social influence, could determine behavioural intention of users. In turn, the behavioural intention of users could determine the adoption and acceptance of innovation, which in this case is the eNaira. Facilitating condition depends on the age and experience of users to influence the adoption of new ideas, social influence depends on gender, experience and voluntariness of use of the innovation by the users to influence the behavioural intention of users, which could in turn influence their adoption of the eNaira. Effort expectancy, on the other hand, depends on gender, age and experience to influence behavioural intention of users, thereby determining their level of adoption of new ideas. Finally, performance expectancy depends on gender and age to influence behavioural intention of users, which in turn could determine their level of adoption of the eNaira.

Figure 10.1: Unified Theory of Acceptance and Use of Technology



Source: Adapted from Venkatesh et al. (2003).

2.3 Empirical literature

Numerous studies have been conducted on sentiment analysis relating to technology adoption, branding of a product, and emotions and feelings of

people on new ideas and innovations, including digital currencies. Horton et al. (2018) investigate students' perception of digital currency and conclude that majority of the students surveyed would rather remain neutral, which shows that they are likely not familiar with cryptocurrency. On the other hand, Liu and Zhang (2018) examine users' attitudes toward the adoption and acceptance of the Internet of Things (IoT) by analysing their sentiments expressed on the on Twitter platform. They observe that most tweets reflect positive sentiment on IoT, though some of the users expressed fear and concern over the security of their assets and privacy.

Similarly, a study was conducted by Chen and Liu (2022) on the public perception of Facebook's digital currency initiative through text mining on Twitter platform. They used Linguistic Inquiry and Word Count (LIWC) and observed that when neutral is isolated from the analysis, positive sentiment has 63.0 per cent, while negative sentiment has 37.0 per cent. The study concludes that peoples' sentiment on the Libra digital currency was positive. In another paper, Samuel (2022) used sentiment analysis of data drawn from the Twitter platform to predict fluctuations in Solana prices and find that public opinion and sentiments about Solana as an alternative cryptocurrency were positive. This implies that Solana would have wide acceptability in the Netherlands.

On the contrary, Tudor-Mircea and Mircea (2019) examine peoples' sentiments on cryptocurrency, using sentiment analysis in the social media. They employed Stanford coreNLP and IBM Watson methods on 7,331 and 7,327 tweets and find that negative sentiment on cryptocurrency outweighs the positive sentiment even when the neutral response is isolated. This shows that people were skeptical about the adoption and acceptance of cryptocurrency as a means of financial transaction in the United States.

To the best of our knowledge little or no attention was given to the area of using sentiment analysis to determine the adoption and acceptance of the eNaira as a digital currency in Nigeria. This study, therefore, fills the gap by examining the willingness to adopt the eNaira using data obtained from the Twitter platform to carry out a Sentiment Analysis.

3.0 Methodology

3.1 eNaira Sentiment Analysis

The procedure involves the extraction of relevant data and the sentiment analysis stages. In the data extraction stage, comments about the eNaira are mined from the Twitter platform, beginning from when it was launched. Data from Twitter were selected as they capture both news and individual perceptions, in addition to the ease of interaction with the Twitter Application Programming Interface (API). The sentiment analysis stage involves converting the unstructured data in the collated tweets into structured data using Natural Language Processing (NLP).

3.1.1 Data Extraction

A livestream crawler was used to extract 26,884 tweets, referencing the eNaira over the 25-10-2021 to 20-09-2022 period. The dataset covers both tweets and replies, personal information about the source of the tweets was excluded to address privacy concerns. Table 10.1 presents a cross-section of some of the extracted tweets.

Table 10.1: Sample of Some Extracted Tweets

S/No	Timeline	Content
1	2021-10-25 14:42:05+00:00	"Is the eNaira app working at all?"
2	2021-11-06 10:04:35+00:00	I just transferred money from my GTB account into my eNaira wallet, and the transaction was fast and seamless!!! My eNaira wallet was credited under 30 seconds Kudos CBN!!!!
3	2021-12-27 23:23:04+00:00	Apparently, I am the only one I know that has eNaira. Been trying to spend it but no one seems to be accepting it.
4	2022-05-18 06:41:51+00:00	The eNaira is the most advanced CBDC in the world, according to research carried out by PwC. eNaira is a big deal in the world
5	2022-06-07 20:20:03+00:00	@cenbank good evening. I have enrolled as eNaira merchant for over two weeks now and my account is still under review.
6	2022-09-18 17:01:45+00:00	I feel for the FinTechs that dedicated resources to building infrastructure around the eNaira.

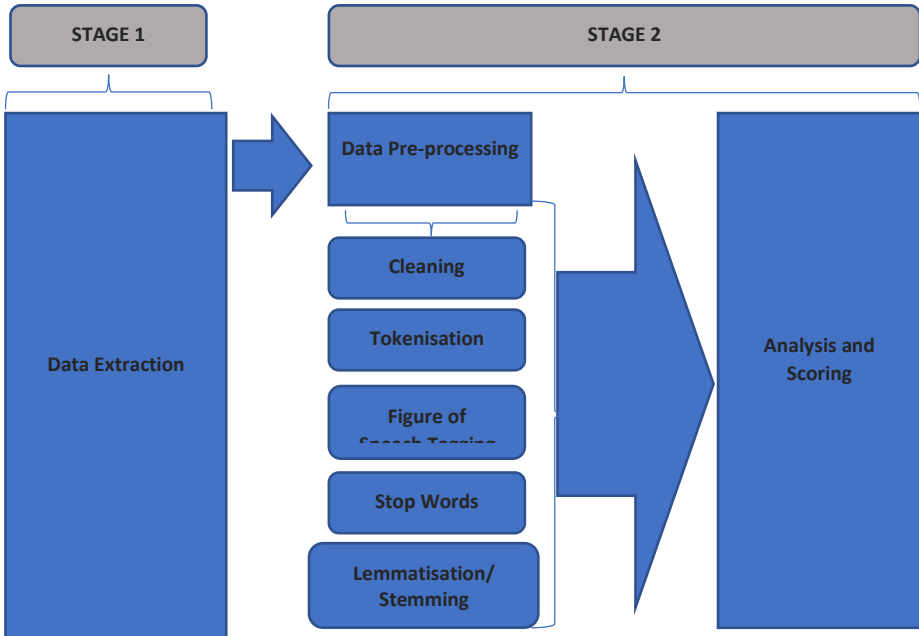
Source: Authors' extraction from twitter.

3.1.2 Sentiment Analysis

The approach adopted in this paper is like the analytic frameworks of Clements and Reade (2020) and Kraaijeveld and De Smedt (2020), CBN (2022), Xu et al. (2022). The tweets are initially pre-processed before scores detailing the sentiments are ascribed to them through the steps below (see Figure 10.2).

The first step of pre-processing tweets removes punctuation marks and special characters such as #, \$, @, !, ?, after which each sentence is reduced into smaller parts called tokens in a process tagged tokenization. All the tokens are classified into their respective part of speech, ranging from verb, noun, pronoun, etc, to maintain the context in which each word was employed.

Figure 10.2: Process of Sentiment Analysis



Source: CBN, 2022.

Words such as: is, have, we and of, which do not add value to the sentence and will not alter the meaning of the sentence when removed are deleted from the sentence using the Natural Language Toolkit's (NLTK) list of stop words.

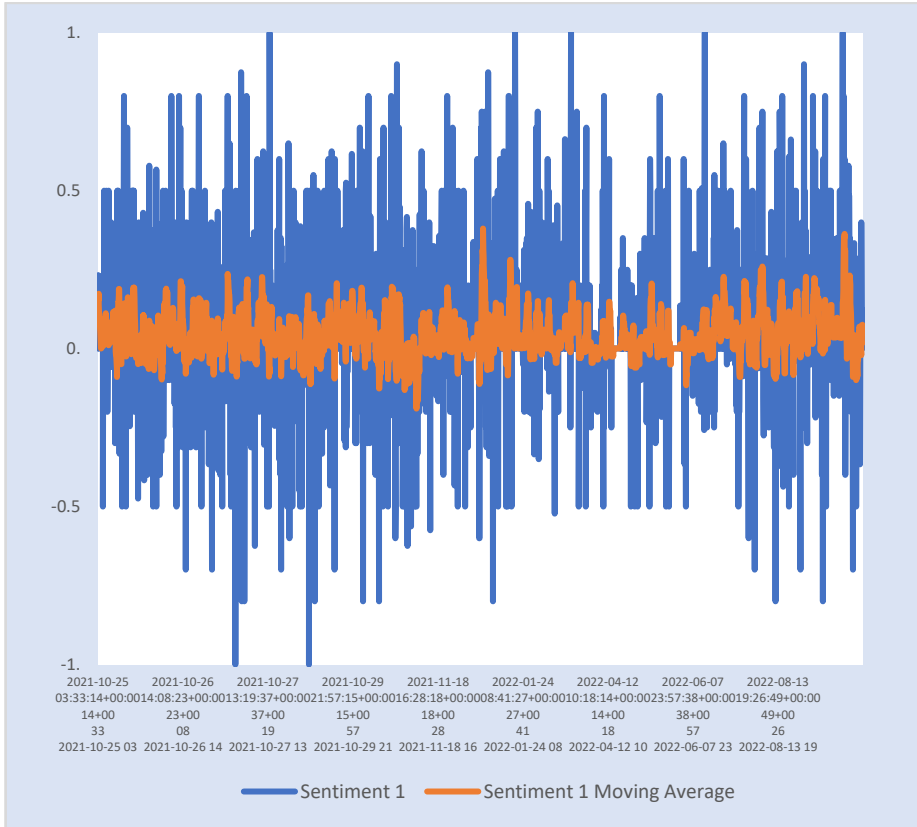
Other unimportant words which are not part of the NLTK's stop words such as 'http' and 'https' are manually added as custom stop words. The lemmatisation stage of cleaning normalises the tokens by returning them to their base forms as words such as 'poorly' are reduced to 'poor' and 'increased' is reduced to 'increase'.

The next phase uses the wordnet dictionary of the NLTK to generate the polarity of tweets. Here, words in the dictionary have already been pre-defined and scored by the compilers of the wordnet dictionary. The sentiments are categorised into positive, neutral, and negative, and scores attached to each word range from -1 to +1. Negative words tend towards -1, neutral words are assigned a score of 0 while positive words are ascribed positive values tending towards +1. The total score of every tweet is calculated as the average score of the words in that tweet. To arrive at monthly values, the tweets are summed for each month to obtain the eNaira sentiment index for that month (CBN, 2022).

4.0 Discussion of Results

After pre-processing and cleaning the 26,884 tweets, only 3,573 were converted into sentiments. This is because most of the tweets were incoherent, some were in pidgin, some were in foreign languages and some referenced individuals whose usernames included the keyword eNaira. Interestingly, the search revealed over 100 usernames that referenced eNaira, most of which were Asian and had no connection to the CBDC. Thus, the inclusion of these references would significantly bias the results. Figure 10.3 presents the computed eNaira sentiment index and the moving average. The chart suggests that the positive sentiments about the eNaira outnumber the negative sentiments. The moving average also appears to be largely positive most of the time.

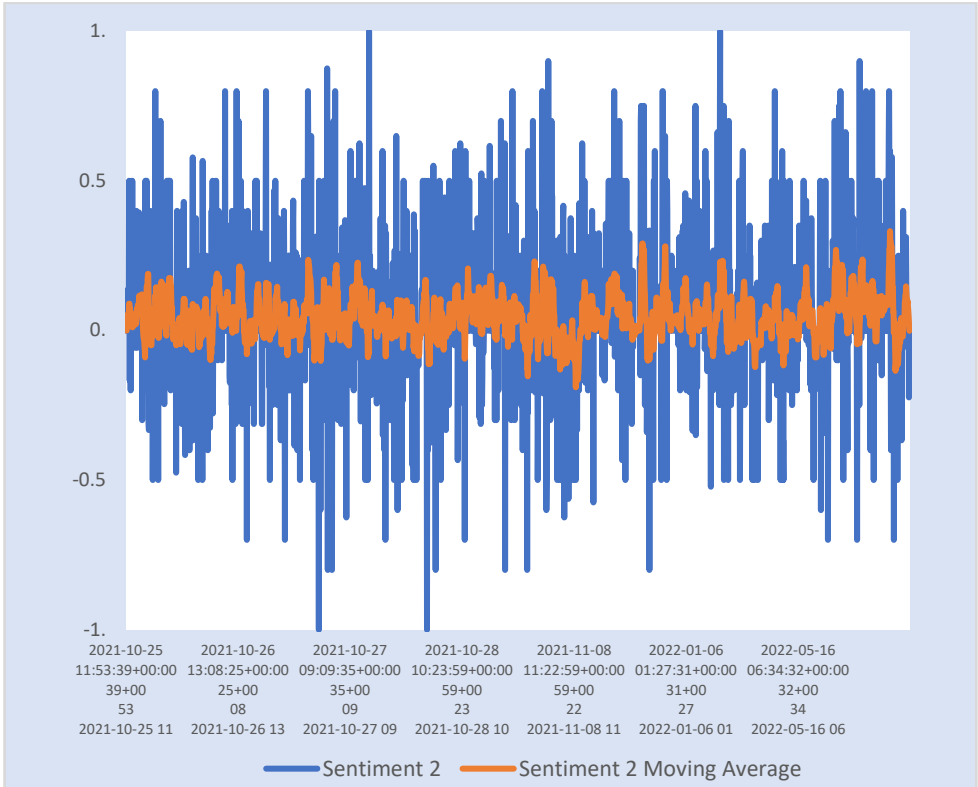
Figure 10.3: eNaira Perception Index 1



Source: Authors' computation.

Manual cleaning was also performed on the data to eliminate unsuitable tweets missed by the algorithm, further reducing the number of tweets to 2,442. Figure 10.4 presents the second eNaira sentiment after manual cleaning. This chart looks like Figure 10.3 as the positive sentiments outnumber the negative sentiments.

Figure 10.4: eNaira Perception Index 2



Source: Authors' computation.

A closer look at the tweets reveals that the neutral tweets surpassed the positive and negative ones. Out of the 3,573 sentiments extracted from the first round of cleaning, 48.3 per cent of sentiments were neutral, while 39.3 per cent and 12.4 per cent were positive and negative, respectively. When the neutral tweets are excluded, the positive sentiments significantly exceed the negative sentiments as 79.1 per cent of the tweets exhibit positive sentiments about the eNaira while 23.9 per cent exhibit negative sentiments. This suggests that the public perception of the eNaira is more positive than negative.

Table 10.2: Summary of Sentiments

		Positive	Neutral	Negative	Total
1st Round of Cleaning	Number	1404	1727	442	3573
	%	39.29	48.33	12.37	
	% without Neutral	76.06		23.94	
2nd Round of Cleaning	Number	774	1282	386	2442
	%	31.70	52.50	15.81	
	% without Neutral	66.72		33.28	

Source: Authors' computation.

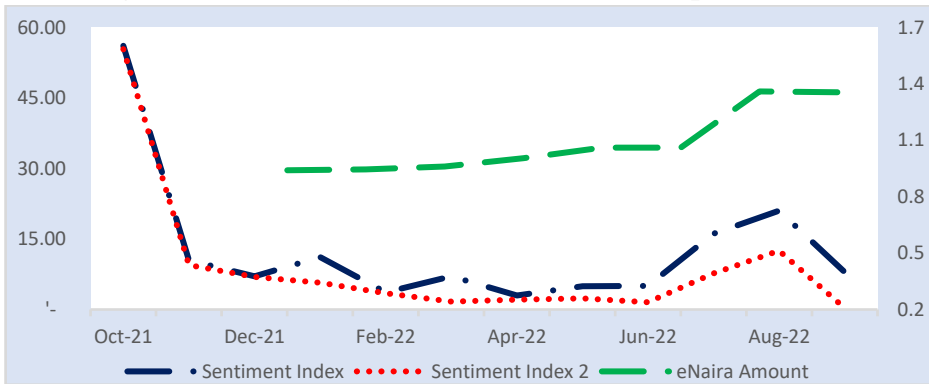
After the second round of cleaning, the number of sentiment-eligible tweets declined to 2,442 and 52.5 per cent of the tweets are classified as neutral. The proportion of positive tweets stood at 31.7 per cent while negative tweets accounted for 15.8 per cent of the sentiments. After extracting the neutral tweets, the polarity of most of the tweets were positive as 66.7 per cent of the tweets exhibited optimistic sentiments on the eNaira, while 33.3 per cent of the tweets exhibited pessimistic sentiments on it. Comparatively the second round of cleaning led to a decline in the number of positive and negative tweets. However, the proportion of positive sentiments declined while the proportion of negative sentiments increased.

4.1 Evolution of Public Perception of the eNaira

Figure 10.5 reveals the evolution of public perception of the eNaira from its inception on October 25th, 2021, to September 2022. Using both the sentiment and the sentiment moving average indexes, the chart shows a downward trend in public perception after inception. The perception was subdued from November 2021 to June 2022. However, some oscillations are visible.

Perception started improving in July 2022 and August 2022, before declining in September 2022. The improvement could be attributed to the eNaira roadshows in July and the eNaira Hackathon and the unveiling of the USSD code in August. The minimal upward movement in perception from November 2021 to June 2022 coincided with the commendation of the eNaira by PWC and IMF.

Figure 10.5: Monthly Evolution of eNaira Perception Index



Source: Authors' computation.

Figure 10.5 also illustrates some co-movement between the public perception and the amount of the eNaira, suggesting that public sentiments drive the adoption of the CBDC. Periods of subdued movement in perception are mirrored by periods of marginal upward movement in the amount of the eNaira, whereas periods of significant improvements in public perception are trailed by significant increases in the amount of the eNaira.

4.2 Identification of Words Related to the eNaira

The word cloud was employed to highlight the popular terms commonly referenced in conversations about the eNaira. Since the size and colour of each word is proportional to the frequency of usage in tweets, the most prominent words can be identified quickly. To prevent the dominance of words such as eNaira, CBN, and central bank, in the word cloud, these words were included in the list of custom stopwords. This has the potential to identify key issues influencing the optimistic perception about the eNaira and the reasons behind

the pessimistic sentiments. Word clouds were extracted from the cleaned and processed tweets using both methods as seen in Figures 10.6 and 10.7. The results revealed that the most referenced keywords include wallet, app, people, bank, transaction, use, know, launch, bank account, play store, naira, financial inclusion, crypto, digital currency, etc. Most of these terms are related to the operation of the eNaira app (app, launch, wallet) and the benefit of CBDC (financial inclusion, crypto). This implies that resolving issues around the operation of the eNaira app/wallet may improve willingness to adopt the CBDC as stated in some tweets with negative sentiments. Improved communication about the eNaira and highlighting its benefits may also increase its adoption.

Figure 10.6: Full Sample Wordcloud 1



Source: Author's computation.

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CHAPTER ELEVEN: eNAIRA ADOPTION: A TEXT MINING ANALYSIS OF USER EXPERIENCE

Obiora, K. I., Adebisi, M. A. and Omotosho, B. S.

Abstract

This study analyses the user experience of eNaira speed wallet app based on the reviews posted by users during the period 2021Q4 to 2022Q3. A total of 4,423 reviews were collected using web-scraping techniques and analysed based on standard text mining procedures. On a scale of 1 to 5 (5 being the best rating), the average user rating of the eNaira speed wallet within the study period was slightly below average (2.5), the average rating in each quarter rose from a below average rating of 2.4 in 2021Q4 to an above average star rating of 3.1 in 2022Q3. Also, over the study period, a positive net sentiment score of 4.7 per cent was recorded while the polarity score was 0.09, implying the preponderance of positive sentiments driven by emotions associated with “trust”, “anticipation”, and “joy”. These results imply that users were generally satisfied with their experience using the eNaira speed wallet apps. The negative sentiments expressed by the users were associated with the emotions of sadness”, “fear”, “anger”, and “disgust”. The generated word clouds showed that users may have had issues with the email verification and BVN authentication while on-boarding. We recommend that the CBN continues to (i) sensitise users on the functionalities of the eNaira speed wallets and the benefits of the eNaira innovation, and (ii) analyse and monitor eNaira speed wallet app users reviews to enable early detection of issues that may constitute sources of systemic risk.

Keywords: eNaira, text mining, user experience, central bank digital currencies

JEL Classification: O33, G41, C31

1.0 Introduction

Central Bank Digital Currencies (CBDCs) are electronic variants of cash issues by central banks. These digital currencies, which are backed by the issuing central bank, became popular following the introduction of Bitcoins about 13 years ago and the increasing pace of electronic transactions. According to the Bank for International Settlements, CBDCs are liabilities of the central bank denominated in an existing unit of account and used, not only as a medium of exchange, but also as a store of value. CBDCs are issued to ensure access to legal tender should cash be phased out, promote cash-less society, improve payment systems efficiency, and enhance cross-border payments efficiency, among others (Ward & Rochemont, 2019). According to the World Economic Forum, over 100 countries were already considering the possibility of introducing CBDCs as of August 2022.

The launch of the eNaira in October 2021 made the Central Bank of Nigeria (CBN) the first central bank in Africa to introduce a Central Bank Digital Currency (CBDC). The eNaira is a digital currency backed by the Central Bank of Nigeria and denominated in Naira. The eNaira is expected to promote economic growth, facilitate diaspora remittance, promote transparency in financial transactions, support the implementation of government's social welfare programmes, promote financial inclusion, facilitate trade, engender efficiency in revenue collection, and improve monetary policy transmission. Whereas CBDCs portend several benefits, Nanez-Alonso et al. (2021) observed that the introduction of a CBDC requires a database where the CBDC is registered and an application that facilitates the execution of the CBDC related payments.

The eNaira allows for online retails purchases, and transfers relating to person-to-person, person-to-business, businesstoperson, persontogovernment, governmenttoperson, bank accounttoeNaira wallet and eNairawallettobank account. In the second phase of the eNaira project, the functionalities of the eNaira were extended to unbanked and underserved users via offline channels. Transactions in eNaira can be performed using the eNaira speed wallet, and USSD *997# channel. The eNaira speed wallet is accessible to both android

and iPhone Operating System (iOS) users' smart phones via their respective application stores. Thus, the smooth functioning of the eNaira speed wallet is critical to the adoption of the eNaira by both individuals and merchants.

The adoption of the eNaira and the eNaira speed wallet would be gradual as there is empirical evidence that the diffusion of any innovation is usually not instantaneous (Della-Peruta, 2018). The factors that drive the adoption of innovation include the rate of information diffusion about its use (Allan et al., 2014), technology diffusion including the level and availability of telecommunication infrastructure (Andrés et al., 2010), and level of education among potential users (Comin & Mestieri, 2013). In this paper, we argue that the level of satisfaction expressed by the current users of the eNaira speed wallet app is also a major determinant of adoption and an important aspect of generating diffusion of positive information about the app. The level of users' satisfaction/dissatisfaction about the eNaira can be gleaned from the reviews posted by them while using the app. These reviews provide useful feedback, which could lead to further enhancements of the app and speed up the rate of adoption. It could also lead to a change in the guidelines for operating the app.

In view of the above, we pose some research questions. First, what is the nature of sentiments expressed by users of the eNaira speed wallet since its introduction in October 2021? Second, what are the issues being discussed in the reviews posted by users? Third, how has the level of user satisfaction of the eNaira wallet evolved over time? Fourth, what are the types of emotions expressed by the users? To address these questions, we applied web-scraping techniques to collect 4,423 reviews posted by the eNaira speed wallet users during the period 2021Q4 – 2022Q3 and analysed the resulting corpus using standard text mining procedures. Thus, the main objective of this study is to uncover the nature of sentiments expressed by users of the eNaira speed wallets since its adoption and identify the key issues being discussed in the user reviews.

The rest of the paper is laid out as follows. In Section 2, a review of related literature is presented. Section 3 discusses the text mining techniques

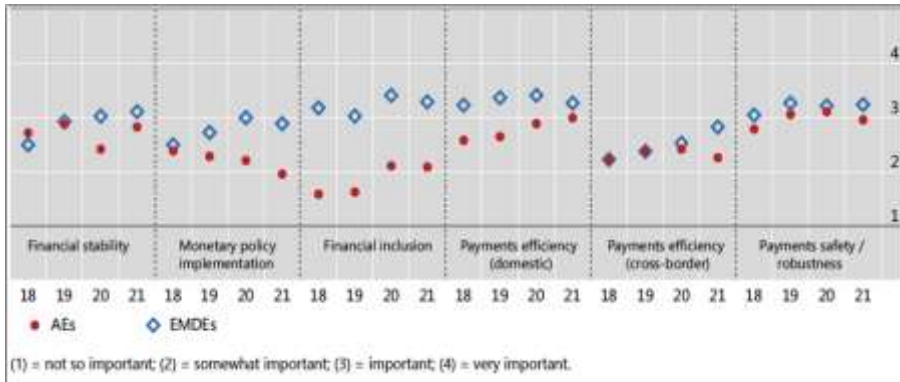
employed, including the data cleaning procedures. The results are presented and discussed in Section 4 while Section 5 concludes the paper.

2.0 Literature Review

The review of the literature presented in this Section focuses on three main strands. The first pertains to the benefits and risks associated with CBDCs as well as its adoption. The second relates to the issues of innovation adoption, such as the eNaira speed wallet. The third dwells on the techniques employed in the literature for analysing user satisfaction with mobile apps.

CBDCs are believed to promote financial inclusion, improve the resilience and safety of the payments system, facilitate distribution of government funded social welfare funds, promote transparency in financial transactions, reduce cash handling costs, reduce business informality, support monetary policy transmission, and improve the efficiency of cross-border payments (Alfonso et al., 2022). As argued by Kosse and Mattei (2021), financial inclusion considerations appear to be the primary drive for the issuance of retail CBDCs in emerging markets and developing economies (Figure 11.1).

Figure 11.1: Motivation for issuing a retail CBDC



Source: Kosse and Mattei (2021)

Notwithstanding the benefits of CBDCs, they have also been known to be associated with certain risks and implementation issues, and the extent of such risks depends substantially on the degree of adoption of the digital currency.

For instance, IMF (2020) noted that cyber-attacks may be a threat to the CBDCs and that it may be subject to use for criminal purposes. Whereas other private digital payments could be vulnerable to the same risk, the reputational costs for central banks could be larger, should there be an attack on the CBDC. Such costs may include disintermediation effects and the increased risks of bank runs. According to the literature, these risks can be controlled by the central bank imposing limits on CBDC holdings. If used for settling international payments, the introduction of CBDCs could also trigger volatilities in capital flows and exchange rates (IMF, 2020).

A second strand of literature, such as Zamora-Pérez et al. (2022) discusses the issues around the adoption of payment innovations in general, and retail CBDCs in particular. These studies also argue that the widespread adoption of CBDCs should not be taken for granted, and thus, highlight the design elements that should be put into consideration to facilitate the adoption of CBDCs by consumers and merchants. According to Mancini-Griffoli et al. (2018), users of digital currencies would generally prefer those that maximise their private benefits while minimising the associated costs. In a related study, Auer and Bohme (2020) explained that to boost adoption, the design features of retail CBDCs must accommodate the needs of consumers. These include universal accessibility, ease of use, and transaction privacy. These are closely related to the attributes identified by Huynh et al. (2020) as promoting the adoption of CBDCs, which include lower transaction cost to the consumer, high speed of transaction, security, ease of use, and privacy, among others. Studies such as Gao and Waechter (2017) have found that privacy is an important consideration for the adoption of innovations. As noted by Zamora-Pérez et al. (2022), incorporating the necessary design features that meet the expectations of consumers, merchants and regulators are integral to the widespread adoption of CBDCs.

The third strand of the literature focused on in this paper relates to the methods of analysing user sentiments. Sentiment analysis, which is also often referred to as opinion mining involves studying subjective information contained in textual data provided by consumers to describe their level of satisfaction with

the product or service consumed. As explained in Omotosho (2021), the analysis of user sentiments, especially in Nigeria, has been conducted based on data from either the administration of structured questionnaire to a limited number of respondents or the use of data scrapped from user reviews written on digital platforms. Studies that have adopted the questionnaire approach in respect of mobile banking applications in Nigeria include Odumeru (2013), Ifeonu and Ward (2015), and Olaleye et al. (2017). Relevant features identified by users as promoting the adoption of mobile banking apps include convenience, security, privacy, integrity, and compatibility with circumstances of users. The literature on the use of text mining for analysing user sentiments of mobile banking apps in Nigeria is still at its infancy with the pioneering efforts being Omotosho (2021) and Adebisi and Omotosho (2022). This current study belongs to the strand of the literature analysing user sentiments associated with CBDCs, using text mining approach. To our knowledge, this is the first study to examine the user sentiments of the eNaira speed wallet.

3.0 Methods of Analysis

This study focuses on the analysis of user sentiment associated with the eNaira speed wallet introduced by the Central Bank of Nigeria (CBN). The eNaira speed wallet is the application developed for making financial and non-financial transactions with Nigeria's CBDC – the eNaira. The eNaira wallet can be downloaded from Google Play Store and Apple App Store. Once the wallet is downloaded and the on-boarding (the sign-up) as well as sign-in procedures are successful, the user is granted access to conduct transactions that are permitted by the wallet. The app also allows users to write reviews about their experience and provide quantitative ratings regarding their level of satisfaction. These written reviews constitute an important source of information for the Central Bank of Nigeria in its efforts at improving the user interface and experience of the eNaira speed wallet.

The textual data used for the sentiment analysis conducted in this study comprises reviews provided by users of the eNaira speed wallet on their respective app stores. The analyses were implemented using the R statistical software. The reviews cover the iOS and Android versions of the eNaira speed

wallet for both individuals and merchants. The retrieved reviews were cleaned in line with standard text mining procedures. The data cleaning procedure involves removing numbers, punctuations, white spaces, and special characters; converting all the characters in the text to lower case; removing English stop words; correcting contextual inconsistencies in the reviews; and stemming the text to ensure that the terms in the texts are uniquely identified.

Having pre-processed the data, we generated word clouds to identify the most frequently used words by the users in their reviews. Next, we analyse the sentiments inherent in the user reviews to derive useful insights regarding the feelings and experience of the eNaira speed wallet users. The sentiments are categorised into three orientations – positive, neutral, and negative. Lastly, we compute the polarity score, which is a quantitative measure of positive or negative intent found in the tone of the reviews (Kwartler, 2017). The textual data used for the analyses spans the period 2021Q4 to 2022Q3.

4.0 Results

In this Section, we analyse the star ratings and the qualitative reviews provided by users of the eNaira speed wallet, using averages, percentage shares, polarity scores, word cloud, and word frequency.

4.1 Analysis of Star Ratings

A descriptive analysis of user ratings of the eNaira speed wallet apps is presented in Table 11.1. The total number of ratings for each star rating and the share of each star rating are presented in parenthesis. The eNaira speed wallet app recorded an unprecedented number of reviews within the first three months of its launch as about 86.0 per cent of the total reviews analysed was recorded during the period.

Table 11.1: User Rating Analysis

Star rating	2021Q4	2022Q1	2022Q2	2022Q3	Total
1	2,168 (57.0)	55 (37.2)	51(38.6)	111(32.6)	2,385 (55.7)
2	241 (6.3)	9 (6.1)	5 (3.8)	38(11.1)	293 (6.4)
3	173 (4.6)	14 (9.5)	17 (12.9)	33 (9.7)	237 (4.9)
4	168 (4.4)	21 (14.2)	11 (8.3)	34(10.0)	234 (4.9)
5	1,052 (27.7)	49 (33.1)	48 (36.4)	125(36.7)	1,274 (28.1)
Total	3,802 (86.0)	148 (3.4)	132 (3.0)	341 (7.6)	4,423 (100)
Average	2.4	3.0	3.0	3.1	2.5

Source: Google Play Store, Apple App Store and Authors' computation

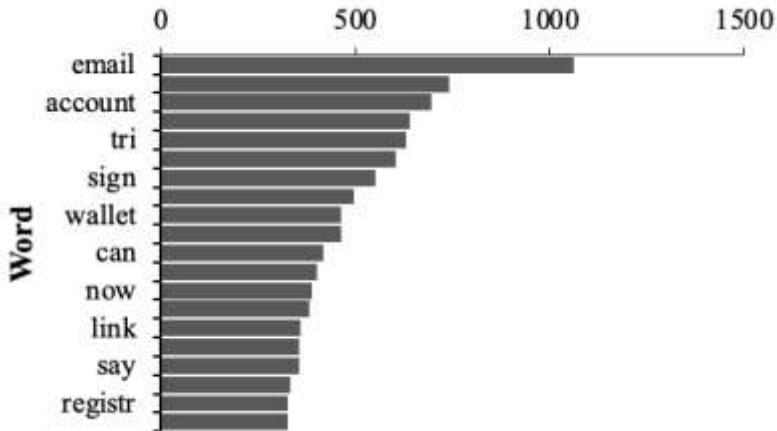
Share of total (shown in parenthesis) is the number of ratings for each category in a quarter divided by the total number of ratings for the period. The benchmark (average) rating is 2.5.

Although the overall average star rating of the eNaira speed wallet within the study period was around the average (2.5), the average rating in each quarter rose from a below average star rating of 2.4 in 2021Q4 to above average star rating of 3.1 in 2022Q3. Also, whereas the share of 5-star ratings was 27.7 per cent in 2021Q4, it rose to 36.7 per cent in 2022Q3. This implies improved user satisfaction of the eNaira speed wallet over the study period.

4.2 Word Frequencies

The top ten (10) frequently used words by the users in their reviews are presented in Figure 11.2. These were: “email”, “account”, “tri”, “sign”, “wallet”, “can”, “now”, “link”, “say” and “register”. A close examination of these words suggests that the eNaira wallet users may have had issues bordering on email or account verification. It suggests that many users may have experienced issues with their email verification while trying to sign-in to the eNaira speed wallet. With the occurrence of the word “link”, users may have had some experience linking their eNaira speed wallet to their bank accounts.

Figure 11.2: Most Frequent Words



Source: Authors' computation

4.3 Word Cloud

The word cloud for the individual star rating category and the full sample are presented in Figure 11.3. As identified in Figure 11.2, the most visible words in the full sample are “email” and “BVN”, “account”, “bank”, “can’t”, suggesting that the predominant concerns may have been those relating to email verification and BVN authentication. This is particularly true for the 1-star rating word cloud, which has the predominant words also being “email”, “BVN”, “account”, “bank”, “can’t”, and “try”. Users who assigned a 1-star rating to the eNaira speed wallet most likely gave such a rating due to their inability to successfully register themselves on the app. The situation is similar for the 2-star rating and 3-star rating word clouds.

However, the 4-star rating and 5-star rating word clouds showed that the words predominantly used by users within such categories are “wallet”, “bank”, “account”, “use”, “good”, “easy”, “work”, “nice”, “excellent”, etc. These imply that users who assigned either 4-star or 5-star ratings were generally pleased with the app, especially with regards to ease of use, ease of registration, and ease of transaction. In view of these findings, it is important that the legacy

5.4 Sentiment Analysis

The shares of positive, neutral, and negative sentiments are presented in Table 11.2 while the associated words are shown in Table 11.3.

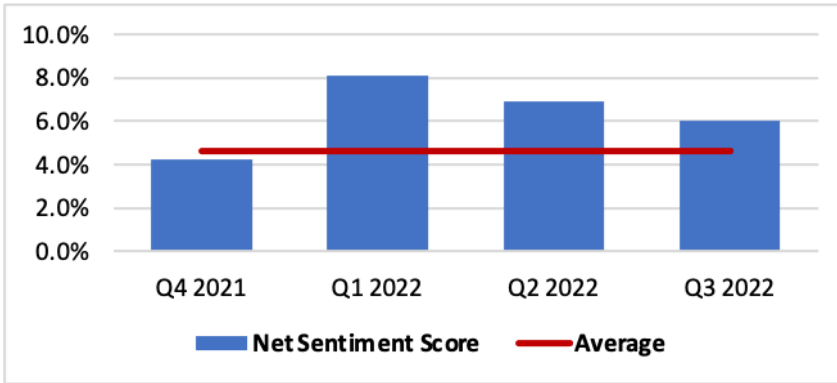
Table 11.2: Share of sentiments

Period	Negative	Positive	Neutral	No. of Words
Q4 2021	3,314	5,089	33,238	41,641
	7.96%	12.22%	79.82%	
Q1 2022	103	223	1,151	1,477
	6.97%	15.10%	77.93%	
Q2 2022	134	244	1,218	1,596
	8.40%	15.29%	76.32%	
Q3 2022	315	558	3,144	4,017
	7.84%	13.89%	78.27%	
All	3,866	6,114	38,751	48,731
	7.93%	12.55%	79.52%	

Source: Authors' calculation

Of the total of 48,731 words analyzed in the corpus, 7.9 per cent expressed negative sentiments while 12.6 per cent expressed positive sentiments, implying a positive net sentiment score of 4.7 per cent for the study period.

Figure 11.4: Net Sentiment Score



Source: Authors’ computation

In 2021Q4, about 8.0 per cent of the words contained in the user reviews expressed negative sentiments while 12.2 per cent expressed positive sentiments. Thus, a positive net sentiment score of 4.2 per cent was recorded, lower than the average of 4.6 per cent for the study period (Figure 11.4). Whereas the net sentiment score trended downwards from a positive 8.1 per cent in 2022Q1 to 6.1 per cent in 2022Q3, the net sentiment scores in 2022 were above the average for the study period. This may be reflective of users’ increased understanding of the eNaira speed wallet and its functionalities.

Table 11.3: Sentiment Words

Positive Sentiment			Negative Sentiment		
Word	Freq	Weight	Word	Freq	Weight
Good	381	6.232	Please	401	10.372
Work	357	5.839	Useless	315	8.148
Contact	260	4.253	Error	218	5.639
Money	256	4.187	Invalid	164	4.242
Like	190	3.108	Bad	154	3.983
Success	177	2.895	Poor	131	3.389

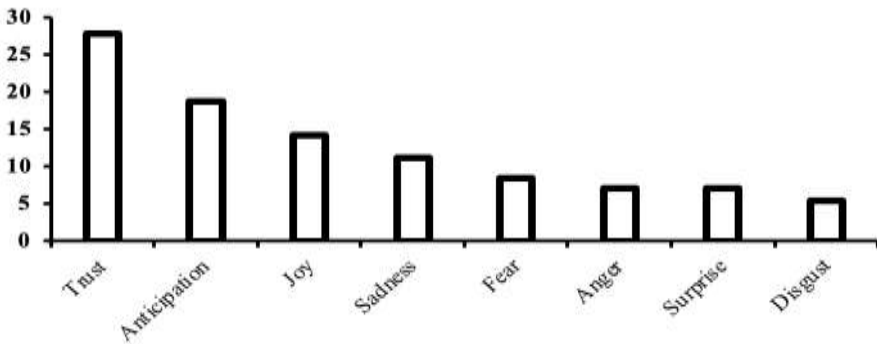
Great	164	2.682	problem	117	3.026
Nice	162	2.650	Scam	108	2.794
Star	160	2.617	Several	107	2.768
Support	150	2.453	Wait	104	2.690

Source: Author’s computation

Table 11.3 presents the ten most predominantly used words by users of the eNaira speed wallet to express positive and negative sentiments. The top 10 words associated with positive sentiment were “good”, “work”, “contact”, “money”, “like”, “success”, “great”, “nice”, “star” and “support”. On the other hand, the top ten words associated with negative sentiment expressed by users were “please”, “useless”, “error”, “invalid”, “bad”, “poor”, “problem”, “scam”, “several” and “wait”.

The words used to express negative sentiments in the reviews appear to suggest that some users were not conversant with the functionalities and registration procedures for the eNaira speed wallet. It is important that users are informed that the eNaira is not a scam.

Figure 11.5: Emotions



Source: Authors’ computation

In terms of the emotions expressed by the users, Figure 11.5 shows that the emotion of “trust” dominated. This was followed by the emotions of “anticipation”, and “joy”. However, the emotions associated with the negative sentiments expressed by the users were those pertaining to “sadness”, “fear”, “anger”, and “disgust”.

Table 11.4: Sentiment Polarity

Period	Polarity	Sd. of Polarity
Q4 2021	0.066	0.525
Q1 2022	0.217	0.533
Q2 2022	0.209	0.500
Q3 2022	0.278	0.598
Full sample	0.092	0.535

Source: Authors’ computation

The polarity scores for the user reviews were computed and shown in Table 11.4. A negative value of the polarity score implies prevalence of negative sentiment over positive sentiments, and vice versa. In line with the overall positive sentiment recorded in Table 11.2, the overall polarity score for the study period was 0.09. Interestingly, the polarity score increased from 0.07 in 2021Q4 to 0.28 in 2022Q3. This corroborates our earlier findings regarding the improvements in the level of satisfaction experienced by users of the eNaira speed wallet.

6.0 Conclusion

This study analysed the sentiments expressed by users of the eNaira speed wallet during the period October 2021 to September 2022. It used textual data of 43, 781 words contained in 4,423 user reviews of the speed wallet app, on Google Play and Apple App stores. The data was sourced using web-scraping techniques and analysed based on standard text mining procedures.

The study found that the average star rating of the eNaira speed wallets increased from 2.4 in 2021Q4 to above average star rating of 3.1 in 2022Q3, implying improved user satisfaction with the app. The sentiment analysis showed an overall positive sentiment over the sample period, with the net sentiment score increasing from 4.3 per cent in 2021Q4 to 6.1 per cent in 2022Q3. This satisfactory outcome was further buttressed by the computed polarity score, which rose from 0.07 in 2021Q3 to 0.28 in 2022Q3. The emotions associated with the positive sentiments were those of “trust”, “anticipation”, and “joy”. On the other hand, the negative sentiments were associated with the emotions of “sadness”, “fear”, “anger”, and “disgust”.

An analysis of the predominant words shown on the generated word clouds and the sentiment categories suggests that users may still be experiencing issues with email verification and BVN authentication while onboarding. Others still considered the eNaira innovation a scam. It is recommended that the CBN continues to sensitise users on the functionalities of the eNaira speed wallets and the benefits of the eNaira innovation. It is also recommended that there should be continuous analysis and monitoring of the user reviews to enable early detection of issues that may constitute sources of systemic risk.

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PART 7

**OTHERS: FINTECH AND
FINANCIAL MARKETS**



CHAPTER TWELVE: EXAMINING THE RELATIONSHIP BETWEEN BITCOIN AND STOCK RETURNS IN NIGERIA

Yakubu, J., and Samuel G. T.

Abstract

This paper examines the relationship between Bitcoin and stock returns in Nigeria, using correlation analysis. The results indicate the presence of a positive relationship between Bitcoin and stock returns. Although the correlation is weak, the continued rise in the adoption of Bitcoin and other crypto assets may see the correlation between these asset classes becoming stronger over time, and this may have implications for financial system stability. The study therefore recommends close monitoring of the adoption of crypto assets by the monetary authority in view of the risks they pose to financial system stability. However, result from the Granger causality test indicates that Bitcoin returns does not Granger cause stock returns and stock returns does not Granger cause Bitcoin returns. This means that the movement in the variables are independent of each other, that is, movements in the past values of Bitcoin returns cannot be used to predict future stock returns.

Keywords: stock market, Bitcoin, cryptocurrency

JEL Classification: E44, G15

1.0 Introduction

Cryptocurrency (crypto) is a virtual or digital currency with secured cryptography on decentralised networks using blockchain technology. The decentralisation of crypto implies that it is not issued by any central authority and therefore cannot be controlled by or interfered with by government. Globally, there has been a sustained increase in the acceptance of crypto assets by investors, as a way of broadening their investment asset classes. Notwithstanding their significant volatility, crypto-assets present both potential opportunities and risks and are increasingly regarded as an emerging asset class by both financial market participants and policy makers (Feyen et al., 2022). This is evident in the significant growth of crypto-assets market

capitalisation from US\$7.12 billion in January 2016 to US\$3.05 trillion in November 2021 (Figure 12.1).

A cursory look at the industry analysis shows that crypto assets activity has grown by over 2,300.0 per cent globally since the third quarter of 2019 with Emerging Market and Developing Economies (EMDEs) having high volume of activities in crypto assets (Team, 2021). The emergence of crypto assets has become popular to both retail and institutional investors despite the earlier perception about their risks that could be counterproductive to businesses and to the stability of financial systems.

The significant growth and adoption of crypto assets in the international financial market is remarkable with approximately 21,910 cryptocurrencies as of November 2022 from 1 in January 2009 (Hicks, 2022). This paper, however, focuses on the first, largest and most regularly used crypto asset, Bitcoin. As a cryptocurrency, the first decentralised digital asset, Bitcoin has drawn the interest of a large pool of investors internationally and has become the biggest cryptocurrency by market share and size today. Bitcoin has the largest market share and capitalisation to the tune of 39.0 per cent and US\$370.03 billion, respectively, as of September 2022 (CoinGecko). Bitcoin exchanges across the international market have spread widely and this has drawn the attention of scholars and regulators. Examining the relationship between Bitcoin adoption and stock returns in Nigeria has become necessary due to divergent views on the impact of cryptocurrencies on financial markets and the global financial system.

With the increased adoption of Bitcoin and other crypto assets, the correlation between these assets and traditional financial assets, such as stocks, has significantly increased over time (Adrian et al., 2022). For instance, S&P 500 and Bitcoin between 2017-2019 did not particularly have significant correlation, but in 2020, there was a significant correlation between these assets (Adrian et al., 2022). Similarly, the growth of crypto assets in Asia has shown correlation between the performance of equity markets and crypto assets, such as Bitcoin and Ethereum. While the returns and volatility correlations between

Bitcoin and Asian equity markets were low before the pandemic, these have increased significantly since 2020 (Choueiri et al., 2022). The increase in correlation between these assets and traditional financial assets limits the assumed benefits of portfolio risk diversification, thereby raising concerns about the contagion risk across financial markets and financial systems at large (Iyer, 2022).

Despite the growing literature on the relationship between Bitcoin and stocks returns in other jurisdictions, to the best of our knowledge, none has been carried out in any country within sub-Saharan Africa. Against this backdrop, this chapter investigates the relationship between stock and Bitcoin returns in Nigeria to determine the degree of correlation between these asset classes.

Following the introduction in Section one, Section two examines some conceptual issues and provides the literature review. Section three focuses on the trend analysis, while Section four discusses the data and analysis of results. The paper ends in Section five with the conclusion and recommendations.

2.0 Conceptual Issues and Literature Review

2.1 Some Conceptual Issues

Bitcoin is a form of digital money that exists independently of any government, state, or financial institution. The asset can be exchanged globally without the need for a centralised intermediary and has a public operating policy that arguably cannot be altered (Nakamoto, 2008). In several exchanges, Bitcoin can be purchased as it is offered to blockchain miners for their efforts in verifying transactions (Dwyer, 2015). Since Bitcoin became the most well-known cryptocurrency in the world, dozens of other cryptocurrencies have been developed either as replacements for Bitcoin, as payment systems, utility or security tokens for other block chains.

Bitcoin, as the first and largest crypto asset, has drawn the attention of many individuals and investors alike for over a decade now. Bitcoin is essentially used as an alternative currency due to its low transaction costs, peer-to-peer transaction model, and spread in the international crypto market space. Bitcoin

is viewed as having hedging ability and therefore seen as virtual gold, as well as a means of exchange (Su et al., 2020). Bitcoin shares some similarities with traditional financial assets such as risks due to speculation and price volatility. However, in periods of increasing market uncertainty or turmoil, cryptocurrencies can play a bit of a hedging role that lowers the overall risk of an investors' portfolio (Li & Huang, 2020). Therefore, Bitcoin can serve as a portfolio asset (along with other conventional financial assets, fiat money) that can be used to hedge the risk of investing in other assets. Thus, the use of Bitcoin as an investment asset and its close interrelationship with other financial assets, such as stocks, requires close examination. Examining the relationship between Bitcoin and other traditional financial assets, such as stocks, provides insight and valuable information to participants in the financial markets and policy makers. If investors know the information spillover effects in the cryptocurrency market, they can adjust asset portfolios or make investment or hedge strategies with knowledge of the high level of interrelatedness (Yi et al., 2018).

International financial markets have become more integrated as economies continue to advance with technological innovations that have brought about increased investments and gains for investors, through the development of various products. As the interconnectedness of these markets increases, so also the portfolio risks, and this reduces the diversification benefits thereby propelling investors to seek alternative assets. A cryptomarket bust could result in contagion spread either through individual or institutional investors who may hold crypto assets or liabilities. Correlation between Bitcoin and stock implies that if there is a bust, resulting in huge loss of crypto assets, investors with both crypto assets or liabilities and stocks may seek to rebalance their portfolio holdings, and that may engender panic and volatility in the stock market with resultant negative effect on financial markets.

2.2 Empirical Review

Several studies have investigated the relationship between Bitcoin and other conventional financial assets such as stocks. Mizerka et al. (2020), examined the relationships between Bitcoin rates of return, stock indices, and variables

characterising Bitcoin users in the developed and MSCI Emerging markets, and their results showed evidence of significant correlation between these classes of assets. Similarly, studies by Omane-Adjepong and Alagidede (2020) and Ćosić and Časni (2019) revealed that the use of Bitcoin in the emerging markets enhanced portfolio benefits of investors. Sami and Abdallah (2020) also examined the impact of the cryptocurrency market on the stock market performance in Middle East and North Africa (MENA) region. The results showed the existence of a significant correlation between the cryptocurrency market and stock market performance in the countries of the MENA region. This means that the stock market performance of MENA region is not completely isolated from changes in the price movement of crypto assets.

Using wavelet transformation approach, Mensi et al. (2020) examined the co-movements between Bitcoin prices, major regional Islamic stock markets and Dow Jones Sukuk Index. The dependence on frequencies of the co-movement between Bitcoin and Islamic equity returns is an interesting observation. From the results obtained, the benefits of diversification were observed to be relatively less significant for long-term investors than for short-term investors at low frequencies because this co-movement was larger and in the same direction at those frequencies. The co-movement in opposing directions at high frequencies suggested that, in the short term, diversification in the Bitcoin and Islamic equity markets would provide superior hedging benefits. We also see that different nations have different strengths of the correlation between Bitcoin and Islamic equity returns. In the same vein, using the wavelet transformation method, Hung (2020) investigated the relationships between the Bitcoin cryptocurrency and the equity markets in the Asia-Pacific region, including Australia, Hong Kong, Japan, New Zealand, and Singapore. They deduced from the pairwise correlation results that there was short-, medium-, and long-term unidirectional links between Bitcoin and the chosen assets in the Asia-Pacific area. The pairs of Bitcoin-Straits Times Index and Bitcoin-NIKKEI provided specific evidence for bidirectional causality at long scales. The dependence of Bitcoin on developed financial markets in the Asia-Pacific area dramatically grew at lower frequencies, despite weak association of Asia-

Pacific equities markets and Bitcoin cryptocurrency at higher frequencies throughout the data period.

Using a regime-switching skew-normal model, Matkovskyy and Jalan (2019) examined the effects of contagion between traditional financial markets, including five equity indices and the centralised Bitcoin markets for the EUR, USD, GBP, and JPY. The findings showed a significant spread of contagion from financial to Bitcoin markets. Similarly, Kang et al. (2020) investigated the dynamic equicorrelation between Bitcoin and four important financial assets (S&P 500, US dollar, Treasury bonds, and gold futures). They established that there was an asymmetric causal relationship between Bitcoin and other asset classes, as well as the possibility that investors may use Bitcoin as a reliable asset for hedging.

Furthermore, looking at other additional conventional assets, using divergent models (EWMA models, Spearman's rho, the Diebold and Yilmaz spillover index, GAS models with conditional multivariate Student-t distribution and time-varying scales and correlations, BVAR models), Matkovskyy et al. (2020) investigated the effects of economic policy uncertainty on the connectivity between conventional financial markets (NASDAQ100, S&P500, Euronext100, FTSE100, and NIKKEI225) and Bitcoin. According to the authors, there was a higher link between Bitcoin's volatility and that of other financial assets than there was between the returns on Bitcoin and other financial assets. This relationship changed with time and became stronger after the debut of the Bitcoin future.

Using return and volatility spill overs between the largest cryptocurrency and four asset classes in bear and bull market scenarios, based on a smooth transition VAR GARCH model, Bouri et al. (2018) investigated the connections between Bitcoin and conventional investments. The authors noted that the markets for most other assets were inextricably linked to those for bitcoin, and they provided context for the connections between the two market environments as well as evidence that bitcoin absorbed more volatility than it transmitted.

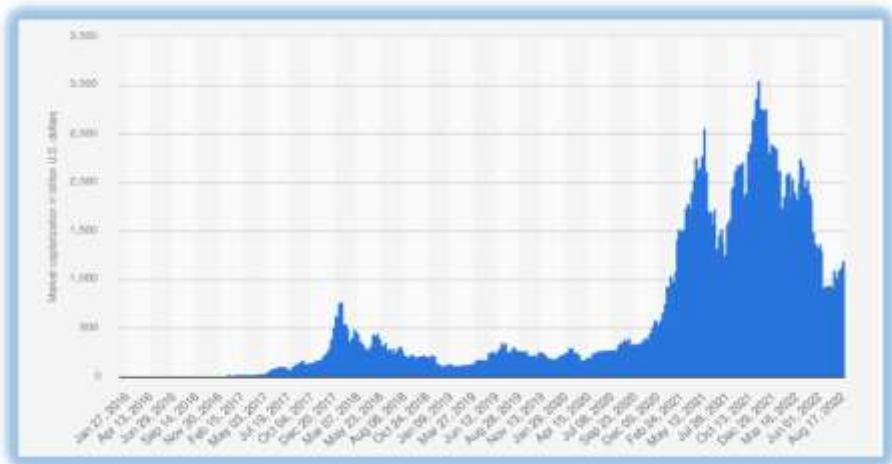
Despite the rapid expansion of the non-central bank currencies, and the studies that focus on their relationship with the stock markets, there is relatively, paucity of studies in the extant literature. The Cryptocurrency market provides several attractive opportunities for investors that are likely to affect the performance of the stock market. It is necessary to investigate the relationship between these asset classes to ascertain if a relationship exist between them in the Nigerian market, especially considered against the background that Nigeria ranked sixth in the 2021 Global Crypto Adoption Index (Team, 2021).. Therefore, it is vital to have an in-depth understanding of the relationship that exists between these assets, given the competing nature of investment in either class of assets, deriving as it were, from the same pool of funds in any given jurisdiction.

3.0 Trend Analysis

Nigeria is the leading country among the Emerging Middle East and African Economies trading in Bitcoin and crypto assets generally (Adesina, 2021). In 2020, the volume of trade in crypto assets in Nigeria amounted to US\$352.00 million, which was far above those of South Africa and Kenya with US\$90.20 million and US\$85.00 million, respectively. Between January 2021 and June 2022, Nigeria was top in Bitcoin trading, which amounted to US\$1.16 billion, indicating significant adoption of the digital asset by Nigerians. Kenya, which came second recorded trading volume of US\$325.00 million during the same period. In 2021 alone, the value of trade in Bitcoin in Nigeria was US\$760.00 million with approximately six million trades during the year. In the first six months of 2022, Nigeria's trade stood at almost US\$400.00 million, indicating that the country has sustained its leadership in Bitcoin transactions (Zimwara, 2022). In the 2021 Chain Analysis Report on Global Crypto Adoption, Nigeria was the 6th leading country in the adoption of cryptocurrency, particularly because of its resilience in crypto dealings (Team, 2021). According to the IMF report as highlighted by He et al. (2022), countries with weak economic fundamentals are likely to witness a surge in crypto adoption, as their population would perceive crypto as a hedging instrument against exchange rate fluctuations and inflation.

Concerns about financial stability have been raised as cryptocurrencies such as Bitcoin have developed from being a marginal asset class with few users to a key player in the digital asset revolution. Despite considerable volatility, the market value of these innovative assets increased from US\$7.12 billion in January 2016, to US\$3.05 trillion in November 2021 because of their rising popularity among institutional and retail investors alike (Figure 12.1). The onset of the COVID-19 pandemic engendered an increase in trading in these assets and as a result, contributed significantly to the rise in market capitalisation in November 2021.

Figure 12.1: Overall cryptocurrency market capitalisation (Billion US Dollars)



Source: CoinGecko.

Since its introduction, Bitcoin has continued to lead in the crypto asset market. Bitcoin is the largest cryptocurrency asset by market capitalisation since its launch, which is frequently traded on the global financial exchanges for digital assets (Figure 12.2). The emergence of decentralised finance, technological advancement, and rising institutional and retail investor interest have all contributed to Bitcoin's explosive growth. In September 2021, for example, Bitcoin and Ether ranked among the world's top 20 traded assets, competing

with the market capitalisation of some of the world's largest companies (Iyer, 2022).

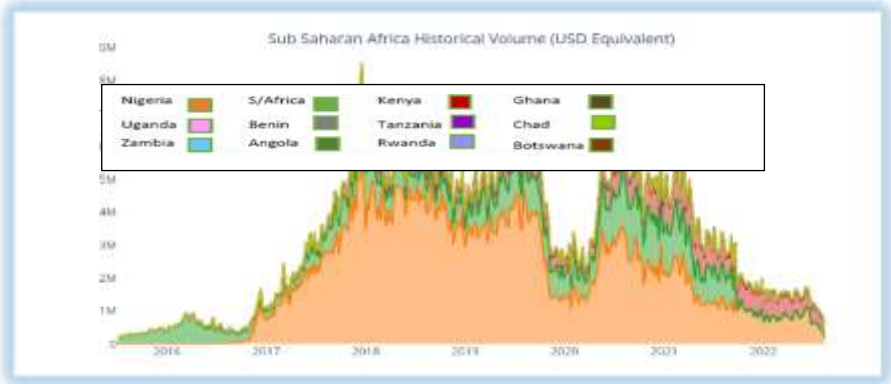
Figure 12.2: Percentage of Total Market Capitalisation of Major Crypto Assets



Source: Coinmarketcap.

The dominance of Bitcoin in the crypto market has been evident over time. In 2013, Bitcoin had a market share of 96.3 per cent and maintained a significant proportion up until January 2016, when it recorded a 91.4 per cent share of the market (Figure 12.2). With the introduction of other cryptocurrencies into the market, Bitcoin's share of the market began to decline, plunging to 39.2 per cent in June 2017. With the onset of the COVID-19 pandemic, the market share of Bitcoin rallied up to 71.9 per cent in January 2021.

Figure 12.3: Sub-Saharan Africa Historical Volume (\$ US Equivalent)

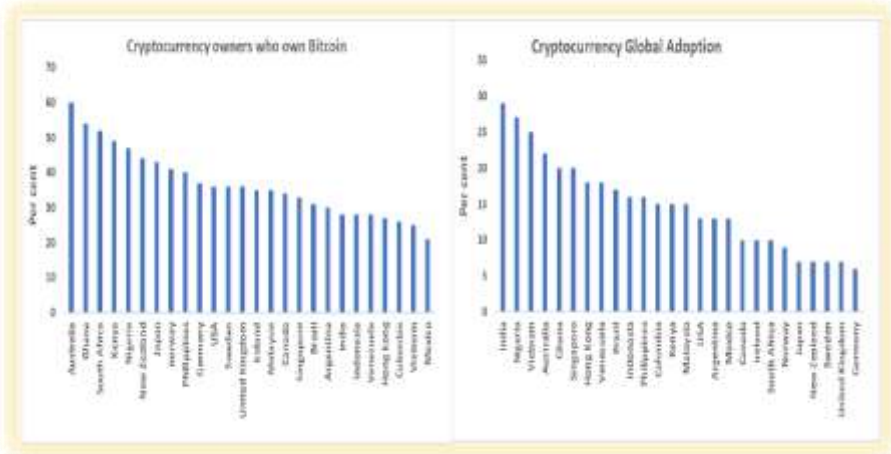


Source: UsefulTulips (n.d)

Note: USD Equivalent = Summation of (Volume BTC * Global Spot Price).

Nigeria's interest in crypto assets, particularly Bitcoin, has been rising over the years. In Sub-Saharan Africa, Nigeria is the leading country in crypto market dealings. The peak of transaction volume for Nigeria amounted to 5.54 million, while South Africa and Kenya recorded 2.23 million and 0.68 million, respectively (Figure 12.3). Similarly, in the crypto currency adoption index survey of 22 countries, Nigeria's top position is also reflected (Figure 12.4), which shows that Nigeria is the country with the highest level of crypto adoption after India (Laycock, 2021). According to the survey, the top countries' investors majorly put their investments into Bitcoin, Ethereum, and Cardano.

Figure 12.4: Cryptocurrency Ownership and Adoption



Source: Laycock (2021).

3.1 Challenges of Cryptocurrency Growth to Stock Market and Financial Stability

The rise in the crypto assets adoption in Nigeria and the correlation between Bitcoin and stocks raises the concern of transmission of shocks that can pose a challenge to the stability of the financial system, and the possibility of spill overs of investor sentiments between the assets. For instance, Bitcoin volatility explains about one-sixth of S&P 500 volatility during the pandemic, and about one-tenth of the variation in S&P 500 returns (Adrian et al., 2022). In this case, if there is a sudden drop in Bitcoin prices, it may result in making investors more risk-averse and cause a downturn in stock market investment. Spill overs in the opposite direction will produce converse outcomes, indicating that sentiment in one market is communicated to the other in a complex manner.

Many of the entities operating in the crypto market ecosystem lack strong operational, governance, and risk practices. Crypto exchanges, for instance, have faced significant disruptions during periods of market turbulence. There are also several high-profile cases of hacking-related thefts of customer funds (Drakopoulos et al., 2021). Although the nature of operations in this market and the hacking-related issues have not yet significantly impacted the stability

of the national or global financial system, as crypto assets continue to gain popularity, their significance in terms of potential effects on the larger economy is expected to grow.

4.0 Data and Methodology

This study utilises monthly closing prices of Bitcoin (BTC) and the All-Share Index (ASI) for the analysis. The data covers the period from January 2016 to August 2022, which is equal to a total of 80 observations. The data for the conventional asset class (ASI) was obtained from NGX, while the data for Bitcoin prices are obtained from CoinGecko. We employed Pearson’s correlation analysis to examine the relationship between Bitcoin and Stock returns in Nigeria.

4.1 Analysis of Results

Figure 12.5: Bitcoin Price, ASI and Stock Returns



Sources: NGX, CoinGecko, and Authors’ computation.

Figure 12.5 shows that Bitcoin prices and the All-Share Index appear to exhibit a co-movement over time. Between November 2017 and February 2018, there was a surge in Bitcoin prices. Although the ASI also moved up, the increase was lower when compared to that of Bitcoin. With the advent of the COVID-19 pandemic, it was expected that stock markets across both international and

domestic markets would experience turbulence. However, the Central Bank of Nigeria made substantial interventions to curb the impact of the pandemic on the economy. In a similar vein, Central Banks across the globe also made several interventions to curb such impact on stock markets. Thus, crypto and stock prices both trended higher amid challenging global economic conditions with investors having increased risk appetite. Although both asset classes witnessed upward movement, the higher price swings of Bitcoin are reflected in its higher volatility when compared to the moderate movement in stock prices.

Table 12.1: Correlation Matrix

Variables	ASI	BTC
ASI	1.000	
BTC	0.322	1.000
	0.004	

Source: Authors' computation.

Note: ASI: All Share Index, BTC: Bitcoin.

The computed correlation coefficient confirms the trend observed and shows that Bitcoin and stock market movements are correlated with stock returns. The result shows correlation coefficient of 0.32, which indicates that the returns of Bitcoin and stocks are positively correlated. Though the correlation of 0.32 between Bitcoin and stock returns is deemed weak, it is noteworthy, however, that there is more volatility in the price change of Bitcoin. Bitcoin is not subject to the same regulations and government policies as the stock market. Although the result of correlation analysis in this paper is considered weak, there is an indication that Bitcoin market is in sync with the stock market. The rising interest in crypto assets in Nigeria may see this correlation becoming stronger over time, implying limited or declining diversification benefits that were initially perceived by investors in the crypto assets.

Table 12.2: Granger Causality Tests

Null Hypothesis:	Obs	F-Statistic	Prob.
BTC does not Granger Cause ASI	78	0.65818	0.5208
ASI does not Granger Cause BTC		0.35851	0.6999

Source: Authors' computation

Correlation analysis is primarily concerned with finding out whether a relationship exists between variables and then determining the magnitude and direction of that relationship. Granger causality test, on the other hand, determines whether one time series is a factor and offer useful information in forecasting another time series. To carry out the Granger causality test, we first conducted unit root test to ensure the data series are stationary. The result from the ADF unit root tests shows that both stock returns and Bitcoin returns are stationary at levels. The results are statistically significant at the 1.0 per cent significance level with t-statistics of -7.4344410 and -7.578686 for ASI returns and Bitcoin returns, respectively. Result from the Granger causality test indicates that Bitcoin returns does not Granger cause stock returns and stock returns does not Granger cause Bitcoin returns. This means that the movement in the variables are independent of each other, that is, movements in the past values of Bitcoin returns cannot be used to predict future stock returns.

5.0 Conclusion and Recommendations

This study examined the relationship between Bitcoin and stock returns in Nigeria. The Bitcoin market capitalisation has significantly increased over time amid increasing demand in the Nigerian market. As indicated in the pairwise correlation results, we observe that the correlation between Bitcoin prices and Nigeria stock returns is statistically significant. The correlation between both variables is positive as attested to by the positive sign of the correlation coefficient. Therefore, there is the need for further investigation with a view to obtaining a better understanding of the magnitude of the relationship between stock returns, stock volatility and the Bitcoin prices.

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CHAPTER THIRTEEN: INVESTIGATING THE RELATIONSHIP BETWEEN CRYPTOCURRENCIES AND FIXED INCOME MARKET IN NIGERIA

Akintola, A. A. and Question, E. M.

Abstract

The study investigates the relationship between cryptocurrencies and the fixed income market in Nigeria, using data that covered the 2018M01 to 2022M09 sample period. The study employed a simple correlation analysis to examine the direction, magnitude and significance between the bid-to-cover ratio and the volume of trades in bitcoin. The results from the correlation analysis show the existence of a negative relationship between the 30-year bond bid-to-cover ratio and the volume of trades in bitcoin in Nigeria, while the results from the Granger causality test results show the absence of causality between the 30-year bond bid-to-cover ratio and cryptocurrencies (bitcoin). The paper, therefore, recommends that the CBN and the Debt Management Office (DMO) articulate and implement policies that are geared towards deepening the fixed income market with a view to attracting investment away from cryptocurrencies to dampen volatility in the economy..

Keywords: cryptocurrencies, fixed income, Bitcoin

JEL Classification: D53, E40, O16

1.0 Introduction

The launch of Bitcoin by Nakamoto in 2009 has led to the advancement of cryptocurrencies as digital financial assets and has paved the way for a variety of applications of blockchain technology to non-financial sectors. Several representative cryptocurrencies, such as Bitcoin, Ethereum and Dogecoin, are considered to have established themselves as reliable digital assets. Despite the seeming volatility, cryptocurrencies are gaining traction in global financial markets, (Kim et al., 2021). The volatile nature of cryptocurrencies price movement is attributed to the high returns associated with it (Katsiampa, 2017).

In recent years, the growth in cryptocurrency returns, particularly Bitcoin has received considerable attention (Chaim & Laurini, 2019; Dyhrberg et al., 2018; Ji et al., 2019; Urquhart, 2016; Wei, 2018). Despite the growth in cryptocurrency returns, policy makers and economists alike maintain a cautionary approach towards its viability as an asset class, given its volatility and the lack of underlying fundamentals.

The cryptocurrency market has grown exponentially over the years, fueled by their increasing use as components in investors' portfolios and the rise in the number of firms holding cryptocurrency assets on their balance sheets (Koutmos, 2018). Thus, consideration of the relationship and predictability between cryptocurrencies and the fixed income market is important for investors, portfolio managers and policymakers as this will enable the trio to better optimise the inherent investment risks. At end-December 2021, data from coinbase show that the share of bitcoin relative to other major cryptocurrencies is 71.5 per cent (Coinbase, 2021). This shows that a change in the price of the asset could positively or negatively affect the cryptocurrency market. Bitcoin may be used to hedge against a variety of different risks, including those associated with the stock market, foreign currencies, and commodities (Dyhrberg, 2016). Cryptocurrencies can also have significant impact on fixed income securities and the stock market (Vardar & Aydogan, 2019; Salisu et al., 2019).

From the above, and intuitively speaking, a rate hike by the monetary authority will lead to a fall in high growth stocks and cryptocurrencies, buoyed by sell-offs while investments in fixed income securities, such as treasury bonds/bills will rise. The structure of stocks and cryptocurrencies mirror the same co-movement, given their prices and market capitalisation. In context, cryptocurrencies are traded as stocks and as such should exhibit same (inverse) relationship with fixed income securities.

For Nigeria, the fixed income market shows high sensitivity to monetary policy rate adjustments especially, the 30-year tenor, the longest horizon of the bond market. Changes in monetary policy are easily transmitted through changes in

the rate of the 364-day tenor treasury bills and further transmitted to the 20-year, 25-year and 30-year bonds in Nigeria (Saidu et al., 2018). The debt instrument, therefore, serves as a veritable proxy for fixed income instruments in the country. The main objective of this paper is to investigate the relationship between investments in cryptocurrencies and fixed income securities in Nigeria. An understanding of this relationship will give an insight to policy makers and asset market investors on the viability or otherwise of including cryptocurrencies in a portfolio of investments.

Following this Introductory, Section 2 focuses on the review of relevant literature. Section 3 provides a trend analysis while in Section 4, we present the method of study and discuss the empirical findings. Section 5 concludes the study with relevant policy recommendations.

2.0 Literature Review

The literature on cryptocurrencies is still gaining traction, particularly on its link to other asset classes. Their variability and volatility make it difficult to estimate and model the expected returns. Empirical studies have shown the existence of a link among various classes of assets in the assets market. The traditional assets such as equities, fixed income instruments, foreign exchange and mortgage, among others, have shown levels of connectedness in various studies (Diebold & Yilmaz, 2012; Udejaja, 2019; Fasanya et al., 2021; and Fasanya & Akinde, 2019). For these studies, the focus had been the conventional traditional assets and how the individual asset reacts to shocks emanating from the others.

The advent of decentralised finance has however shifted the argument to cryptocurrencies and its determination as an asset. Studies have attempted to situate the investible characteristics of cryptocurrencies in comparison to other financial assets (Pirgaip et al., 2019). Comparing cryptocurrencies as financial assets or currency relative to others including Standard & Poor's 500 Index (S&P 500), gold, and Treasury Bonds, findings showed that Bitcoin has a very high volatility compared to the other assets (Doumenis et al., 2021). The study

further concludes that in comparison with debt instruments which shows no correlation, Bitcoin was more of a speculative asset than a steady store of value.

Other studies determine causal links between cryptocurrencies and other asset classes. Hung (2021) using Multilayer Perceptron Neural Network Non-linear Granger causality and Transfer Entropy approaches, showed a bi-directional relationship between green bonds, stock, and Bitcoin markets, while green bonds had a unidirectional connection with the price of CO₂ emission allowances. The results indicate evidence of connectedness of green bonds with these assets while showing its hedging property against the price volatility in these markets. Similarly, Bouri et al. (2018) investigates the nexus between Bitcoin and other asset classes including equities, stocks, commodities, currencies, and bonds based on returns and volatility spillovers in bear and bull market conditions. Using a VAR GARCH-in-mean model, the study found that Bitcoin returns are related quite closely to those of the other asset's classes with greater evidence that Bitcoin receives more volatility than it transmits.

A few studies such as (Eisl et al., 2015; Constanza, 2018; Ghabri et al., 2021) have indicated that despite its volatility, the inclusion of Bitcoin in a portfolio contributes to both the expected return and the riskiness of the portfolios. However, the returns contribution seems to outweigh the additional risks faced by the investor. It thus offers a high return for its rather high-risk premium and does not move in correlation with other financial securities. With respect to the possible relationship with fixed income instruments, the focus of this study, Claeys et al. (2018) found an inverse relationship between cryptocurrencies and fixed income securities. This corroborates the results of a study by VALK, an institutional investment platform, which shows that fund managers favour cryptocurrencies and digital assets as concerns over poor valuations and yields in the fixed income market grows. Relatedly, Kim (2022) identified the cryptocurrencies market pass through to other markets coming from the commodities backed-stable coins. This study shows that an increase in the issuance of major stablecoins (Tether and USD Coin) on a given day in the US increases commercial paper issuance quantity while decreasing the yields on both commercial paper yield and Treasury yield. The transmission follows the

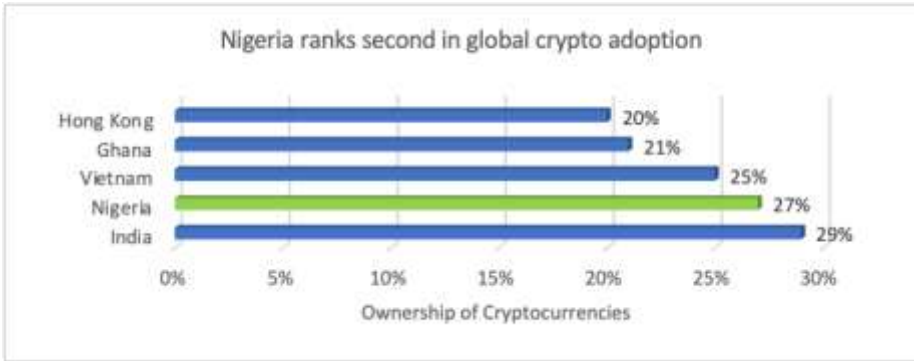
issuance of stablecoin creating excess demand for commercial paper which increases the issuance amount while inducing yields to drop in response to the interplay of the forces of demand and supply.

The literature on the subject while still growing, has attempted to situate bitcoin within the context of its viability as an investible asset, and or its impact on other assets in a portfolio. Though the direction of causality with respect to a relationship were discussed in the literature, empirical studies on the cryptocurrency-fixed income assets nexus remain scanty.. While Kim, (2022) identified the pass-through coming from the commodity backed stablecoins to the yield of treasury bills with an inverse relationship, and Claeys et al. (2018) showing similar outcome, these are foreign based studies that do not take into cognisance the assets market dynamics in a small open economy such as Nigeria's with its emerging financial market. Hence, this study attempts to determine the possible relationship between cryptocurrencies and fixed income instruments in the Nigerian assets market.

3.0 Trend Analysis of Cryptocurrencies and Fixed Income Assets

There has been a gradual push by investors globally towards cryptocurrencies. Between 2017 and 2021, countries, corporations, and Individuals, stored some of their wealth in cryptocurrencies as it assumes the role of digital gold. Available data from BuyCoins shows that Nigeria is the largest market for bitcoin trading in Africa. The total trading volume in Nigeria across all channels stood at US\$200.00 million per month (BuyCoins, 2021).

Figure 13.1: Relative share of cryptocurrencies adoption in 26 countries

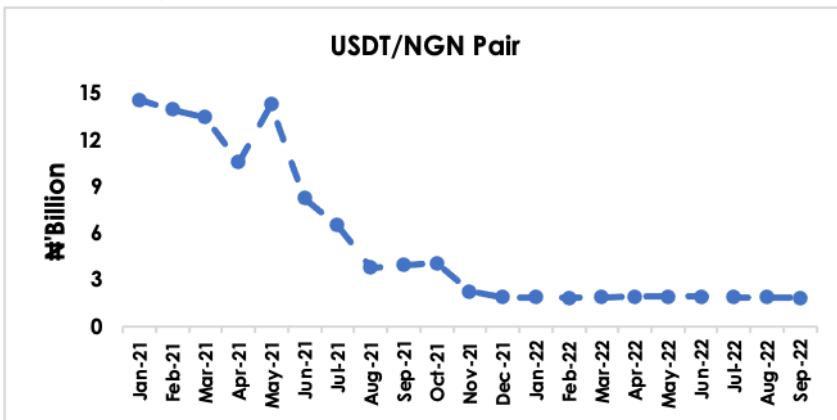


Source: Finder.com/Staff computation

Finder's Cryptocurrency Adoption Index measures the growth of Cryptocurrencies Worldwide through an ongoing survey of internet users in 26 countries.

Finder.com (2021) revealed that about 32.0 per cent of Nigerians surveyed had owned or used cryptocurrencies at some point and approximately 27.0 per cent of Nigerians hold cryptocurrencies as an asset class. Figure 13.1 represents the percentage of surveyed internet users that hold a type of cryptocurrency in 26 countries. The bulk of these selected countries are emerging economies that are driving the integration of cryptocurrencies in the world.

Figure 13.2: Value of Trades on the USDT/NGN Pair

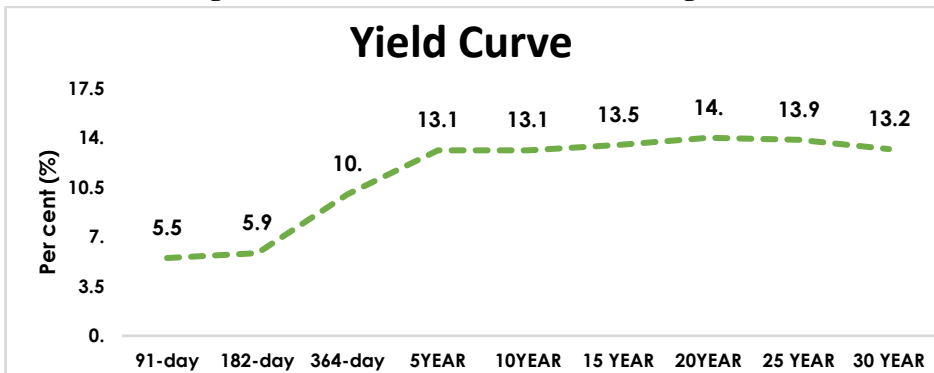


Source: Binance/Staff computation

Figure 13.2 is an illustration of strong bullish sentiments by Nigerians towards investment in cryptocurrencies. The USDT is a stablecoin that mirrors the US dollar and is backed 100 per cent by actual assets in the Tether platform reserves (crypto.com). The chart depicts the risk appetite of investors in Nigeria for Bitcoin relative to stablecoins. The USDT/NGN exemplifies increased trading activities, as it recorded a high of ₦14.35 billion in May 2021, but fell to ₦1.12 billion in February 2022, the lowest it recorded thus far in 2022. Though, there was a marginal increase in the USDT/NGN pair (March and April 2022), the hike in the monetary policy rate (MPR) from 11.5 per cent to 13.0 per cent in May 2022, and further to 14.0 per cent in July 2022 was associated with the 21.7 per cent fall in the value of bitcoin investments in Nigeria within the same period (Coinbase, 2022).

Similarly, Figure 13.3 details the direction of the yield curve in Nigeria. This covers the scope of both the money and capital markets, ranging from over 5.0 per cent to over 13.0 per cent (from 91-day treasury bill to the 30-year bond). Consequently, the yield curve in Nigeria is normal which is illustrated by the steep rise across the different tenors and maturities. The yield curve helps to determine the current and future strength of the economy.

Figure 13.3: Fixed Income Market in Nigeria



Source: CBN Quarterly Statistical Bulletin | Staff Computation

The trend in the yield curve above further explains how well investors, economic agents and portfolio managers are responding to periods of economic

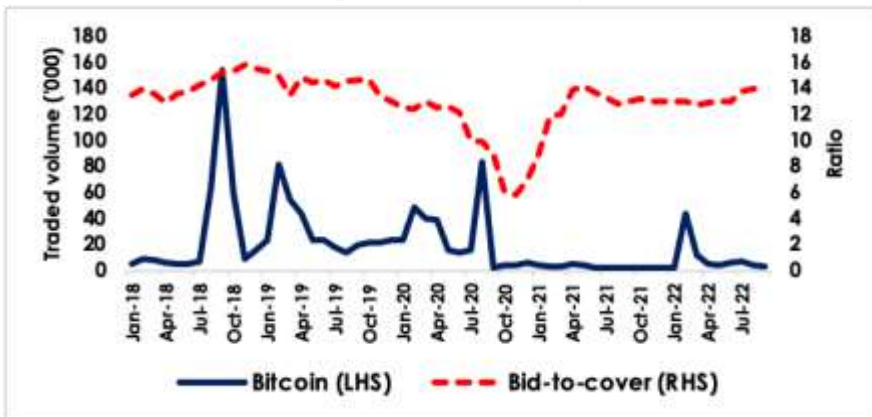
growth and inflation expectations in Nigeria. The yield curve is closely watched by economists and investors due, mainly, to its predictive power which provides insights into the state of the economy and the direction of monetary policy (Diebold & Rudebusch, 2013). Consequently, the risk-free rate which is characterised as the longest tenor (30-year bond) was proxied as the fixed income market in Nigeria, mainly, because all short-term nominal rates are transmitted to the long-term nominal rates. For context, the transmission begins from money market instruments to capital market bonds, and due to the normal yield curve in Nigeria, it is inherent and implied that these changes in yields are reflected in the longer tenors.

The yield on the longest tenor (30-year bond), although termed risk-free, still trended below the inflation rate, albeit narrowed the negative real rate of return in Nigeria. The bid-to-cover ratio was constructed to capture the level of demand for the 30-year bond. Consequently, the ratio is an effective measure during an auction which indicates the price at which investors are willing to purchase the security. On the other hand, given the high level of volatility and uncertainty associated with the price of the bitcoin from March 2022 to September 2022 and coupled with the sustained hike in the MPR to combat inflationary pressures, the risk appetite of investors turned adverse towards cryptocurrency relative to fixed income asset class. The demand for fixed income securities grew in response to the uptick of yields that grew consistently with the rise in market interest rates. This lays credence to the existence of an inverse relationship between the cryptocurrency market and the fixed income market.

Following the 285th Monetary Policy Committee (MPC) Meeting that held in May 2022, which raised the Monetary Policy Rate (MPR) to 13.0 per cent from 11.5 per cent in the preceding Meeting, the 30-year bond moved in tandem and witnessed an uptick, with the tenor moving northwards over the 13.5 per cent band in the July 18, 2022, auction. This development was associated with a decline, by 15 per cent, in crypto asset trading volumes in Nigeria in the same period. This is a further indication of the inverse relationship between both asset classes.

Figure 13.4 shows the relationship between fixed income securities and cryptocurrencies in Nigeria. The total subscription and the total amount allotted from January 2018 to September 2022 were analysed in this study. The bid-to-cover ratio was computed to draw meaningful inferences to aid the structure of the fixed income market and recommendations for policy makers in Nigeria.

Figure 13.4: Relationship between Fixed Income Securities and Cryptocurrencies in Nigeria

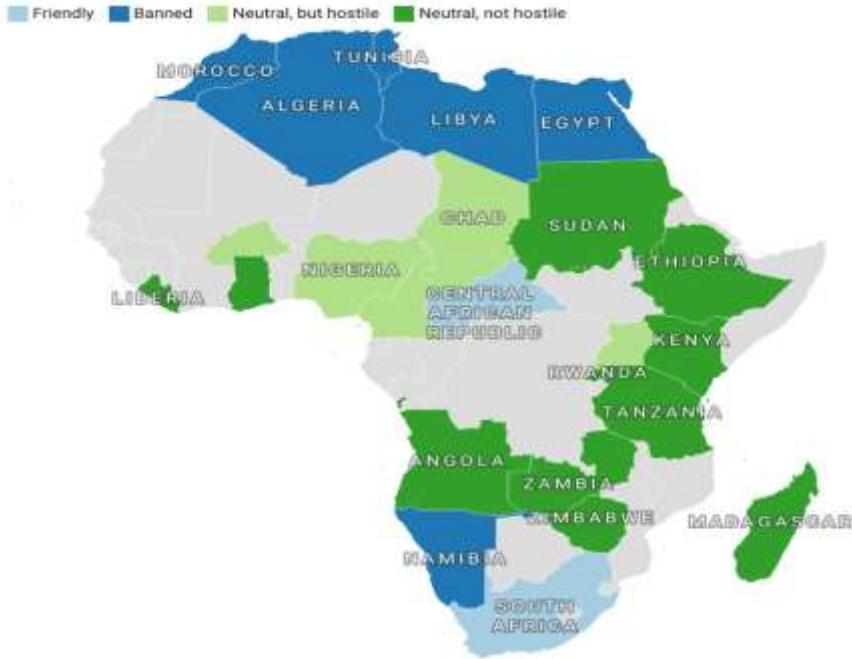


Source: CBN Statistical Database/Coindesk/Staff Computation

In Figure 13.4, the computed bid-to-cover ratio represents the viability of the fixed income market in Nigeria and is computed by dividing the total subscription by total amount allotted in the market. A high ratio indicates a strong demand for security and is generally viewed as a positive sign because it suggests strong investor appetite for the security while a low ratio indicates weak demand and lower prices for the security. The chart further illustrates the negative relationship between the fixed income market and cryptocurrency (Bitcoin). During periods of spike in bitcoin prices, spurred by high trade volumes, the bid-to-cover ratio falls significantly, notably in September 2018, March 2019, December 2019 and December 2020. During periods of rate hikes, investors tend to chase profits leading to higher demand for fixed income securities.

3.1 Jurisdictional Developments on the African Continent

Figure 13.5: Position of Some African Countries towards Cryptocurrencies



Source: Baker McKenzie/Coindesk/Freeman Law/Central Banks Circular/Staff Computation

In sub-Saharan Africa (SSA), some African governments are pro-crypto, while others are anti-crypto. The pro-crypto governments are headlined by the Central African Republic (CAR) which became the second country in the world after El Salvador to recognise Bitcoin as a legal tender. Other pro-crypto countries such as South Africa have recognised crypto investments as taxable sources of income, are referred to as ‘Friendly countries’.

Under the pro-crypto governments, countries that have not recognised cryptocurrencies and discouraged its usage but have not developed any regulations to dissuade its usage are referred to as ‘neutral, but not hostile countries’. For anti-crypto governments, countries outrightly banned

cryptocurrencies (both as an asset class or as a means of payment). This is the case of majority of the North African economies, such as Morocco, Algeria, and Tunisia. The other group of anti-crypto governments, are countries that have not banned cryptocurrencies but have passed regulations that limits its trade, are referred to as ‘neutral, but hostile countries’.

‘Friendly countries’ such as the Central African Republic (CAR) became the first country in Africa, and the second in the world after El Salvador in April 2022 to accept bitcoin as a legal tender alongside the CFA Franc. South Africa is in this category with favorable policies towards cryptocurrencies. In April 2018, the South African Revenue Services (SARS) announced that it intended to apply income tax rules to cryptocurrencies, and it expected taxpayers to declare their cryptocurrency gains. The focus of this study is on the investment landscape in Nigeria between cryptocurrencies and the fixed income market. Nigeria is the biggest market for cryptocurrencies in Africa and second in the world. According to Paxful (n.d), at end-December 2020, users in Nigeria received US\$684.00 million for volume traded in cryptocurrencies, this number further rose to US\$2.40 billion at end-May 2021.

Nigeria’s approach towards cryptocurrencies which is classified as ‘neutral, but hostile’, provides an investment environment that dissuades the risk appetite of investors towards bitcoin and other cryptocurrencies and to stimulate investment in the fixed income market, while enhancing the transmission of monetary policy in Nigeria. Ostensibly, this stance made it difficult for the Exchanges (Binance and Luno) operating in Nigeria to collect payments from bank customers since cryptocurrencies are rarely bought using cash. The CBN cited financial safety as the reason for its stance towards cryptocurrencies because the “asset class has become well-suited for conducting many illegal activities including money laundering, terrorism financing, purchase of small arms, light weapons and tax evasion”.

4.0 Discussion of Result and Analysis

4.1 Data Source

The data on the 30-year bond was sourced from the CBN Statistical Database, while the data on the traded volumes of bitcoin were sourced from CoinDesk. The selection of variables was guided by the interaction between both markets and the preference of investors authenticated by the literature. The risk-free rate in the fixed-income market is the 30-year bond, which is the longest tenor in the capital market. It is highly sensitive to policy rate adjustments as investors react to the direction of monetary policy. This transmission in interest rates through monetary policy affects all other short-term rates and then impacts on long-term rates in the financial markets. Thus, the bid-to-cover ratio of the 30-year bond and the traded volumes in bitcoin, which is the highest traded cryptocurrency, are used for the empirical analysis.

4.2 Correlation Analysis

The study employs a simple correlation analysis to ascertain the relationship between investments in cryptocurrencies and the fixed income securities in Nigeria. The bid-to-cover ratio mainly signifies the level of demand for securities in the fixed income market, while the cryptocurrency market was proxied by the volume of trades of bitcoin in Nigeria. For robustness checks, the test for causality for cause-and-effect relationships were observed. It is pertinent to note that causality cannot exist without a form of correlation; however, any correlation does not mean the existence of causality. In addition, causality cannot exist unless the cause happens prior to its effect and moreover it provides statistically significant information about its effect. Consequently, causality between two variables can be proven with the use of the Granger causality test. Y is said to “Granger cause” X if information about the history of Y improves one’s ability to predict the behavior of X, above what can be achieved when only information about the history of X is used for this purpose. Thus, if Y does not Granger cause X, Y is strictly exogenous to X.

Table 13.1: Correlation Analysis

Covariance Analysis: Ordinary		
Sample: 2018M01 2022M09		
Included observations: 57		
Correlation		
Probability	BID-TO-COVER RATIO (30-year bond)	BITCOIN
BID-TO-COVER RATIO (30-year bond)	1	

BITCOIN		-0.05699 1
		0.9664 -----

Source: Authors' computation

The table above presents a correlation analysis between the volume of traded bitcoin and the bid-to-cover ratio of the 30-year bond in the fixed income market in Nigeria. From the result, the linear correlation coefficient is less than zero (0), showing that there exists a negative relationship between both variables. Consequently, the variables take the form of approximately $r_{y,x} = -0.06$, which signifies that both variables have a very weak negative relationship. Accordingly, if the trade volume of bitcoin rises, the bid-to-cover ratio of the 30-year bond will, likely fall and vice-versa.

In terms of the direction, magnitude and significance, the relationship between both variables is negative, though weak. The result of the correlation analysis is in line with the *a priori* expectation of this study, which is a negative relationship between the cryptocurrency market and fixed income market in Nigeria.

Table 13.2: Pairwise Granger causality Tests

Pairwise Hypothesis	Observations	F-statistics	P-value	Decision	Type of Causality
A B	55	1.9725	0.1498	Do not Reject H_0	No causality
B A	55	0.8874	0.4181	Do not Reject H_0	No causality

Key: Alpha (α) = 0.05

Decision rule: Reject H_0 if p-value < 0.05.

↗ = Does not Granger cause.

A = Trade volumes of the bitcoin (Naira million).

B = Bid-to-cover ratio (30-year bond).

From Table 13.2, the p-value is insignificant, that is, greater than the 5 per cent level of significance which infers that no causality exists between cryptocurrencies (bitcoin) and the 30-year bond bid-to-cover ratio. This result is in line with some economic theory and postulations. The intuition is that the market capitalisation of the stock market mirrors the derivation of the market capitalisation of cryptocurrencies (bitcoin). Alam et al. (2017) found that there exists a strong negative significant relationship between interest rates and changes in the share price of equities. When interest rates rise, there will be significant changes in portfolio shifts from equities to the fixed income market.

5.0 Summary and Conclusion

The paper investigated the relationship between cryptocurrencies and the fixed income market in Nigeria. Relevant literature was reviewed to establish the existing gap in the literature. To answer the objective of this study, the trend analysis, correlation analysis and Granger causality tests were evaluated to capture developments and make inferences between both variables in the study. The trend analysis, correlation analysis and Granger causality tests were carried out using data that covered the 2018M01 to 2022M09 sample period.

The results from the correlation analysis show that there exists an inverse relationship between cryptocurrencies and the fixed income market in Nigeria.

This means that, on the average, a rise in the volume of trade in the cryptocurrency market is associated with a fall in the bid-to-cover ratio of the 30-year bond by 0.06 per cent. This is also in line with the trend analysis that illustrated the inverse correlation between both asset classes. The long spikes in the trade volumes of Bitcoin were associated with significant declines in the bid-to-cover ratio of the 30-year bond. The results were in line with the *a priori* expectations. Consequently, robustness checks were carried out using the Granger causality test, which showed that there exists no causality between both variables.

Considering the empirical evidence obtained, it is recommended that for a 'neutral, but hostile' economy towards cryptocurrency, such as Nigeria, higher yields on fixed income securities could be useful in reducing the appetite for investment in crypto assets while encouraging investment in the fixed income segment. This is due to the ban placed by most of the emerging economies in North Africa (Morocco, Algeria, Tunisia, Egypt) on trading cryptocurrencies and accepting it as a legal means of payment, a possible explanation for the relative stability of their economies. The CBN should learn from the experiences of these countries, to further enhance a less volatile and relatively more stable Nigerian economy. Thus, the negative relationship between both asset classes should provide the direction for the CBN and the Debt Management Office (DMO) in exploring ways to deepen the fixed income market to accommodate more instruments while promoting investment in that market.

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CHAPTER FOURTEEN: REGULATING FINTECH IN A DEVELOPING ECONOMY: LESSONS FROM JURISDICTIONAL EXPERIENCES FOR NIGERIA

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Abstract

This study examines approaches to FinTech regulation. It considers the development of FinTech, its pervasiveness in the offering of financial services and the motivation for regulators to protect market operators and users. The analysis of jurisdictional experiences from Singapore, Brazil and Kenya and a synopsis of regulatory frameworks, issues and challenges, provides lessons for Nigeria. We find that there is no single approach for Fintech regulation, rather, the policy objectives, socio-economic conditions, extant legal structure, and level of development of the ecosystem determine the frameworks designed and implemented in regulating Fintech across jurisdictions.

Keywords: FinTech, payments, financial services, financial regulation

JEL Classifications: G18, G23, E58, 033

1.0 Introduction

Innovation in Financial Technology (FinTech) is fast shifting the paradigm in the financial services and products, leading to a rethink on the scope, form, nature, and future of financial regulations. In recent years, the financial sector has seen accelerated growth in the adoption of FinTech and financial institutions (FIs) are fast adapting to it, reflecting their expectations for significant change in the industry. The change brought about by FinTech is disruptive as it has demonstrated the potential to lower barriers of entry into the financial services market and elevate the role of data as a key commodity and drive the emergence of new business models. Thus, the scope and nature of FIs' risks and activities are rapidly changing and the rules governing them need to evolve as well. This underscores the need for regulations to evolve to cover new activities and business models that have been brought about by FinTech, which is changing the financial services value chain and transforming the entire financial ecosystem.

Although digital disruption is not new, the impact of FinTech on the financial services industry is different, due mainly to the macroeconomic impact it has on financial integrity and stability. More so, the challenges it poses for regulators and policymakers, including lack of reliable data and unconventional business models, the potential legal amendments that might be required and the bearing on consumer protection. This makes it very important that as policymakers foster an enabling environment, the appropriateness of the financial sector policy framework and the potential risks to statutory objectives are monitored closely and mitigated.

Against the foregoing background, analysing the regulatory approaches of FinTech is paramount for policy makers towards market monitoring and setting operating guidelines, licensing requirements, monetary and macroprudential policies. Therefore, the objective of this paper is to draw lessons for the regulation of FinTech in Nigeria from jurisdictional experiences. The contribution of the paper is mainly in providing a focus on FinTech regulation for Nigeria by reviewing the jurisdictional experiences of other economies.

Following the introduction, Section two provides a review of conceptual issues in Fintech. Section three examines the jurisdictional experiences, the Nigerian experience and the lessons drawn for Nigeria. The regulatory policy options in Fintech for developing countries is discussed in Section four. Section five x-rays the issues and challenges, while Section six concludes the paper.

2.0 Review of Conceptual Issues

2.1 Concept of FinTech

The exact definition of FinTech has remained ambiguous, and as such there does not appear to be a consensus on its definition. Literarily, FinTech is used to describe new technology that seeks to improve and automate the delivery and use of financial services. (Gabor & Brooks, 2017) defined FinTech as companies that use modern technologies to run a business model in the financial services industry, whereas others use the term to refer to the entire industry (Kim et al., 2016). The Financial Stability Board (FSB) explains FinTech as “technology-enabled innovation in financial services that could

result in new business models, applications, processes or products with an associated material effect on the provision of financial services” (FSB, 2019).

Generally, FinTech is utilised to help companies, business owners and consumers better manage their financial operations, processes, and lives, by utilising specialised software and algorithms that are used on computers and, increasingly, smartphones. FinTech usually references an organisation where financial services are delivered through a better experience using digital technologies to reduce cost, increase revenue and remove friction like barriers to access for users in underserved areas. It also refers to any business that uses technology to enhance or automate financial services and processes. Generally, the term covers a broad and rapidly growing industry serving both consumers and businesses.

Globally, the adoption of FinTech in the financial system comprises of traditional applications such as, back end operations for banks, information and data storage and processing infrastructure, Automated Teller Machines (ATMs) and credit cards, to more disruptive and innovative applications like blockchain, peer-to-peer lending, cryptocurrency, agent banking, mobile money, payments processing, microfinance and lending, digital banks, the use of machine learning algorithms, and data science to perform all tasks from processing credit risks to running hedge funds.

FinTech companies operate mainly in digital financing, investments, financial advisory (Robo-advisors) and digital money (Cryptocurrencies and online payments). FinTech firms also adopt a variety of technologies like, blockchain technology, big data analytics, Internet of Things (IoT), cloud computing, artificial intelligence (AI), robotics and social media networks to enable their financial activities. Similarly, cybersecurity infrastructure, intuitive user interfaces, and mobile device technologies are all important for enabling the deployment of FinTech solutions (Gomber et al., 2017).

2. Concept of RegTech

Financial regulation is derived from the need to provide protection for investors and other users of the financial system, financial stability, market efficiency, competition and the prevention of financial crime (Idris et al., 2017). In practice, these goals are achieved through specific mandatory legal and reporting requirements imposed on financial institutions.

The increased and rapid pace of digitalisation of financial services has, however, necessitated the use of technology to streamline the regulatory process in financial services. Additionally, the increasingly complex regulatory environment and data landscape, has created the need to find more efficient ways for financial institutions to comply with regulatory requirements., especially considered against the background that regulatory technology accelerates the capacity of regulators to tackle new types of financial crime and enforce changing regulatory rules.

RegTech is a subset of FinTech that uses innovative and integrated technology to facilitate the delivery of regulatory requirements more effectively and efficiently than existing capabilities (FCA, 2021). It provides automated solutions for monitoring, reporting, and analysing regulatory requirements, thereby significantly reducing costs, and improving productivity (Papantoniou, 2022). Beyond automation, RegTech empowers organisations with the tools required to drive efficiency and sustainability in their regulatory compliance functions and provides increased transparency between market participants and regulators, drive standardisation, and continue to deliver value to shareholders.

Financial service providers are required to comply with a myriad of regulations and reporting standards. As the business and operating models evolve, these standards and the means of implementing them also require upgrades. Hence, these organisations invest a significant amount of time and money in the compliance space to safeguard against audit, regulatory and reputational risks. RegTech offers these financial institutions the opportunity to enhance their regulatory environment through the implementation of technologies, including report automation tools, visual analytics for identifying patterns and

developing actionable insights, robotic process automation (RPA) to reduce the time and efforts required to execute examination, evaluation and reporting functions, next-generation data architecture and business process management (BPM) (Ernst & Young, 2019).

The benefits of RegTech to both operators and regulators cut across different spheres of the regulatory landscape. RegTech solutions ensure compliance whilst reducing the risk of regulatory breaches, fines, and reputational damage by working more accurately and efficiently. RegTech solutions have also been deployed by financial institutions to achieve compliance with the General Data Protection Regulation (GDPR). GDPR is regarded as one of the strictest privacy and security laws globally by mandating a stringent standard for personal data protection (Ben, 2020). The GDPR is a regulation that requires businesses to protect the personal data and privacy of EU citizens for transactions that occur within EU member states. It became effective in May 2018 among all member countries of the European Union. It was designed to "harmonise" data privacy laws across all of its member countries as well as providing greater protection and rights to individuals. Nigeria domesticated the GDPR through the Nigeria Data Protection Regulation (NDPR) 2019 which applies to all transactions intended for the processing of personal data, and to the processing of personal data notwithstanding how the data processing is conducted or intended to be conducted in respect of natural persons in Nigeria. Moreover, RegTech solutions providing visual analytics have the capability to perform trend analysis, sensitivity analysis, scenario analysis, anomaly detection, early warning, and predictive modelling across various durations.

2.3 Concept of Regulatory Sandbox

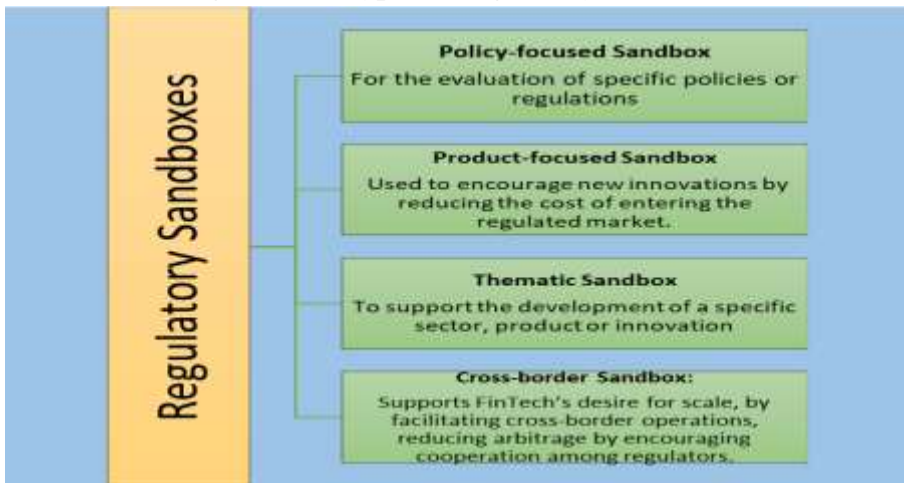
The regulatory sandbox is one of the regulator's responses to innovations in the digital finance space. It focuses primarily on promoting Fintech, while addressing financial stability risks. The idea of a regulatory sandbox is relatively new. First launched in 2016 by Project Innovate, UK, global regulatory sandboxes have increased to over 73 by November 2020. In Africa, Nigeria is among the forerunners, with the Central Bank of Nigeria's

introduction of a regulatory framework for sandbox operation in the Nigerian banking system.

Technically, a regulatory sandbox is defined as ‘a controlled, time-bound, live testing environment, which may feature regulatory waivers at regulators’ discretion’ (World Bank, 2020). It is also described as a virtual environment for testing new, innovative products, service delivery channels or business models under regulatory guidance and supervision.

Since no one-size-fits-all approach exists for implementing a regulatory sandbox, several types of sandboxes have emerged over the past years, each with unique traits and attributes. Sandboxes are classified by objectives into four: policy-focused, product or innovation focused, thematic, and cross-border. Some sandboxes can be a combination of the different types.

Figure 14.1: Types of Regulatory Sandboxes.



Source: Author's illustration

2.4 Open Banking

Open banking has emerged strongly in the past few years as a system to give customers the right to share with parties they trust the information that banks have about them in a secure manner and to open processes and services in

banking. The main objectives pursued by regulatory frameworks of open banking are generally encouraging innovation and fostering competition, resulting in new products and services at competitive prices to the benefit of consumers (World Bank, 2022).

Regulators choose a variety of approaches to open banking. Usually, the differences are along the scope of data that is to be shared, the definition of the financial institutions that must publish their application programming interfaces (APIs)- a software intermediary that allows two applications or systems to communicate and share messages- and share data, the mandatory or voluntary nature of the framework, the definition of the type of license that third-party providers need to operate, and the definition of concrete standards, among other things. While there is no single right approach, there are common challenges that countries considering open banking regulation certainly need to bear in mind in terms of the definition and interoperability of technical standards. These are security, governance, consent and authentication mechanisms.

Generally, regulations are encouraging the use of APIs as a more secure and reliable practice. Some jurisdictions, like Mexico have taken a prescriptive approach, requiring banks to share customer-permissioned data, and requiring third parties that want to access such data to register with regulatory or supervisory authorities. Other jurisdictions like Singapore and Japan have taken a facilitative approach, issued guidance and recommended standards and releasing open API standards and technical specifications. The US, and other jurisdictions such as Sweden, the UK follow a market-driven approach, having no explicit rules or guidance that requires or prohibits banks from sharing customer permissioned data with third parties. The frameworks created vary across countries in terms of stage of development, approach, and scope (Deloitte, 2019).

Open banking regulations are still in the early stages, with the earliest issued around 2018, therefore making it still very early to draw substantial lessons. The regulation is based on the principles of financial inclusion and innovation,

the promotion of competition, consumer protection, the preservation of financial stability, the prevention of illegal operations, and technological neutrality within the financial system.

3. Jurisdictional and Nigerian Experiences in Fintech Regulation

The policy objectives, socio-economic conditions, extant legal structure, and level of development of the ecosystem determine the frameworks for regulating Fintech across jurisdictions. Nigeria has performed commendably in regulating fintech. However, there exists an opportunity for improvement. Hence, we set out to draw lessons for Nigeria by examining approaches to Fintech Regulation from Singapore, Brazil, and Kenya as they are high performing fintech ecosystems across Asia, South America, and Africa. Singapore and Brazil have consistently ranked in the top 10 of Fintech development over the past 5 years (Findexable, 2022). While Kenya's strides in mobile money and improving financial inclusion have gained global acclaim. Financial inclusion in Kenya grew from 26 per cent in 2006 to 83 per cent in 2021 (Chitavi et al., 2021). Therefore, the countries above provide viable jurisdictions from which lessons on Fintech regulation that protects market participants and promotes innovation can be garnered and applied.

3.1. Singapore

Fintech regulation in Singapore is coordinated by the Monetary Authority of Singapore (MAS). The MAS leverages its existing "balanced" approach in promoting financial development and ensuring a safe and sound financial sector, and in sync with its objective to harness technology to improve the efficiency of the financial markets (Fan, 2018).

Singapore does not have a specific license framework for Fintech companies. Fintech companies must acquire the right licenses that match their business models, while certain Fintech business models require multiple licenses based on the service(s) they offer.

FinTech firms are mainly financial institutions, primarily regulated by the Monetary Authority of Singapore (MAS), but recent trends include the rise of non-financial tech players in the Fintech space which requires collaboration between the MAS and other regulators.

In line with its vision as a hub for global trade and finance, Singapore has undertaken several initiatives to create a financial ecosystem to facilitate the digitalisation of its economy and the development of Fintech. The MAS has a key task of fostering Fintech innovation and making Singapore an international hub for Fintech in line with the country's overall ambition of being a Smart Nation (Strait Times, 2014).

In July 2015, the MAS set up the FinTech & Innovation Group (FTIG) as its specialised FinTech office within its organisational structure and appointed a Chief FinTech Officer to head the FTIG, to serve as a primary point of coordination for its initiatives, particularly the development of FinTech-related regulatory policies and the mobilisation of the use of technological innovations in the financial industry (Rajah & Tann, 2016). The FTIG has five divisions, each with a clear focus on a specific segment of the Fintech ecosystem:

- The Payments Development and Data Connectivity Office (PDDC), responsible for developing the Singapore payments ecosystem, as well as cross-border data connectivity for financial services;
- FinTech Infrastructure Office (FIO), FIO is responsible for regulatory policies and strategies for developing safe and efficient technology enabled infrastructure for the financial sector, in areas such as cloud computing, big data, and distributed ledgers;
- FinTech Ecosystem Office (FEO), which scans the horizon for cutting-edge technologies with potential application to the financial industry and works with the industry and relevant parties to test-bed innovative new solutions;
- AI Development Office (AID), develops and implements AI Strategy for the Singapore financial industry, facilitates national wide AI projects and builds up AI finance ecosystem in Singapore; and

- Green FinTech Office (GFO), spearheads MAS' efforts to harness technology and data to enable sustainable finance.

In 2016 MAS launched the Fintech Regulatory sandbox. According to the guidelines, the applicant can be a financial institution, a FinTech firm, professional services firm partnering with or providing support to such businesses or any interested company that can experiment with innovative financial services in a production environment, but within a clearly defined space and duration. The emphasis is on the use of innovative technologies to provide financial services that are regulated or may be regulated by MAS (MAS, 2017).

Singapore's Sandbox takes a more innovator-centred approach than the UK model by lowering barriers to entry and has a greater emphasis on industry benefits. This is corroborated by entrepreneurs of Fintech startups, who admitted its highly practical benefits. The Sandbox entities (applicants accepted into the Sandbox) are freed from the administrative and financial burdens imposed under an ordinary compliance process; they are also entitled to a broader testing ground (whereas licensed operators may reach out only to a limited group of clients) which is crucial for refining their core technologies.

Additionally, to complement the current regulatory sandbox, the sandbox express was launched in 2019. The sandbox express, at the first stage, covers the following activities regulated by MAS: carrying on business as an insurance broker; establishing or operating an organised market; and remittance business (MAS, 2019).

Furthermore, in June 2021, the MAS established the Financial Sector Technology and Innovation (FSTI) Proof of Concept (POC) scheme, that provides funding support for experimentation, development, and dissemination of nascent innovative technologies in the financial services sector, two types of companies are eligible for application: a financial institution with MAS licence within banking, capital market, financial advisory, insurance and money changing & remittance businesses; and a technology or solution

provider (artificial intelligence, APIs, blockchain/distributed ledger technology (DLT), cloud, cybersecurity, digital ID & e-KYC and RegTech) with at least one financial institution that is licensed as a partner (MAS, 2018).

In recognition of the importance of RegTech within the fintech regulatory landscape, Singapore has promulgated various RegTech initiatives, including Know-Your-Customer (“KYC”) Utility and Supervisory Technology (“SupTech”). To better inform and implement these far-reaching initiatives, MAS organises RegTech-Financial-Institution dialogues, which are regular closed-door dialogues allowing for mutual knowledge sharing between operators and regulators. The MAS can leverage such interactions to better recognise financial institutions’ pain points and needs, so that initiatives can be designed to address real needs, and financial institutions can at the same time better understand and support the MAS’ regulatory objectives.

Regarding KYC Utility, MAS is currently liaising with various local and foreign banks to explore setting up a shared-service platform of KYC operations using the “MyInfo platform”. This was an outcome of the MAS’ observations of the duplication of functions and inefficiencies stemming from the banks’ use of individual platforms. The integrated platform is expected to harmonise the KYC policy requirements across banks and entrench significant systemic efficiencies. Relatedly, Singapore is making plans for solving the problem of identity verification in the financial industry by building a National Digital Identity (“NDI”), scheme. This is an initiative which allows every resident of Singapore to establish his legal identity in a secure manner when making online transactions. This process is secured using two-factor authentication and a public-private key pair and is built on the existing Singapore Personal Access (SingPass) system (MAS, 2017).

Moreover, to buttress its capacity for cross-border regulations, given the borderless nature of digital financial services, the Singapore government is actively cooperating at the international level with the authorities and regulatory bodies of other countries, both at the global level, in which it is a member of the Global Financial Innovation Network (“GFIN”), and at the

regional level, as a member of the Association of Southeast Asian Nations-ASEAN Financial Innovation Network (AFIN).

With research and development being a key component of financial innovation, the MAS launched a US\$27.00 million grant scheme in 2017 with the objective of supporting R&D in artificial intelligence and data analytics for the financial sector. This scheme has since received more than 30 applications from financial and research institutions. Furthermore, MAS has begun collaborating with MIT Media Lab for the purposes of Fintech R&D, and the Intellectual Property Office of Singapore has established a Fintech Fast Track initiative for patents, potentially shortening the timeline for patent applications to six months, where the industry convention is about two years (MAS, 2017).

These regulatory efforts have generated tangible results, with Singapore attracting the most funding for Fintech within ASEAN region in 2021. As of end-November 2021, Singapore had attracted almost half (49.0 per cent) of the total US\$3.50 billion raised by ASEAN Fintech companies, amounting to US\$1.60 billion in funding.

3.2. Brazil

In Brazil, Fintech products and services involving payments (the issuance of pre-paid cards and credit cards, acquiring services, etc) and lending are subject to the rules issued by the National Monetary Council (CMN) and the Central Bank of Brazil (BCB), whereas those regarding securities, such as crowdfunding, are subject to the regulatory framework issued by the Securities and Exchange Commission (CVM).

A key initiative by the Central Bank of Brazil in Fintech regulation was the enactment of Law No. 12,865 on October 9, 2013 (passed by Parliament) as the legal framework for payment services in Brazil. By this law, a licence is required (either prior to commencing the relevant activities or upon reaching specific operational thresholds, as applicable) if the fintech company executes the following types of payment services:

- issuance of electronic money and associated services, such as issuance of prepaid instruments, management (prior approval if the commencement of payment activities occurred after 1 March 2021);
- issuance of post-paid payment instruments (such as credit cards) (approval after reaching applicable threshold); and
- acquiring services (approval after reaching applicable threshold) and payment transaction initiation services (prior approval).

Another significant regulation in the context of Fintech development was the enactment of SFN, Resolution no. 4,480, of the Central Bank of Brazil, regulated by the National Monetary Council (CMN), in April 2016, which allowed Brazilians to open a checking account and savings account via the Internet. This move launched a new competitive landscape, taking the banks from a traditional performance and imposed a more aggressive performance requirement due to the efficiency of Fintech Startups (Godinho, 2021).

Furthermore, the CMN Resolution 4,656/2018 by the BCB was established as a response to the rise in peer-to-peer lending activities which circumvented the traditional bank-led credit creation model. The regulation provides for the direct credit company and the peer-to-peer loan company, regulates the peer-to-peer loan and financing operations, and establishes requirements and procedures for license approval, transfer of corporate control, restructuring and license revocation of the institutions mentioned therein (Banco Central de Brasil, 2020a).

In May 2018, BCB launched the Financial and Technological Innovations Lab (Lift)-a virtual environment that allows the collaboration between the academia, the market, technology enterprises and startups aimed at developing technological innovation, sharing knowledge, and evaluating the projects' results (Banco Central de Brasil, 2020a).

To foster international collaboration the BCB has been a consistent participant in initiatives by international fora, including the Financial Stability Board (FSB); the International Organization of Securities Commissions (IOSCO), the

International Monetary Fund (IMF), and the Committee on Payments and Market Infrastructures (CPMI) and the Basel Committee on Banking Supervision (BCBS) - both under the Bank for International Settlements (BIS).

The BCB's Regulatory Sandbox was established in 2020 as an environment where the Banco Central de? Brasil (BCB) licenses, for a certain period, entities to test innovative projects, while they observe a specific set of regulatory provisions that supports the controlled and delimited execution of their activities. The BCB and the National Monetary Council (CMN) regulates the BCB's Regulatory Sandbox, of which the overarching principles are set by BCB Resolution No. 29/2020.

Accordingly, the participants licensed to operate in the BCB Sandbox must carry out their transactions with integrity, reliability, security, and confidentiality, and implement a structure for the risk management of the project under test. The entities participating in the BCB Sandbox must comply with the legislation and regulation on Anti-Money Laundering and Terrorist Financing (AML/CFT), as well as with the BCB rules for handling complaints from their customers and users.

In response to movement restrictions due to lockdowns occasioned by the Covid-19 pandemic, which restricted the capacity of businesses and individuals to access banking services, especially payments, the Banco Central de? Brasil (BCB) created Pix, the Brazilian Instant Payment scheme that enables its users (people, companies and governmental entities) send or receive payment transfers in few seconds at any time, including non-business days (Banco Central de Brasil, 2020b). In addition to increasing convenience for the users making payments, Pix promotes:

- Lower financial costs, increased security, and improved customer experience;
- Digitization of the retail payments market;
- Higher market competition and efficiency;
- Financial inclusion; and

- Gap-filling of retail payment instruments available to the population.

These developments have helped Brazil maintain its position as a leading Fintech ecosystem with Sao Paulo ranked as the fourth (4th) most developed city for Fintech activities globally (The Global Fintech Index, 2021).

3.3 Kenya

Kenya has consistently maintained its position as one of the world leaders in mobile money and home to perhaps the most well-known example of Fintech-based financial inclusion firm?, M-Pesa. M-Pesa is a money transfer service established in 2017 by Safaricom (a telecommunications company), which functions much like a limited mobile bank but without the need for an internet connection. M-Pesa combines Safaricom's mobile infrastructure with an agent model; Safaricom stores their balance and customers can go to one of 110,000 agents throughout the country to conduct transactions in person.

The whole system runs on technology like text messaging and has expanded to seven countries. These initiatives, backed by others, such as Equity Bank's Equitel have vastly expanded financial inclusion in the country. While financial inclusion in Kenya was put at just 26.0 per cent in 2006, it has risen significantly to 83.0 per cent of the adult population as at end-2020. This proportion has access to at least basic financial services and the share of adult population in the state with a mobile money account is close to 85.0 per cent (Chitavi et al., 2021).

The Central Bank of Kenya (KCB) supported the development of this ecosystem by striking the right regulatory balance at an early phase of development. In 2009, the Bank ruled that digital payment services were not banking services, allowing for a lighter regulatory touch that helped prevent the burgeoning service from being tied down by burdensome regulations (Mwega, 2014). Eliminating confusion about the legal status of service and under what conditions it could operate, gave confidence to users, partners and provided the enabling environment for the initiative to grow unencumbered.

The Kenyan Capital Markets Authority launched its Regulatory Sandbox in 2019 as a tailored regulatory environment that allows for the live testing of innovative capital market related products, solutions, and services to deepen and develop the capital market. The live testing is conducted under a less onerous regulatory regime and is expected to attract fintech companies and existing capital market intermediaries seeking to add value through the application of technology to financial services among other innovations. Activities by participants are governed by the Regulatory Sandbox Policy Guidance Note (PGN), 2019 which provides the legal framework for its establishment (CMA, 2020).

To promote the highest standards in consumer protection within the digital economy, the Kenyan government established the Data Protection Act (2019) – modelled on the EU’s GDPR- which sets out restrictions on how personally identifiable data obtained by firms and government entities could be handled, stored, and shared. It stated that Data controllers and processors must be registered with relevant regulators in their sectors of operation. Furthermore, the office of the Data Commissioner was established, and the first Data Commissioner was appointed in November 2020.

The National Payment System Act (NPSA, 2011) and Regulations (NPSR, 2014), set out licensing requirements for Payments Solutions Providers (PSPs) and for AML measures for PSPs and their agents, including cash merchants, who are also required to comply with the Crime and Anti-Money Laundering Act, 2009 and the Prevention of Terrorism Act, 2012 (Catalyst Fund, 2021). The scope of services under the NPSA, 2011 and NPSR, 2014 include: sending, receiving, storing or processing payments, or provision of other services in relation to payment services through any electronic system; ownership, possession operation, management, or control of a public switched network for the provision of payment services; and the processing or storage of data on behalf of such payment service providers or users of such payment services.

Moreover, to address challenges relating to the proliferation of unlicensed and unregulated financial services and products, six regulators issued a joint public

notice in 2018, highlighting the risk of unregulated mobile lenders. Following the notice, the Kenyan government warned the public against dealing with digital credit providers. In addition, in April 2020, the CBK banned unregulated digital and credit-only lenders from submitting names of loan defaulters for blacklisting at the Credit Reference Bureaus (CRB). This also introduced a minimum threshold of KES1,000 (US\$9.00) for negative credit information that is submitted to CRBs by lenders. The CBK has also announced plans to implement further regulations on digital credit, including provisions governing the interest rates charged for digital lenders' loans and requiring prior approval of the launch of new products or the increase of interest rates by online lenders.

The Central Bank of Kenya has consistently implemented policies that allow non-bank financial service providers ease of entry into the market, thereby encouraging innovation, while promoting financial stability which led to increased financial inclusion (Murgor, 2021).

3.4 The Nigerian Experience

Fintech in Nigeria has evolved significantly from the adoption of information technology solutions for back-end operations of commercial banks in the late 1980s. This period was characterised by the introduction of more cogent regulations into the banking system and an attendant need for better management and operation practices. Most technology solutions used by Nigerian banks within this period were imported from Indian and American Service providers like SAP Banking, NCR, among others. However, Nigerian companies began developing technology solutions for banking and financial services in the early 1990s.

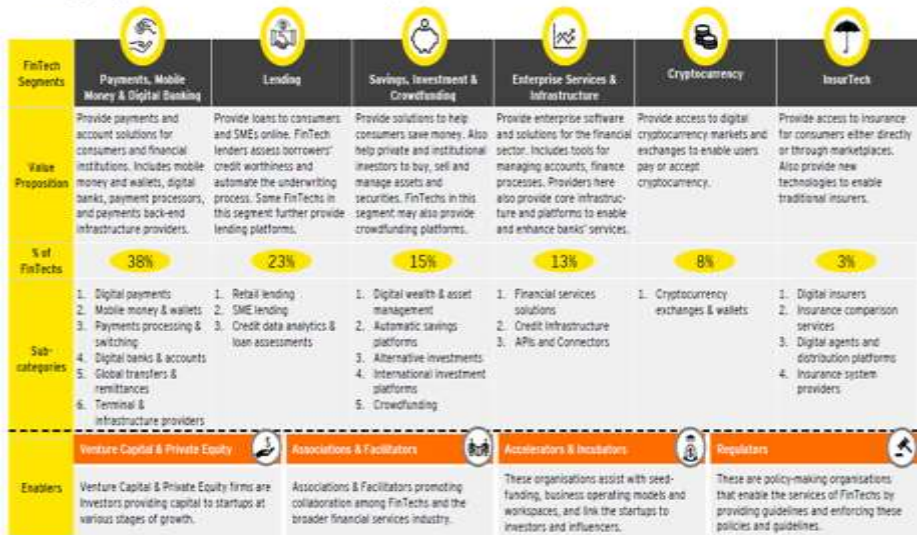
The Nigerian Inter-Bank Settlement System (NIBSS) Plc was incorporated in 1993 to provide infrastructure for handling inter-bank payments. SystemSpecs and Unified Payment Services Limited founded in 1992 and 1993 respectively offered infrastructure for payments for the banking community in Nigeria. Interswitch and eTranzact founded in the early 2000s delivered multi-application, multi-channel electronic transaction switching and payment

processing platforms to banks and other financial services providers. From these early days, significant growth has led to the current landscape dominated by a plethora of Startups offering a wide range of financial services from payments processing to cryptocurrencies and wealth management.

From the sparse landscape of the late 1990s and early 2000s the fintech industry in Nigeria has blossomed into a vibrant ecosystem spurred by positive payments and financial system policies of the central bank and an influx of venture capital. The current landscape of the Nigerian fintech industry is illustrated in Figure 14.2 below.

Figure 14.2: Structure of Nigerian Fintech Market

There are six broad FinTech segments supported by an ecosystem of enablers; Payments, Mobile Money and Lending jointly constitute c.60% of the FinTech population



Source: Ernst & Young (2021).

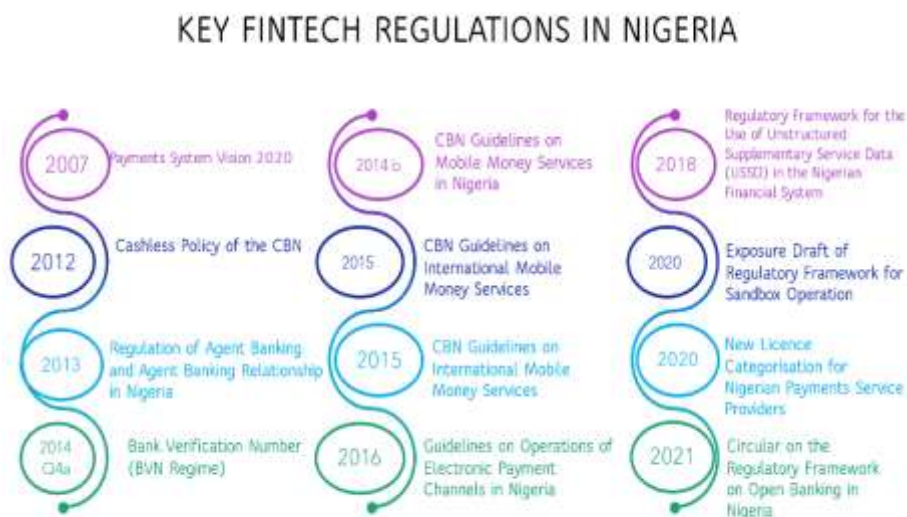
The growth of Fintech in Nigeria has been driven by some key factors. One of the main driving forces behind the rise of Fintech in Nigeria is the need for financial inclusion (Tonuchi, 2020). Data from the Central Bank of Nigeria and EFINA reveal that financial inclusion stood at 64.1 per cent in 2020 (below the 80.0 per cent target) but a slight increase from 63.2 percent in 2018. However,

the current financial exclusion rate of 35.9 per cent in the country is an indication that significant progress has been made having declined from 46.3 per cent in 2010 (EFInA, 2021).

Access to financial products and services is a prerequisite for achieving financial inclusion and fintech offers access and usage of financial services to underserved segments of the population. Fintech delivers a platform for a wide range of innovative services that ensure the simplicity and convenience of all financial procedures, such as turning investments into crowdfunding, making microcredit available to the informal economy, etc. By deploying communications technology, and using mobile applications, the barriers to entry, occasioned by the need for users to actively seek physical locations is removed. Moreover, data analytics, algorithms and machine learning models are deployed for KYC and credit rating, thereby eliminating the requirements for cumbersome documentation and identity verification (Andrianaivo & Kpodar, 2012).

As Fintech has experienced tremendous growth in Nigeria, the Central Bank of Nigeria has consistently enacted strategic initiatives and policies in the financial sector to support the growth of innovation and maintain financial system stability. Some of these initiatives and policies include the Payments System Vision 2020 (2007), National Financial Inclusion Strategy (2012, 2018), Cash-less Policy (2012), Framework for Regulatory Sandbox Operations (2018, 2021), Open Banking Initiative (2021), the eNaira-Central Bank Digital Currency project (2021), several guidelines for operations of non-bank financial services providers, among others.

Figure 14.3: Key Regulations Impacting Fintech Development in Nigeria



Source: Author's illustration

These policies and initiatives have created stability, strengthened investor confidence, provided protection for stakeholders, and fostered innovation which has accelerated the development of Fintech. Consequently, Nigerian Fintech startups have become attractive investment propositions to global venture capital firms. Nigerian startups raised US\$1.50 billion of the total US\$4.69 billion raised by African startups. Fintech startups received the bulk of funding in 2021, taking up 62.0 per cent (~US\$2.90 billion) of total funding in African start-ups (Briter Bridges, 2022).

3.5 Lessons for Nigeria

Policymakers, regulators and supervisors worldwide are finding themselves in a regulatory dilemma when trying to achieve the right balance between enabling innovative FinTech and safeguarding the financial system. Policy responses to FinTech seen across jurisdictions can be broadly grouped into: applying existing regulatory frameworks to new innovations and their business models, often by focusing on the underlying economic function rather than the

entity; adjusting existing regulatory frameworks to accommodate new entrants and the re-engineering of existing processes to allow adoption of new technologies; and creating new regulatory frameworks or regulations to include (or prohibit) FinTech activities.

In essence, regulating Fintech requires balancing the stability mandate of monetary authorities with effectively harnessing the welfare enhancing potential of financial innovation. Hence, from the analysis of concepts, regulatory frameworks, and jurisdictional experiences, this paper proposes and recommends some policy options for consideration.

Given the central role of compliance in consumer protection and market integrity, the Bank should strengthen its deployment of regtech solutions for monitoring, reporting and compliance by licensed financial institutions especially Other Financial Institutions (OFIs). This would entrench regulatory reporting and compliance efficiency and safeguard against audit, regulatory and reputational risks which could have negative impact on the financial system. Singapore provides a benchmark as it has promulgated various Regtech initiatives, including Know-Your-Customer (“KYC”) Utility and Supervisory Technology (“SupTech as well as organising Regtech-Financial-Institution dialogues, which are regular closed-door dialogues allowing for mutual knowledge sharing between operators and regulators.

To forestall regulatory arbitrage within the financial sector, the bank should consistently engage and collaborate with other regulators and develop a harmonised approach to regulating innovation within the financial system. This collaborative approach could involve domestic stakeholders (NDIC, SEC, PENCOM, NAICOM etc.) like in the case of Kenya or international and regional collaboration (College of Supervisors of the West African Monetary Zone (CSWAMZ) for instance like Singapore. This is especially relevant because of the borderless nature of Fintech solutions and their models of distribution and user acquisition.

As espoused by Singapore's MAS, through the launch of a US\$27.00 million grant scheme in 2017 with the objective of supporting R&D in AI and data analytics for the financial sector and partnership with MIT Media Lab for the purposes of Fintech R&D, the bank should institute an initiative to support cutting edge research and development in financial innovation in collaboration with local and international educational institutions. The objective being to spur further innovation, propel the bank to the vanguard of financial innovation globally and create an ecosystem that serves the economic growth agenda of government within financial stability considerations. Likewise, capacity development programs for Bank staff to acquire relevant skills required to monitor, evaluate, and analyse Fintech market dynamics and Fintech company operations and business models should be established by the Bank.

Over the years, the Bank has instituted several forward-looking policy measures to guide the development of financial innovation in Nigeria. The bank should, therefore, sustain this approach and incorporate study tours to advanced jurisdictions as a channel for knowledge acquisition on the future of Fintech development and regulation.

4.0. Regulatory Policy Options in Fintech for Developing Economies

To support the development of an appropriate legal, regulatory, and supervisory framework around policy responses, countries have been exploring different regulatory approaches and initiatives to promote innovation and experimentation. Regulatory approaches could be applied either in combination or solely and are not mutually exclusive. The World Bank has classified them into the following categories:

- **“Wait & See”**

The Wait-and-See approach, as the name indicates, involves the regulator in a primarily observer capacity. This approach consists of permitting new FinTech business models to function with the explicit intention of allowing innovations to develop unhindered by what could be interpreted as disproportionate regulatory requirements. Many

jurisdictions have applied this approach when there is a collective need to better understand a technology and its possible application(s) in the financial market.

Wait-and-See approaches, while useful, have shown to have a shelf-life and need to be carefully used. While some jurisdictions have employed a passive approach, it is important to note that an active approach is often required to better mitigate risks to the financial sector through active learning.

- **“Test & Learn”**

The Test-and-Learn approach could be defined as cautiously permissive and involves some flexibility that is provided on a case-by-case basis. Flexibility is granted by way of exempting from rules for new firms or new activity(s). The extent to which those regulators can make use of the tools and associated dispensations depend in part on the specific legislative context.

The Test-and-Learn approach, however, has some drawbacks when it comes to scalability. While small or highly specialised FinTech ecosystems are well suited for such a model, jurisdictions with large and diverse FinTech markets could cause a strain on regulatory capacity and make it difficult to handle a growing number and variety of actors requesting exemptions.

- **Ignore: “Keep It Unregulated”**

This approach supports leaving FinTech largely unregulated. In the early days of fintech, regulators in most jurisdictions chose a “wait and see” approach. A relevant use case was the approach to Cryptocurrencies, especially Bitcoin, as a catalyst for the fintech ecosystem, which started in 2008 with the seminal paper by Satoshi Nakamoto “Bitcoin: A Peer-to-Peer Electronic Cash System”. However, many jurisdictions had their initial statements issued only in 2013 (Rauchs et al. 2018). As activities within a jurisdiction’s Fintech

ecosystem increase, levels of fraud, inappropriate market practices, and other illegal activities are bound to increase. Therefore, jurisdictions hesitant to overregulate, but increasingly seeing the need for a response to ensure investor and consumer protection and market integrity, would resort to issuing warnings to the market as witnessed by the warning to Nigerian market participants on crypto-related activities by the Nigerian Securities and Exchange Commission in 2017. This approach is criticised based on the idea that fintech benefits from the legal certainty of regulation. However, regulators adopting this non-interventionistic approach would consider whether fintech's risks and rewards could be integrated into the existing framework, or whether a new paradigm is required.

- **Duck Type: “Same Risk, Same Rules”**

This approach which takes the concept of duck typing- A test that looks at an investment's substance, rather than its form, as the determining factor for whether it is a security- entails shoehorning fintech rules into the existing regulation. This is based on the understanding that some fintech models are essentially digital or crypto representations of an instrument, an institution, or a financial infrastructure platform. A straightforward approach to regulating these models is to focus on their economic function or, more specifically, their underlying risk. The same risk - whether digital or not - would need the same regulatory approach, be it reporting requirements, a license, or a ban.

Duck typing regulation is principle-based, as it regulates the same risk with the same rule, and it is technology-neutral as it focuses on the economic function. An example is the Initial Coin Offering (ICO) guidelines by the Swiss Financial Market Supervisory Authority (FINMA): “In assessing ICOs, FINMA will focus on the economic function and purpose of the tokens (i.e., the blockchain-based units) issued by the ICO organizer” (FINMA, 2018). Compliance with respective existing regulations and, in all cases, with anti-money laundering legislation is required. Duck typing regulates the function, rather than the instrument, institution, or infrastructure platform.

However, fintech innovations may also lead to new functionality. Regulators need to identify these new functions and, if need be, code them into new regulations that specifically address them.

- **Code: “New Functionality, New Rules”**

This approach entails coding fintech using regulations that are specifically tailored to new functionality made possible through technological innovation. It contrasts with Duck typing regulation which works if fintech operates in the same way as traditional finance. This is because with financial innovation, new combinations of risks might emerge. Alternatively, the core risks might be shown in forms only made possible through using new technology. Both scenarios might need additional specific regulations. Similarly, new risks stemming from interconnected financial markets were brought to the forefront during the global financial crisis. While underlying risks namely, market, credit, liquidity, and operational risks, are basically unchanged, it is apparent that safeguarding individual financial institutions is insufficient and a separate additional macroprudential layer is necessary.

Indeed, current research suggests that fintech might lead to new functionality based on, among other elements: (a) the specific features of blockchain technology; (b) the new combination of business models; and (c) new digital operational challenges. For instance, Cong and He (2018) demonstrated that blockchains have profound economic implications on consensus generation, industrial organisation, smart contract design, and anti-trust policy. (Rauchs et al., 2018) found that 57.0 per cent of crypto-asset service providers were operating across at least two market segments to provide integrated services for their customers. Supporting the trend that fintech is characterised by a strong and increasing cross-segment expansion instead of limiting itself to the value chain of a classic bank or insurance company therefore requiring new regulations to cover this multifunctionality of operations.

5.0. Issues and Challenges

As the financial system adapts FinTech, concerns arise regarding a range of issues and challenges, including:

Transition

The adoption of FinTech may pose transition challenges, and policy vigilance would be needed to make economies resilient and inclusive to capture the full benefits of this emerging trend. This brings several challenges for regulators.

Blurred International Borders

One of the most prominent challenges of regulating FinTech is that it blurs international borders. Providers can offer services globally, causing complex transaction monitoring for public authorities. This issue is exacerbated as some of the players are outside the scope of domestic regulations, highlighting the need for international co-operation. Some examples of cross-border services are crypto-exchanges, peer-to-peer lenders and those offered by Big Tech companies like Google, Amazon, Facebook, and Apple that are entering the realm of financial services.

Disintermediation

Another important issue that regulators have had to deal with is the increased disintermediation in the financial value-chain and the bypassing of traditional intermediaries. This is further complicated by bringing different sectors from finance and technology together with telecommunications and infrastructure to compete and collaborate as they provide services. Often sectors fall under the mandate of different regulators and call into question regulators' assumptions about market participants and practices.

Speed of Adoption

The high rate of adoption of FinTech and the potential for players to scale rapidly the impact it has on the financial system puts further pressure on the regulator to respond rapidly without necessarily having the full picture.

Reliable Information

Lack of reliable information about the structure and operations of FinTech markets and the fragmentation of the institutional and supervisory setting. The rapid pace of change necessitates regulators to be agile and adapt to the constantly changing environment. To do so, policymakers need to understand how to balance support and encouragement of FinTech and disruptive technologies mitigating risks, including macro-fiscal risks of financial integrity and stability. While many FinTech risks might be addressed by existing regulatory frameworks, new issues are arising from new firms, products, and activities that lie outside the current regulatory perimeter requiring adaptation of the framework to facilitate the safe entry of new products, activities, and intermediaries (Element VI, of Bali FinTech Agenda). It demands improvements and extensions of monitoring frameworks to support public-policy goals and avoid disruptions to the financial system.

- **Legal/Regulatory Risks:** Fintech activities are novel, and most are not appropriately covered by existing legislation, requiring legal and regulatory frameworks to adapt.
- **Lack of coordination:** Efforts toward adapting legal and regulatory frameworks to new innovations often span across different ministries, departments and agencies, who often have parallel and overlapping supervisory and regulatory functions.
- **Consumer Protection and Capabilities:** Vulnerable population groups do not always possess the required skills and experience to appropriately use digital financial products and services. As a result, new risks like fraud (i.e., digital ponzi schemes) or theft (i.e., data breaches from a P2P platform) are compounded for vulnerable consumers who are using digital channels to often enter the financial sector for the first time.
- **Oversight, Risk Management and Governance:** The due diligence on Fintech firms could be somewhat less rigorous than for regulated

firms that sit clearly within the regulatory perimeter introducing a risk of potential regulatory arbitrage. This could introduce contagion, dependency or even concentration risk that might not be mitigated in a timely manner.

- **Cyber risks:** Cyberattacks are becoming more prevalent, and the susceptibility of financial activities to cyberattacks is higher as products and services continue to migrate to digital platforms, particularly as different entities become more inter-connected, and platforms are opened or shared.
- **Data:** Transparency, privacy, and ownership. With the rise of open banking, BigTech and alternative sources of data, newer players have access to customer information given the nature of interaction with the customer.
- **Competition:** Ensuring a level playing field between regulated financial institutions and Fintech players, and amongst them, remains a challenge.
- **AML/CFT Risks:** Fintech could be used to conceal or disguise illicit origin or sanctioned destination of funds, facilitating money laundering or terrorist financing, and the evasion of sanctions. In the case of crypto currencies, for instance, their traceability is limited due to user anonymity and anonymising service providers that obfuscate the transaction chain. The decentralised nature of governance along with the anonymity offered by these platforms has created additional vulnerabilities that require regulatory responses.
- **Third-party reliance:** Some Fintech activities can increase third-party reliance within the financial system. Disruptions to these third-party services may pose wider systemic risks the more central these third parties are in interconnecting multiple systemically important institutions or markets. In some cases, the third parties may not be

financial institutions (e.g., cloud services) and hence not subject to financial regulation and supervision.

- **Business Risk of Critical Financial Market Infrastructure (FMI):** If innovative payment and settlement services grow into critical FMI, they could introduce a stability risk. For example, general business losses can have the potential to impair the provision of critical services and interfere with recovery or an orderly wind down.
- **Contagion:** For instance, large losses hitting a single Fintech firm could be a major loss for the whole sector and lead to contagion. Contagion risk may also be raised by increased access and problems associated with weak ‘links between the multiple entities involved within a particular financial activity.
- **Procyclicality:** Fintech activities could be prone to procyclical market dynamics, due to more pronounced herd behavior. For instance, investors and borrowers on Fintech lending platforms may exhibit larger swings in behavior than with traditional intermediation of funds when a sudden unexpected rise in non-performing loans triggers a drying up of new funds.
- **Excess volatility:** Several Fintech activities are specifically designed to be fast. This might imply that they are more likely to create or exacerbate excess volatility in the system.
- **Disintermediation:** Digital currencies and wallets could themselves displace traditional bank-based payment systems, while aggregators could become the default means of accessing banks and applying for new bank accounts and loans.
- **Maturity & Liquidity Mismatch:** maturity mismatches could arise through securitisation or if lending platforms were to start using their own balance sheet to intermediate funds. In addition, Fintech enabled

platforms may not perform liquidity transformations leading to liquidity mismatches.

- **Increased Inequality** - Although the benefits of Fintech are often touted to help to improve financial inclusion of underserved consumers, Fintech also poses risks in widening the digital divide. Large, vulnerable populations still do not have access to sufficient mobile or internet services, and therefore new innovations may only capture higher-income population groups.

6.0 Conclusion

The rise of FinTech has connected global financial markets and presented significant opportunities, as well as challenges, requiring the attention of policymakers. While policymakers are aligned on the strategic importance and challenges, authorities face the task of implementing practical, appropriate regulatory measures in markets to enable stable and orderly adoption of new technologies and business models by the market and regulators.

Therefore, in this paper, we looked at common regulatory approaches seen around the world. Essentially, the paper analysed Fintech regulation in developing economies by exploring the concepts of Fintech and regulation, considering various frameworks and approaches to the regulation of financial innovation-policies, principles and techniques drawing from jurisdictional experiences. It is evident that there is no one encompassing approach for Fintech regulation, rather, the policy objectives, socio-economic conditions, extant legal structure, and level of development of the ecosystem determine the frameworks designed and implemented in regulating Fintech.

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COMMENTARY: PROGRAMMABLE MONEY: THE NEXT FORM OF MONEY

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Money, as a medium of exchange of value, is one of the early innovations of humanity. It has evolved from peer-to-peer barter system to rare earth metal coins, issued by kingdoms, to convertible notes backed by gold reserves and maintained by the treasury of central banks, to the present world fiat money, regulated by central banks, but circulated by commercial banks through the fractional banking system.

As we are increasingly becoming a global economy, poor policy choices by any central bank could create a ripple effect of inflation and debasement of value of global currencies in proportion to the dominance of that currency.

In 2008, Bitcoin showcased a proof-of-concept for a new form of programmable money governed by a protocol of peer-to-peer network of computers maintained by the public. This led to a modern barter system, like the democratisation of money, facilitating peer-to-peer exchange of value without relying on the traditionally trusted third parties like central banks, banks and other financial intermediaries.

Democracy gives freedom, but it is as good as the rationality and active participation of the people in the system with informed decisions. Because of the unregulated nature of these private currencies, the bad actors are finding ways to manipulate the public by creating artificial demand, thus creating speculative value, volatility and financial instability. As the technology is in its nascent stages, the protocols and security mechanisms are vulnerable to attacks with no one to reach in case of dispute or loss.

Regardless, the increased adoption of these alternative currencies, due to the advantages of quicker global settlement, cost effectiveness (1 per cent as

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compared to 6.94 per cent average cost as per the World Bank) and privacy, has drawn the attention of central banks. However, currency substitution and loss of sovereign control pose risks.

Today, 4 out of every 5 central banks are working on Central Bank Digital Currencies (CBDCs). In my perspective, CBDC is a sovereign response to mitigate the risks associated with private currencies, while embracing the technology behind them for enabling innovation in the incumbent ecosystem.

A central bank digital currency is central bank issued digital money, with the attributes of high speed, cost effectiveness and privacy (based on design choice) and having 1:1 claim to fiat money. A CBDC keeps the public interest and financial stability as key goals and should strike a balance between control and privacy.

Though central banks across the world have adopted various approaches for CBDC design, some common constructs to facilitate multi-CBDC corridor network for cross-border transactions are imperative. Thus, central banks could forge new corridor networks based on the specific country-to-country relations. This could be facilitated using blockchain technology, which simulates trust and transparency through shared transaction ledgers, facilitating automatic reconciliation of data, and creating alternative payment rail.

The ability to choose the unit of value and payment rail will bring disruptions in the money value chain. Thus, traditional financial intermediaries such as banks, non-banks and payment service providers, need to re-position by bringing in broader services around programmable money and leveraging operational efficiencies of public blockchains, to compete.

If the future of money is programmable, it is logical to conclude that the future of regulation is programmable governance. The design system of the CBDC should be a supervisory network and marketplace to enable stakeholders to plug in their nodes and offer services based on smart contract standards defined by the central bank.

The smart contract standard encodes the policies that define compliance and prevent any transactions going out of scope and any such deviation, shall be recorded for audit. Traditional governance is hugely dependent on lagged reporting and audit but leveraging distributed ledger technology (DLT) based CBDC network, the central bank gets near real time and verifiable transactions data.

I congratulate the Central Bank of Nigeria for being one of the pioneers in the retail CBDC space and on the first anniversary of the eNaira on October 25, 2022.



CENTRAL BANK OF NIGERIA