

Financial Technology Investment and Poverty Reduction in Nigeria

Ihunanya Ngozi Erundu¹, Joseph Niyan Taiwo², Joseph Ugochukwu Madugba³,
Chinyere Iheoma Erundu^{4*}, Adenike Omowumi Oladipo⁵
and Udochukwu Iheanacho Erundu⁶

¹Research Department Lagos Business School, Pan-Atlantic University, Kwara State, Nigeria.
Email: ierundu@lbs.edu.ng

²Accounting and Finance Department, Landmark University, Kwara State, Nigeria.
Email: taiwo.joseph@lmu.edu.ng

³Accounting and Finance Department, Landmark University, Kwara State, Nigeria.
Email: madugba.joseph@lmu.edu.ng

⁴Sociology Department, University of Port Harcourt, Rivers State, Nigeria.
Email: chinyere.erundu@uniport.edu.ng

⁵Accounting and Finance Department, Landmark University, Kwara State, Nigeria.
Email: oladipo.adenike@lmu.edu.ng

⁶Computer Science Department, Landmark University, Kwara State, Nigeria.
Email: udyerondu@gmail.com

*Corresponding Author

Abstract: The study investigated financial technology investment and poverty reduction in Nigeria spanning from the year 1981 to 2020. In order to determine the kind of relationship that occurs between the variables of the study, secondary data sourced from Central Bank of Nigeria Statistical Bulletin was employed. The study employed public sector investment in financial technology and private sector investment in financial technology as proxies for financial technology investments, while Human Development Index was adopted as a metric for poverty reduction. However, the study adopted ex-post-facto research design. The descriptive test, normality test, test for outliers, and unit root test to establish the stationarity of data were carried out. The Cointegration method was adopted to test the hypotheses using the e-views 9 statistical software. The study showed that only public sector investment in financial technology impacted negatively and significantly on poverty reduction which was measured by Human Development Index in Nigeria. While private sector investments in financial technology were positive and a significant determinant of Human Development Index. This implies that an increase in financial technology investments, will lead to an increase in poverty reduction in Nigeria. Therefore, the study concludes that the impact of financial technology investment on poverty reduction is positive and significant. Therefore, the study recommends

that government should spend more in developing efficient financial technology framework, so that it can significantly reduce poverty in Nigeria by incorporating financial technology into their poverty intervention programs, as it helps to reduce poverty. Also, the government should enact policies that will encourage private sector investment in financial technology and provide funding for FinTech start-ups, as this will allow citizens to benefit from lower costs while capitalizing on perceived positive gains from private sector investments in financial technology.

Keywords: Financial technology, Human development index, Investment, Poverty reduction.

I. INTRODUCTION

Financial Technology, also known as FinTech, is transforming the financial world for consumers in various ways. For instance, rather than going to a bank physically, one can now secure a bank account online and even link it to a smart-phone to track transactions and convert the phone into a “digital wallet” to make payments [77]. FinTech uses advanced technologies to provide a range of financial services to consumers, including banking, insurance, investments, or anything else related to finance [71]. The transformation brought about by financial technology, or FinTech, has been amplified significantly due to the internet and widespread use of mobile phones and tablets

[57]. Technology has been influencing the financial sector for a long time, but FinTech has taken it to another level by distributing banking and financial services through advanced technological innovation guided by computer programs and algorithms.

The transformation of the financial sector through technology has been ongoing for decades, with major market distinctions resulting in changes in the way people handle their money [7]. The first financial technology, credit cards, and automated teller machines were introduced in the 1960s and 1970s, respectively, paving the way for electronic stock trading and e-commerce business models in subsequent decades [1]. With emerging focus on crypto currencies, blockchain, wealth-tech, and cyber security, the FinTech solutions that receive investment have continued to broaden and develop [37]. Even during the pandemic, FinTech has expanded its reach, from large developing markets to small municipalities in the US and Europe. Interestingly, the fastest-growing countries in the FinTech industry in 2021 were Saudi Arabia, Turkey, Indonesia, Brazil, and China, all of which have high smart-phone usage and limited financial access, allowing for the flow of FinTech concepts between continents and nations [30].

African FinTechs are making significant strides in terms of raising investment capital, with start-ups in the industry consistently outperforming all other start-ups on the continent. In fact, the figures speak for themselves: Opay secured \$400 million in Series C investment, Flutterwave received \$170 million in a Series C round, and TymeBank received \$180 million in a Series B round. Other major recipients of FinTech investment included MFS Africa, which raised \$100 million, and Jumo and MNT Halan, both of which raised \$120 million. Zepz (previously WorldRemit) secured \$292 million in Series E funding, while Chipper Cash raised \$250 million, Tala raised \$145 million, and Wave raised \$200 million [48]. As the adoption of mobile phones and the internet continues to grow across Africa, the investment in African FinTechs is expected to increase incrementally in the coming years [48].

Nigeria, as the most densely populated country in Africa and with the region's highest GDP [49], has a thriving FinTech environment, leading the way in start-ups and digital services from traditional institutions. The Nigerian FinTech sector is rapidly evolving, with a focus on payment processing, and is projected to reach \$543 million by 2022, driven by increased mobile phone usage among the financially excluded [22]. The increasing usage of smart-phones, which has transformed customer behaviour and prioritized simplicity and accessibility, has helped the local FinTech business grow. With 162 million mobile customers in 2017, Nigeria has the largest mobile market in Africa, and the widespread acceptance of FinTech and the solutions it offers make the industry attractive to investors [40].

The Nigerian FinTech sector has immense potential for growth, as evidenced by the 82% increase in mobile banking transactions from 2017 to 2018, which reached 87 million transactions valued at \$5 billion [46]. With over 200 FinTechs currently operating in the country and investments totalling

\$560 million USD, these companies offer a variety of services, including payments, loans, savings, and insurance [23]. FinTechs in Nigeria have the potential to contribute up to \$3 billion in economic investment and \$1 billion in new income to the financial services industry in the long run [23]. The combination of growing smart-phone and mobile technology penetration, along with unmet needs, has created an opportunity for FinTechs to drive financial inclusion, which is a strategy for promoting inclusive economic growth, reducing inequality, abolishing systemic poverty, and improving communal welfare. To facilitate this, the Central Bank of Nigeria launched the financial inclusion plan in 2010, aiming to continue pursuing mobile payment technologies and other cashless policies to lower the cost and accessibility of financial services and transactions and implementing credit improvement schemes and initiatives to boost MSMEs [16].

Financial technology has the potential to boost economic recovery, reduce poverty and improve gross domestic product levels. According to Onuoha *et al.* [54], the endorsement of electronic online banking has enhanced Nigeria's financial inclusion efforts. Furthermore, promoting Financial Technology solutions drives worldwide innovation in financial services, altering the nature of commerce and end-user expectations [40]. This provides a significant potential to construct a more inclusive economic recovery by reaching out to disadvantaged groups and communities. Financial technology assists in the acceleration of current countries' digitization, which is a viable platform for addressing payment shortfall, mobilizing capital for equitable and effective intermediation, and guaranteeing a long-term route to economic recovery [32]. Thus, the growth of FinTech has the potential to make poverty reduction more feasible, which is critical because poverty represents the number one Sustainable Development Goal (SDG) that strives to exterminate poverty in every dimension by 2030 [51].

Poverty is a complex and dynamic issue, affecting millions of people globally [2]. Addressing poverty is one of the biggest challenges in the world, as poverty deprives people of basic needs and essential elements of a dignified life [52]. In remote regions, about 80% of the population lives in poverty, with limited access to infrastructure and basic social services [2]. According to the UNDP [69], over a billion people globally live in deplorable conditions that result in starvation, illness, despair, and deterioration. It is therefore crucial to find ways to alleviate poverty and improve people's living conditions. Financial technology is one such solution that has the potential to help reduce poverty by providing greater access to financial services and products [35].

However, despite Nigeria's vast natural resources, poverty is still prevalent in the country, with over 91 million Nigerians living in extreme poverty, according to the World Poverty Clock [75]. This represents the highest number of severely poor individuals in any country, surpassing Tanzania, Kenya, South Africa, and Zambia. Hofer *et al.* [34] notes that Nigeria is amongst the underprivileged countries in the world, surpassing even India. Over sixty years after gaining independence, Nigeria

has moved from a moderate poverty threshold to being one of the world's poorest nations today. Despite various economic policies developed by the Nigerian government, poverty still remains a key deterrent to the country's socioeconomic progress. Even though previous administrations have made efforts to eradicate poverty, these efforts have proven futile [20].

As eradicating poverty is the first of the Sustainable Development Goals (SDGs), it is a global priority that requires urgent attention. Therefore, it is important to identify strategies to eliminate poverty in Nigeria. Financial development plays a crucial role in poverty alleviation. To identify strategies that increase poor people's access to finance and reduce poverty, scholars have investigated the role of financial development and trade openness. Appiah-Otoo and Song [5] propose resolving financial market flaws as a means of enhancing poor people's access to loans. In previous studies, trade openness has been recognized as a strategy to decrease poverty [15], [9].

Investing in financial technology can be a transformative tool in reducing poverty and promoting economic development. As technological advancements become increasingly intertwined with modernization barriers, there is a need to capitalize on investment opportunities in financial technology to achieve the dual objectives of eradicating poverty and boosting shared prosperity [40]. However, foreign private investors have dominated the investment in the financial technology sector, depriving it of the much-needed funds to achieve its full potential of helping the underbanked and unbanked populations. Also, despite the benefits of financial technology, there is a paucity of literature on its investment potentials as it relates to poverty reduction [42].

To fill this knowledge gap, this study focuses on examining the reasons and solutions for achieving the SDG of poverty reduction in Nigeria through quantitative analysis of financial technology investments, particularly from the public sector. This study is further divided into four parts: literature review, research methods, analysis of data, and conclusions.

II. LITERATURE REVIEW

A. Concept of Financial Technology

Financial technology, also known as "FinTech," has been a topic of extensive discussion in various literatures, with diverse perspectives and arguments. This term, coined from the words "financial" and "technology," describes the use of technology in providing financial services and goods, including banking, insurance, investment, and other financial services. However, this term has been criticized for its sensationalism and jargon, leading to varying interpretations and misunderstandings of its meaning [27].

The term "FinTech" refers to a wide range of organizations that address the needs of different financial consumers while relying on digital technology to provide solutions, as defined by

various literatures [7], [36], [43]. This term first appeared in the early 1990s when Citigroup established a "Financial Services Technology Consortium" to improve technical partnerships between financial institutions [7]. Paradoxically, FinTechs are now considered to be the most formidable competitors of banks, offering better, faster, and more cost-effective services to clients by using technological advancements to bridge the gap between traditional banks and their clients' expectations [28].

Financial Technology encompasses various financial services, such as fundraising, credit, mobile payments, and portfolio management that have been revolutionized by technology [39]. These services are offered through mobile phones, personal computers, the internet, and cards linked to a solid digital payment system [57]. The rise in global financial flows and rapid technological advancements has shifted attention to FinTech in recent years, leading to a surge in start-ups and investments [65]. Deloitte describes FinTech as an ecosystem of small technological start-up firms that offer financial services to the market or primarily serve the financial services sector. This concept is not new; it began in 1866 with the first connection across the Trans-Atlantic transmission line, which led to the creation of global telex and the improvement of connected financial services, known as FinTech 1.0 [48]. In summary, the development of FinTech is closely tied to the advancement of supporting technology.

B. Financial Technology in Nigerian Banks

Nigeria's status as one of Africa's top FinTech centres is a significant achievement, considering the challenges the country has faced. According to Monye [44], the FinTech landscape in Nigeria can be divided into three segments: FinTech 1.0, FinTech 2.0, and FinTech 3.0. FinTech 1.0 emerged after the first bank in Nigeria started using technology at the front-end and back-end of their activities, which led to increased competitiveness in the banking industry as a result of the 1986 Structural Adjustment Programme. This phase ended in 2007 with the introduction of the Payment Systems Vision 2020 by the Nigerian Central Bank. Since the debut of PSV 2020, FinTech 2.0 has been in operation and characterized by a shift towards mobile payments, a greater involvement of start-ups and technology, a drive for financial inclusion, and increasing regulations. Notable pioneers of FinTech 2.0 include Paga, Paystack, and Kudi.

FinTech 3.0 is set to emerge with the release of the first mobile payment platform by a telecommunications company, likely MTN, due to the Payment Service Bank Regulation 2018 by the Central Bank of Nigeria. The potential impact of a telecommunications-led Mobile Money Operator is unknown, but the achievements of M-Pesa Safaricom in Kenya and MTN's Mobile Money in Ghana offer some insight into the possibilities. In conclusion, the history of FinTech in Nigeria reflects an evolution of technologies and services, and the future looks promising [44].

Over the years, Nigerian banks have expanded into a completely new and revolutionized sector with the help of technological developments, according to Emmanuel and Adebayo [24]. The financial technology business has become highly competitive due to globalization, leading to the utilization of technical breakthroughs in the industry. The resulting “New Generation Banks” are characterized by a dynamic business environment with quick variations, greater cognizance, and increasing client expectations, as Okoye *et al.* [50] noted. This worldwide change curve in the banking industry has been defined by the complicated and competitive environment of the twentieth-century banking business, as stated by Pierre [59].

At the heart of this global shift curve are high-tech breakthroughs that have played a vital role in transforming the Nigerian financial system. The Central Bank of Nigeria [17] affirms that the Nigerian financial industry has made significant investments in advanced technology, resulting in increased efficiency in innovative services and products, providing competitive advantages. Institutions have widely accepted the application of technology to financial transactions due to the boom in technology, resulting in the development of Automated Clearing Services, Automated Payment Systems, and Automated Delivery Channels, as Agboola [3] pointed out.

C. Financial Technology and Nigerian's Cashless Policy

The push towards a cashless economy does not mean a complete absence of cash transactions but rather a reduction of cash-based transactions to a minimum. Woodford [78] highlights that a cashless policy is aimed at minimizing transactional fractures that can be remedied through the use of cash balances. This creates a need to maintain these balances despite receiving a rate of return.

Nigeria's financial technology journey started with the Smart Card initiative in 1996 by a consortium of banks [68], [19]. However, it was the success of M-Pesa in Kenya that brought a transformation in digital banking services and products in Nigeria and globally. The aftermath of the 2007/2008 global financial crisis and the success of M-Pesa prompted Nigeria's payment system overhaul aimed at improving financial inclusion, reducing the cost of banking services, and enhancing the effectiveness of monetary policy [79]. Nigeria's financial technology goods are classified into wholesale and retail digital products, with the real-time gross settlement system (RTGS) being the wholesale digital product, while ATMs, POSs, IB, MB, Nigerian Interbank Settlement System Instant Payment (NIP), Nigerian Interbank Settlement System Electronic Fund Transfer (NEFT), and e-bills pay transactions are the retail products. In response to the limitations of cash-based transactions such as high handling costs, risks associated with cash-based transactions, increasing subsidy by the banking public, and the informal sector, the CBN launched its cashless policy in April 2011 [79].

The CBN's commitment to regulating financial goods and developing the payment system persisted despite the suspension

of the cashless policy. In 2016, the CBN released a guideline on electronic payment channels, and in 2018, the Guideline for Licensing and Regulating Payment Service Banks in Nigeria was published to promote financial inclusion. These guidelines included a review of electronic banking transaction charges, accountability and responsibility provisions, and a sanction regime to address unauthorized charges. These reforms reinforced the Nigerian financial system and encouraged the adoption of digital payment systems [79].

The reforms were successful, and on September 17, 2019, the cashless policy was reinstated with some modifications. The revised circular maintained the key features of the suspended policy, such as the staggered implementation across states and the encouragement of electronic payment platforms. The CBN also reinforced the Consumer Protection Department to address complaints related to electronic transfers. However, with the rise in the number of digital transactions, cash receipt fees were reintroduced [79].

D. Concept of Poverty

In order to properly address poverty, it is important to first understand what it is. However, there is no single definition of poverty that is widely accepted in the existing literature. This is because poverty is a complex issue with multiple dimensions [70]. In fact, how one defines poverty is often dependent on the methodology used to conceptualize and measure it.

One such methodology is the monetarist approach used by the Nigeria Bureau of Statistics to measure poverty in Nigeria. This method involves using the poverty line, national poverty rate, and income or consumption measurement to identify individuals who are considered poor [67]. According to the monetarist perspective, poverty is defined as a lack of sufficient funds to acquire basic goods and services necessary for a socially acceptable standard of living. However, income is influenced by various factors such as education, health, life expectancy, and child mortality.

While the monetarist approach provides an ex-post assessment of poverty, it is considered inadequate since poverty is a stochastic phenomenon and a household's current poverty status may not accurately predict their future hardship [18]. Despite these limitations, understanding different methodologies for measuring poverty is crucial to effectively address this complex issue.

In emerging nations such as Nigeria, the vulnerability approach appears to be a superior way of theorizing poverty. Unlike the monetarist approach, which focuses on income and consumption, the vulnerability approach considers how individuals are exposed to the risk of shocks that could make them vulnerable to poverty [9]. These shocks could include economic, unemployment, health hazards, human capital hazards, and anthropogenic shocks.

According to Barrientos and Hulme [9], the vulnerability approach to poverty is concerned with how people could

become poor due to unfavorable events. This approach is ex-ante and futuristic, considering not only those who are currently poor but also those who may become poor due to macroeconomic shocks or illnesses [60]. In contrast, Dauda [21] defines poverty as a condition where a person or family is unable to meet basic necessities or is at risk of losing their existing way of living. While Dauda's definition of poverty is focused on the current situation of individuals or families, the vulnerability approach is more forward-looking and takes into account potential risks and future events that could lead to poverty [9].

In exploring the issue of poverty in Nigeria, it is important to consider a more comprehensive approach, such as the vulnerability approach, due to the numerous shocks and vulnerabilities that individuals face. This approach highlights how people can become poor due to unfavourable events and is considered a futuristic, ex-ante, and stochastic method of poverty measurement. However, other methods of identifying poverty exist, such as the level of spending and consumption, as noted by Blackwood and Lynch [11]. Sen [62] also defined poverty in terms of entitlements to different bundles of commodities and services that a person has control over, taking into account how such goods are obtained and the provision of relevant goods. On the other hand, the World Bank [74] offers a more comprehensive definition of poverty that encompasses physical needs such as food, housing, education, and healthcare, as well as non-physical needs such as identity and participation.

Adam Smith's definition of poverty highlights the significance of social and psychological aspects, in addition to the material state. He emphasized that "by necessities, I mean not only the commodities that are indispensably necessary for the support of life, but whatever the custom of the country sees as indecent for creditable people, even of the lowest order, to be without" [64]. On the other hand, Karl Marx emphasized the context-specific and relative nature of poverty and did not specify an absolute measure, stating that "Our demands and enjoyments emerge from society; we measure them, consequently, by society and not by the products of their fulfilment" [73].

E. Poverty in Nigeria

Poverty is a persistent problem that affects different aspects of human life. It is a multifaceted issue that manifests itself in various ways, including social, economic, environmental, and political factors. In Nigeria, poverty is a significant challenge that has persisted over the years, making it one of the world's poorest and most unequal nations. Despite the attention that Nigeria's poverty concerns have received from successive governments, the paradox of poverty in the midst of wealth persists and even worsens during periods of economic growth [53].

Despite economic growth, poverty in Nigeria remains on the rise, with the North-East and North-West geopolitical zones topping poverty indicators, unlike growing economies in Asia,

North America, and Europe where economic growth leads to poverty reduction [21]. According to the National Bureau of Statistics [46], the percentage of Nigerians classified as moderately and severely poor has increased over the years, with 30.3 percent and 38.7 percent of the population, respectively, living in poverty in 2010. The number of people living in absolute poverty has also significantly increased from 17.1 million in 1980 to almost 112.47 million in 2010, although the figure dropped to 84.0 million in 2019. These statistics show the asymmetric relationship between economic growth, development, and poverty in Nigeria.

Despite various poverty-reduction strategies and programs implemented in Nigeria, poverty eradication remains elusive. These programs were sectoral reforms with the primary objective of alleviating poverty, and they include Operation Feed the Nation, Free and Compulsory Primary Education, Low-Cost Housing, River Basin Development Authorities, Rural Banking, Family Economic Advancement Programme, Petroleum Trust Fund, among others [56]. However, despite the implementation of these programs, poverty levels have remained high. The government has participated in various poverty reduction projects, but there has been minimal enhancement in living standards, especially during the SAP and post-SAP periods [6], [21]. Several reasons have been cited as the cause of poor success in poverty mitigation projects in Nigeria, including substandard strategy and execution, policy irregularities and discontinuities, inadequate finance, and fraudulence.

F. Theoretical Review

The theoretical underpinning of this study is built on two competing theories of financial technology and poverty.

- *Progressive Social Theory of Poverty*

Social theorists in the nineteenth century challenged the individual theory of poverty, arguing that economic and social institutions were responsible for perpetuating poverty. They suggested that capitalism created a reserve army of unemployed individuals to keep wages low, leading to poverty despite people's hard work and positive attitudes [14]. Poverty is thus the result of a complex interplay of economic, social, and political factors that hinder progress. In Nigeria, government actions and policies exacerbate poverty, despite good intentions. The Structural Adjustment Program (SAP) and its various effects, including devaluation of the Naira, price hikes, industrial closures, privatization, and an unregulated free market, contributed to increasing poverty levels [6], [21]. The Nigerian political economy has played a significant role in the country's poverty levels, as policies and actions may lead to impoverishing residents rather than alleviating poverty.

- *Innovation Diffusion Theory (IDT)*

In 1962, Rogers established the innovation diffusion theory, which was one of the earliest social science frameworks to

investigate any type of innovation. This hypothesis is based on four primary elements that influence behaviour: Innovation, Communication Channels, Time, and Social Systems [61]. The theory describes how new ideas or technologies spread and the characteristics that influence a person's behaviour and the rate of innovation diffusion. Rogers argued that five innovative characteristics, such as relative benefit, compatibility, complexity, trialability, and observability, influence an individual's behaviour [61].

The diffusion of innovation theory has been widely used to study technological adoption, appraisal, and implementation [29]. In the context of information technology, Moore and Benbasat [45] adapted and refined the five attributes of innovations into a set of constructs that could be used to study individual technology acceptance. They also enhanced the Rogers model by incorporating the voluntariness of usage and image. Therefore, parameters like compatibility, perceived utility, and ease of use were discovered to have the most influence on utilization decisions, while other characteristics like demonstrability, image, visibility, and trialability had no substantial influence on the person's usage.

G. Empirical Review

Poverty reduction is a growing concern for social scientists from various fields, including finance, economics, entrepreneurship, and management [80]. Recently, scholars have begun to explore the connection between economic growth, poverty reduction, and the development of new technologies and procedures [4], [12], [13], [41]. This approach to poverty reduction contrasts with traditional poverty research theories, which primarily focus on financial aid and other long-term poverty alleviation strategies [72]. However, there is still a lack of conclusive data on the impact of investment in financial technology on poverty reduction through the availability of cashless financial instruments.

Research has shown the positive impact of mobile money on poverty alleviation in Kenya. According to Suri and Jack's [66] long-running household panel survey, M-Pesa has helped female clients transition from subsistence farming to micro-enterprises. They attribute this to disadvantaged households' increased access to the official financial system through mobile money. The success of M-Pesa in Kenya highlights the importance of fundamental financial services in advancing economic well-being.

In contrast, the impact of investments on Nigerian economic development has been less clear. Ozoh *et al.* [58] found that domestic investment had little influence on growth over the study period, while foreign direct investment did not respond favourably to growth. However, the study showed that investments in Nigeria's industrial sector could lead to long-term benefits.

On the other hand, financial innovation has been shown to have a positive effect on economic growth. In their study,

Moreso, Bara, and Mudzingiri [10] used the Autoregressive Distributed Lag (ARDL) model to estimate the influence of financial innovation on economic development. They found that financial innovation can contribute to economic growth and development.

In the pursuit of financial inclusion through FinTech, regulatory oversight plays a crucial role, as noted by Guild [31]. Guild emphasizes that regulatory bodies must implement a responsive approach to regulating FinTech services, as opposed to an overly interventionist one. The success of FinTech services in Kenya, India, and China in advancing financial inclusion was evaluated with varying degrees of success in the acceptance of FinTech services. On the other hand, Orokpo and [55] looked at ICT as a substitute model for poverty reduction in Nigeria, using a historical method tempered with empirical observation. The authors concluded that in order to sustain the benefits of Nigeria's telecom revolution and promote productivity while eliminating poverty, the government, development partners, and all participants must work together to organize ICT in all segments of the national economy.

Financial inclusion has been found to be an effective tool in reducing poverty in many regions around the world. Lal [38] explored the influence of financial inclusion on poverty reduction through cooperative banks in three northern Indian states. The study found that financial inclusion through cooperative banks has a direct and positive impact on poverty reduction, providing the poor with rudimentary financial services like savings, loans, credit, and insurance. On the other hand, Okoye *et al.* [50] investigated the relationship between financial technological revolution and economic growth in Nigeria, using quarterly time-series secondary data from the CBN statistical bulletin. The study found a positive connection between economic growth and several features of financial technological innovation, such as mobile phone transfers.

The role of FinTech in economic growth has been a topic of scepticism; however, Shahin, *et al.* [63] employed cross-country data to address this issue. They identified variables such as the percentage of the population using the internet or mobile phone to access a financial institution account and the ratio of people who made or received digital payments to examine the association between GDP per capita and chosen banking sector digitalization metrics. Their findings showed that there is a direct correlation between GDP per capita and selected banking sector digitalization metrics, indicating that digitalization of banking services has a significant impact on the financial services market.

Meanwhile, in their study "Poverty reduction in rural China: Does digital finance matter?" Chen and Zhao [81] aimed to investigate the use of digital finance as a means to alleviate poverty in rural areas of China. Using prefectural-level digital financial indices and micro-data on rural families from the China Household Finance Survey (CHFS) in 2017, the researchers discovered that digital finance considerably reduces absolute and relative poverty among rural Chinese families. They also offered evidence that digital finance's poverty-reduction

effect is attributed to reducing credit and information barriers, extending social networks, and encouraging entrepreneurship. This research provides insight into establishing public financial policies on poverty reduction in emerging nations.

Appiah-Otoo and Song [5] and Ye *et al.* [76] conducted studies on the impact of financial technology (FinTech) on poverty reduction in China. While Appiah-Otoo and Song [5] focused on the direct and indirect effects of FinTech sub-measures on poverty using panel data from 31 provinces from 2011-2017, Ye *et al.* [76] used web crawler technology analysis to fashion a FinTech index for respective provinces. They suggested a unique sparse support vector quantile regression to analyse the impact of FinTech on poverty reduction within particular Chinese provinces, given the heterogeneity of poverty across distinct provincial regions. Despite the differences in methodology, both studies showed that FinTech improves poverty reduction in China by complementing financial development and economic growth, with the benefits being significantly higher in low-income provinces than in high-income provinces. The findings from both studies suggest that policymakers and practitioners must establish additional digital financial technology systems, particularly in China's low-income regions, to reduce poverty.

III. METHODOLOGY

This study examined the impact of financial technology investment on poverty reduction in Nigeria spanning from the year 1981 to 2020. Hence, it employed the use of Ex-post Factor Research Design; it is used in this study since data pertaining to both variables is secondary in nature and is accessible in the Central Bank of Nigeria statistics bulletin as it examines a dataset and searches for possible relationships between variables. It essentially refers to how we might do impact analysis on existing data. The population of the study is made up of the economic variables included in this study, which include public sector FinTech investment, private sector FinTech investment, and Nigeria's human development index. The control variable is Gross National Income Per Capita (GNIPC).

A. Model Specification

The study employed the following model, which is in line with the study carried out by Emara and Mohieldin [25] on "Beyond the Digital Dividends: FinTech and Extreme Poverty in the Middle East and Africa":

Functional form of the model:

$$\text{HDI} = f(\text{PUSIFT}_t, \text{PRSIFT}_t, \text{GNIPC}_t) \text{ -----(3.1)}$$

Converting to econometric form by including the constant term (α_0) and error term (μ_t):

$$\text{HDI} = \alpha_0 + \alpha_1 \text{PUSIFT}_t + \alpha_2 \text{PRSIFT}_t + \alpha_3 \text{GNIPC}_t + \mu_t \text{---(3.2)}$$

Where:

HDI = Human Development Index

GNIPC = Gross National Income Per Capita (control variable)

PUSIFT = Public sector investment in Financial Technology

PRSIFT = Private sector investment in Financial Technology

α_0 = Constant term

$\alpha_1 - \alpha_2, b_1 - b_2$ = Coefficients of predictors

μ_t, e_t = Error terms

t = Time.

Apriori Expectation

The explanatory factors are projected to have a positive link with the Nigerian human development index based on theories as well as empirical investigations.

Thus: $\alpha_1, \alpha_2 > 0$ for model one, while $b_1, b_2 < 0$ for model two.

B. Estimation Technique

In this study, we utilized two analytical tools for our analysis. Firstly, the Johansen Co-integration Testing was used to test the long run relationship between the dependent variable and independent variables. This method was chosen as it is a powerful technique that allows for the testing of co-integration between multiple variables. Secondly, we employed the vector error correction model (VEC) to examine the relationship effect. This model is particularly useful when dealing with time series data that have a long run equilibrium relationship and short run dynamics [26]. To implement the VEC model, we used both Eviews and SPSS statistical software packages. Overall, the combination of these two analytical tools allowed us to thoroughly analyze the relationship between the dependent and independent variables in our study.

IV. DATA PRESENTATION AND ANALYSIS

The focus of this section is to present the findings and discuss the results of our study on the effect of financial technology investment on poverty reduction in Nigeria. To conduct our analysis, we utilized data that were extracted from the Central Bank of Nigeria, covering a period of 40 years. The data variables used in our study include the Human Development Index (HDI), Public Sector Investment in Financial Technology (PUSIFT), and Private Sector Investment in Financial Technology (PRSIFT). Additionally, we used the Gross National Income Per Capita (GNIPC) as a control variable to account for its potential influence on our results.

By analyzing these variables, we aimed to determine the relationship between financial technology investment and poverty reduction in Nigeria. Through the use of econometric techniques, we were able to examine the impact of PUSIFT and PRSIFT on HDI, and assess whether they have a statistically significant effect on poverty reduction. Overall, our findings

provide valuable insights into the role of financial technology in promoting poverty reduction in Nigeria, and contribute to the existing literature on the subject.

A. Descriptive Statistics

TABLE I: DESCRIPTIVE STATISTICS

Variable	HDI	LPRSIFT	LPUSIFT	LGNIPC
Mean	0.445225	1.942322	0.450321	2.995227
Median	0.458000	2.530312	0.906164	2.986772
Maximum	0.534000	3.558597	1.954377	3.468347
Minimum	0.322000	-0.622330	-1.497573	2.491362
Std. Dev.	0.066422	1.509655	1.092186	0.305819
Observations	40	40	40	40

Source: Computed by the Author, 2022.

Evidence from Table I indicated that the average value for Human Development Index (HDI) is 0.445225. The standard deviation of 0.066422 affirms the assertion that the data is to a very good point dispersed around the mean. The minimum and maximum values of 0.322000 and 0.534000 were also shown for the same variable.

Private sector investment in financial technology showed a mean value of 1.942322 as indicated in Table I. The standard deviation of 1.509655 confirms that the data is to a very good point dispersed around the mean. The minimum value of -0.622330 and maximum of 3.558597 were also shown for the same variable.

Also, the public sector investment in financial technology showed a mean value of 0.450321 as indicated in Table I. The standard deviation of 1.092186 confirms that the data is well dispersed around the mean. The minimum and maximum values of -1.497573 and 1.954377 were also indicated for the same variable.

The Gross National Income Per Capita (GNIPC) as a control variable in the model, indicated a mean value of 2.995227, as indicated in Table I. The standard deviation of 0.305819 indicates that the data is well dispersed around the mean. The minimum and maximum values of 2.491362 and 3.468347 were also indicated for the same variables.

B. Normality Test

The test for normality in this study was carried out by employing the Kolmogorov-Smirnov test as contained Table II.

TABLE II: TESTS OF NORMALITY

Kolmogorov-Smirnov^a

	Statistic	Df	Sig.
LHDI	.122	.40	.139

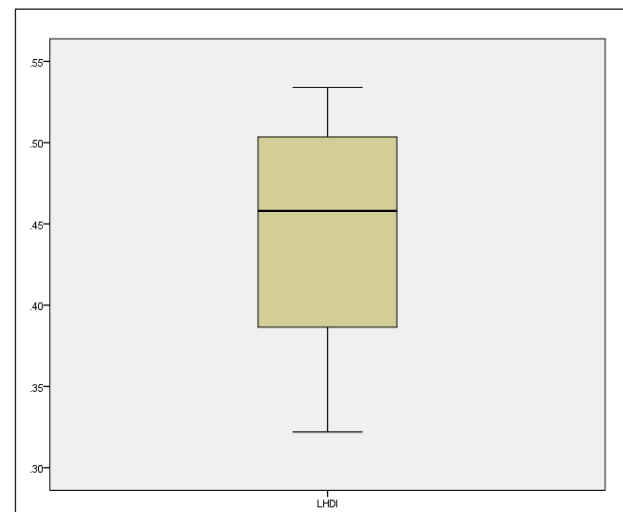
a. Lilliefors Significance Correction

Source: Computed by the Author 2022.

Statistical evidence from Table II showed that statistic value for human development index from the Kolmogorov-Smirnov test is 0.122 with a probability value of 0.139. This is above 0.05 indicating that the data-set is normally distributed and is suitable for further investigation.

C. Test for Outliers

The study used the box plot for the test of outliers as represented in Fig. 1. The box plot showed that there is no outlier that can undermine the result of this study. Again, this confirms that the data-set is suitable for further investigation.



Source: Chattered by the Author 2022.

Fig. 1: Box Plot Showing Test for Outliers for the Dependent Variable in Our Study

D. Unit Root Test

TABLE III: UNIT ROOT TEST (AUGMENTED DICK FULLER)

Variable	Test Statistic	10%	5%	1%	Order of Integration
HDI	-8.794019	***	**	*	I(1)
LPUSIFT	-8.073762	***	**	*	I(1)
LPRSIFT	-7.786075	***	**	*	I(1)
LGNIPC	-5.881337	***	**	*	I(1)

Source: Chattered by the Author 2022.

The regression coefficient of non-stationary data will be deceptive, according to Granger and Newbold [82] and Granger [83]. To determine the stationarity of the data variables in our investigation, we used the augmented Dickey-Fuller (ADF) unit root test. The time series variables in Table III are all stationary at the first difference (i.e., I (1)). This indicates that the data-set is suitable for further investigation and that the findings will not be distorted.

E. Cointegration Test

TABLE IV: JOHANSEN COINTEGRATION TEST (MAX-EIGEN STATISTIC)

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.593468	34.20350	27.58434	0.0061
At most 1	0.371773	7.66442	21.13162	0.1429
At most 2	0.256097	11.24211	14.26460	0.1425
At most 3 *	0.170041	7.082404	3.841466	0.0078

Max-eigenvalue test indicates 1 co-integrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Source: Computed by the Author 2022.

Evidence from Table IV Johansen co-integration table indicates that there is a co-integration among the variables in our study.

The above claim is confirmed from the trace statistic value of 70.19 which is higher than 47.85 critical values. The value is also found to be significant at five percent (1%) levels.

Also, the trace statistic value of 35.98 is higher than critical value of 29.79 and the value is also significant at five percent level. In addition, the trace statistic value of 18.32 is higher than critical value of 15.49; this also is evidence of co-integration. Again, the trace statistic value of 7.08 is also higher than the critical value of 3.84. This also implies that there is evidence of co-integration. Meaning that at least there are about four integrating equations.

Therefore, we reject the null hypothesis and conclude that there is a co-integration between the variables in our study.

From the result as contained in Table IV, this study concludes that there is a long run association among the variables in our study. Meaning that these variables can be combined in a linear fashion, going forward, if there is a short run moment, it may affect individual variable in the short run but there will be long convergence.

F. Regression Analysis

Dependent Variable: LHDl

Method: Vector Error Correction Model (VEC)

Sample: 1981-2020

TABLE V: NORMALIZED LONG-RUN VEC ESTIMATES, AND THE ERROR CORRECTION TERMS

	LHDl	LPUSIFT	LPRSIFT	LGNIPC	C
	1	0.051214	-0.079009	0.011754	0.452679
		(0.01085)**	(0.00914)***	(0.01458)**	
		[4.72116]	[-8.64767]	[0.80632]	
	D(LHDl)	D(LPUSIFT)	D(LPRSIFT)	D(LGNIPC)	
Error	-1.256727	-4.737817	-5.009298	0.763388	
Correction	(0.22097)	(3.59404)	(2.90907)	(0.59686)	
Term	[-5.68727]	[-1.31824]	[-1.72196]	[1.27900]	
R-squared	0.853939				
Adjusted R-squared	0.841767				
F-statistic	70.15732				
Prob(F-statistic)	0.000000				
Durbin-Watson stat	1.384219				

Note: The coefficients of each variable come first; numbers in parentheses are standard errors; and the numbers in squared brackets are the z statistics. ** and *** denote significance at 5% and 1%, respectively.

Source: Computed by the Author 2022.

Results shown in Table V, reveals the relationship between financial technology investments indicators and Human Development Index as a metrics for poverty level in Nigeria. The result illustrates the overall statistical significance of the model with the F statistic = 70.15732 with a probability value of $0.000000 < 0.05$ and it confirms the appropriateness of the model specification. This signifies that financial technology investment has both positive and significant relationship on poverty reduction in Nigeria. Thus, it is assumed that a rise in HDI due the investments in financial technology with all things being equal will bring about a reduction in poverty level.

The adjusted R-squared of multiple determination of 0.841767 indicate that about 84.1% of the total variations observed in human development index (HDI) is explained by changes in the predictor variables (Public Sector investment in financial technology and Private Sector investment in financial technology). The Durbin Watson statistics of 1.384219 indicates there is no auto-correlation.

Statistical evidence from Table V indicated that public sector investment in financial technology has a normalized long-run estimate of 0.051214. This infers that it has a negative impact on poverty reduction (LHDI) in Nigeria, indicating that an increase in Public Sector Investment in Financial Technology (PUSIFT) will lead to a decrease in poverty reduction (LHDI) in Nigeria. In addition, the probability coefficient value of 0.01085 was shown for the same variable is significant at 5% significance level; this means that PUSIFT has a negative but significant influence on Poverty reduction (LHDI) in Nigeria. Our finding agrees with the study of Appiah-Otoo and Song [5]. They found that financial technology through credit and third-party payment, using panel data spanning seven years, reduced poverty in China by supporting financial technology advancement and financial inclusion. Therefore, an increase in government investments in financial technology leading to an inclusive economy will decrease poverty reduction (LHDI) in Nigeria, thereby causing an increase in poverty levels in the country. This demonstrates the lack of government support and investment in financial technology as investment in FinTech is mostly by foreign private investors. Therefore, the government should encourage and invest in financial technology in every manner it can.

The statistical result from Table V shows that private sector investment in financial technology has a normalized long-run estimate of -0.079009. This infers that it has a positive impact on poverty reduction (LHDI) in Nigeria, indicating that an increase in private sector investment in financial technology (PRSIFT) will increase poverty reduction (LHDI). In addition, the probability coefficient value of 0.00914 was shown for the same variable to be significant at 1% significance level. This means that PRSIFT has a positive and significant influence on the human development index in Nigeria. This corroborates with the findings of Chen and Zhao [81], as they matched digital financial indexes through financial technology of the prefectural-level cities with micro-data in rural households

on absolute and relative poverty in China and found that financial technology reduces poverty. Therefore, an increase in investments in financial technology from the private will lead to an increase in poverty reduction (LHDI) in Nigeria.

Gross national Income Per Capita (GNIPC) has a negative relationship with poverty reduction (LHDI) in Nigeria, as indicated in the normalized long-run estimate of 0.011754 with a probability value of 0.01458 at 5% significance level. This means that as a control variable, it is negative but statistically significant in influencing the tested variable in the study.

V. CONCLUSIONS AND IMPLICATIONS

In conclusion, this study has provided empirical evidence that private sector investment in financial technology has a significant positive impact on poverty reduction in Nigeria. This finding is consistent with previous research of Chen and Zhao [81] and Appiah-Otoo and Song [6] and highlights the vast potential of financial technology in addressing economic and social issues in Nigeria. The study also underscores the importance of innovation diffusion theory in understanding the process of innovation adoption in society [61].

The implications of this study for policy are significant. Policymakers in Nigeria should prioritize investments in financial technology and create an enabling environment for private sector investment in this area. Efforts should be made to incorporate financial technology into government schemes and intervention programs aimed at achieving the SDG goal of poverty reduction. Additionally, financial technology should be incorporated into policies and social systems to ensure that the poor have easy access to finance and its support services. Also, the government should enact policies that will encourage private sector investment in financial technology and provide funding for FinTech start-ups, as this will allow citizens to benefit from lower costs while capitalizing on perceived positive gains from private sector investments in financial technology.

Overall, this study contributes to the growing body of literature on the impact of financial technology on poverty reduction in developing countries. The findings highlight the potential of financial technology in addressing poverty and other social and economic issues in Nigeria. Policymakers should take note of these findings and prioritize investments in financial technology as part of a broader strategy for economic development and poverty reduction.

REFERENCES

- [1] B. U. Achugamonu, O. E. Alexander, G. Obindah, A. Arewa, and L. U. Okoye, "Digital finance as a mechanism for extending the boundaries of financial inclusion in Sub-Saharan Africa: A general methods of moments approach," *Cogent Arts & Humanities*, vol. 7, no. 1, 1788293, 2020, doi: <https://doi.org/10.1080/23311983.2020.1788293>.

- [2] B. O. Aderounmu, "Gender analysis of poverty in Sub-Saharan African countries," in *Proceedings of the 1st Covenant University International Women's Multidisciplinary Conference*, 2018.
- [3] A. A. Agboola, "Impact of electronic banking on customer services in Lagos, Nigeria," *Journal of Social Sciences*, vol. 7, no. 1, pp. 27-36, 2001, doi: <https://doi.org/10.1080/09718923.2003.11892321>.
- [4] D. Ahlstrom, "Innovation and growth in emerging economies," in *Designing the Future: Economic, Societal, and Political Dimensions of Innovation*. Austrian Council for Research and Technology Development, Ed., 2015, pp. 353-387.
- [5] I. Appiah-Otoo, and N. Song, "The impact of fintech on poverty reduction: Evidence from China," *Sustainability*, vol. 13, no. 9, p. 5225, 2021, doi: <https://doi.org/10.3390/su13095225>.
- [6] E. A. Arisi-Nwugballa, M. E. Elom, and C. U. Onyeizugbe, "Evaluating the relevance of entrepreneurial orientation to the performance of micro, small and medium enterprises in Ebonyi State, Nigeria," *International Journal of Academic Research in Accounting, Finance and Management Sciences*, vol. 6, no. 3, pp. 221-230, 2016.
- [7] D. W. Arner, J. N. Barberis, and R. P. Buckley, "The evolution of fintech: A new post-crisis paradigm?," *SSRN Electronic Journal*, 2015, doi: <https://doi.org/10.2139/ssrn.2676553>.
- [8] P. Basanta, and M. Malvika, "Impact of trade openness on poverty: A panel data analysis of a set of developing countries," *Economics Bulletin*, vol. 34, no. 4, pp. 2208-2219, 2014. [Online]. Available: <https://econpapers.repec.org/article/eblecbull/eb-14-00590.htm>
- [9] A. Barrientos, and D. Hulme, "Social protection for the poor and poorest: Concepts, policies and politics," *Choice Reviews Online*, vol. 46, no. 03, pp. 46-160846-1608, 2008, doi: <https://doi.org/10.5860/choice.46-1608>.
- [10] A. Bara, and C. Mudzingiri, "Financial innovation and economic growth: Evidence from Zimbabwe," *Investment Management and Financial Innovations*, vol. 13, no. 2, pp. 65-75, 2016. [Online]. Available: https://businessperspectives.org/images/pdf/applications/publishing/templates/article/assets/747/imfi_en_2016_02_Bara.pdf
- [11] D. L. Blackwood, and R. G. Lynch, "The measurement of inequality and poverty: A policy maker's guide to the literature," *World Development*, vol. 22, no. 4, pp. 567-578, 1994, doi: [https://doi.org/10.1016/0305-750X\(94\)90112-0](https://doi.org/10.1016/0305-750X(94)90112-0).
- [12] N. Bloom, B. Eifert, A. Mahajan, D. McKenzie, and J. Roberts, "Does management matter? Evidence from India," *The Quarterly Journal of Economics*, vol. 128, no. 1, pp. 1-51, 2013, doi: <https://doi.org/10.1093/qje/qjs044>.
- [13] N. Bloom, M. Draca, and J. Van Reenen, "Trade induced technical change? The impact of Chinese imports on innovation, IT and productivity," *The Review of Economic Studies*, vol. 83, no. 1, pp. 87-117, 2016, doi: <https://doi.org/10.1093/restud/rdv039>.
- [14] J. Bradshaw, and G. Main, "Child poverty and deprivation," in *The Wellbeing of Children in the UK*, 2016, p. 31.
- [15] J. Cain, R. Hasan, and D. Mitra, "Trade liberalization and poverty reduction: New evidence from Indian states," *Policy Research Working Paper Series. The World Bank*, 2010, doi: <https://doi.org/10.1596/1813-9450-5284>.
- [16] Central Bank of Nigeria, "Financial Inclusion," 2010. [Online]. Available: <https://www.cbn.gov.ng/fininc/>
- [17] Central Bank of Nigeria, "Toward a cashless Nigeria: Tool and strategies," 2012. [Online]. Available: <https://www.ncs.org.ng/wp-content/uploads/2012/08/cashless2012-4.pdf>
- [18] S. Chaudhuri, "Assessing vulnerability to poverty: Concepts, empirical methods and illustrative examples," *Journal of Human Development*, vol. 4, no. 2, pp. 191-215, 2003, doi: <https://doi.org/10.1080/1464988032000074855>.
- [19] D. T. Dalis, "The Nigerian banking system and the challenges of financial intermediation in the twenty-first century," *Journal of Business and Management*, vol. 4, no. 1, 2010. [Online]. Available: https://www.academia.edu/37729320/THE_NIGERIAN_BANKING_SYSTEM_AND_THE_CHALLENGES_OF_FINANCIAL_INTERMEDIATION_IN_THE_TWENTY-FIRST_CENTURY
- [20] V. V. Danaan, "Analysing poverty in Nigeria through theoretical lenses," *Journal of Sustainable Development*, vol. 11, no. 1, pp. 20, 2018, doi: <https://doi.org/10.5539/jsd.v11n1p20>.
- [21] R. S. Dauda, "Poverty and economic growth in Nigeria: Issues and policies," *Journal of Poverty*, vol. 21, no. 1, pp. 61-79, 2017, doi: <https://doi.org/10.1080/10875549.2016.1141383>.
- [22] Economist Intelligence Unit, "State of play: Fintech in Nigeria - Real estate market research and data Nigeria and Africa - ei - Estate Intel," 2020. [Online]. Available: <https://estateintel.com/app/reports/state-of-play-fintech-in>
- [23] EFINA, "Nigeria: New data from EFINA shows financial inclusion growth," GOV.UK, 2020. [Online]. Available: <https://www.gov.uk/government/news/nigeria-new-data-from-efina-shows-financial-inclusion-growth>

- [24] O. S. Emmanuel, and A. A. Adebayo, "ICT's, service delivery and operational performance in Nigerian Banks: A survey of empirical research," *International Multidisciplinary Journal*, vol. 5, no. 4, pp. 44-59, 2011. [Online]. Available: <https://pdfs.semanticscholar.org/b585/8ac8d8ab2a9f0b1a9bbe7a11de87cb43c251.pdf>
- [25] N. Emara, and M. Mohieldin, "Beyond the digital dividends: Fintech and extreme poverty in the Middle East and Africa," *IEEE Trans. Eng. Manage.*, vol. 68, no. 1, pp. 216-226, Feb. 2021.
- [26] R. F. Engle, and C. W. J. Granger, "Co-integration and error correction: representation, estimation, and testing," *Econometrica*, vol. 55, no. 2, pp. 251-276, Mar. 1987.
- [27] Eurosystem, "What is "fintech" and how is it changing financial products?" Accessed: May 11, 2023. [Online]. Available: <https://www.centralbank.ie/consumer-hub/explainers/what-is-fintech-and-how-is-it-changing-financial-products>
- [28] E. Feyen, J. Frost, L. Gambacorta, H. Natarajan, and M. Saal, "Fintech and the digital transformation of financial services: Implications for market structure and public policy," *Bank for International Settlements*, Tech. Rep. BIS Bulletin, no. 117, Mar. 2021.
- [29] R. G. Fichman, "Information technology diffusion: A review of empirical research," in *Proc. Thirteenth International Conference on Information Systems ICIS '92*, Dallas, Texas, USA, 1992, pp. 1-24.
- [30] Findexable, "Global fintech rankings report: Bridging the gap in partnership with spotlight partners," Accessed: May 11, 2023. [Online]. Available: <https://findexable.com/wp-content/uploads/2021/06/Global-Fintech-Rankings-2021-v1-23-June-21.pdf>
- [31] J. Guild, "Fintech and the future of finance," *Asian J. Public Affairs*, vol. 10, no. 1, pp. 1-16, 2017.
- [32] D. Heng, A. Ivanova, R. Mariscal, U. Ramakrishnan, and J. Wong, "Advancing financial development in Latin America and the Caribbean," IMF Working Papers, no. 16/81, Apr. 2016.
- [33] S.-Y. Ho, and B. N. Iyke, "Finance-growth-poverty nexus: A re-assessment of the trickle-down hypothesis in China," *Econ. Change Restruct.*, vol. 51, no. 3, pp. 221-247, Aug. 2017.
- [34] M. Hofer, K. Hamel, and H. Kharas, "The start of a new poverty narrative," *Brookings*, Jun. 2018. Accessed: May 11, 2023. [Online]. Available: <https://www.brookings.edu/blog/future-development/2018/06/19/the-start-of-a-new-poverty-narrative/>
- [35] H. Kharas, K. Hamel, and M. Hofer, "Rethinking global poverty reduction in 2019," *Brookings*, Dec. 2018. Accessed: May 11, 2023. [Online]. Available: <https://www.brookings.edu/blog/future-development/2018/12/13/rethinking-global-poverty-reduction-in-2019/>
- [36] Y. Kim, Y.-J. Park, J. Choi, and J. Yeon, "An empirical study on the adoption of 'fintech' service: Focused on mobile payment services," *Int. J. Appl. Eng. Res.*, vol. 11, no. 2, pp. 1058-1061, 2015.
- [37] KPMG, "Pulse of Fintech H2' 21," Feb. 2022. [Online]. Available: <https://assets.kpmg/content/dam/kpmg/xx/pdf/2022/02/pulse-of-fintech-h2-21.pdf>
- [38] T. Lal, "Impact of financial inclusion on poverty alleviation through cooperative banks," *Int. J. Soc. Econ.*, vol. 45, no. 5, pp. 808-828, 2018.
- [39] J. Madir, Fintech. [Online]. Available: <https://doi.org/10.4337/9781788979016>
- [40] McKinsey, "Executive's guide to developing AI at scale | McKinsey," 2020. [Online]. Available: <https://www.mckinsey.com/business-functions/mckinsey-analytics/our-insights/executives-guide-to-developing-ai-at-scale#intro>
- [41] D. N. McCloskey, *Bourgeois Equality: How Ideas, Not Capital or Institutions, Enriched the World*. Chicago: University of Chicago Press, 2017.
- [42] B. L. Mercurius, S. Steph, and A. S. Fangky, "Role of fintech mechanism to technological innovation: A conceptual framework," *Int. J. Innov. Sci. Res. Technol.* [Online]. Available: <https://www.ijisrt.com/role>
- [43] I. Micu, and A. Micu, "Financial technology (Fintech) and its implementation on The Romanian non-banking capital market," *SEA - Practical Application of Science*, vol. 4, no. 11, pp. 379-384, 2016.
- [44] C. Monye, "Lessons from Nigeria's fintech history: Part 1," *Future Africa*, 2022. [Online]. Available: <https://future.africa/blog/the-history-of-fintech-in-nigeria-part-1/>
- [45] G. C. Moore, and I. Benbasat, "Development of an instrument to measure the perceptions of adopting an information technology innovation," *Inf. Syst. Res.*, vol. 2, no. 3, pp. 192-222, 1991.
- [46] Nigeria Bureau of Statistics, "Nigeria General Household Survey Panel 2015-2016 Wave 3| GHDx," ghdx.healthdata.org, 2019. [Online]. Available: <http://ghdx.healthdata.org/record/nigeria-general-household-survey-panel-2015-2016-wave-3>
- [47] B. Nicoletti, *The Future of FinTech*. Springer International Publishing, 2017.
- [48] A. Njanja, "Fintechs in Africa Continue to overshadow all other start-ups in funding gained," *TechCrunch*, Jan. 2022. [Online]. Available: <https://techcrunch.com/2022/01/04/fintechs-in-africa-continue-to-overshadow-all-other-startups-in-funding-gained/>

- [49] OECD, "Inequality - Poverty rate - OECD data," The OECD, 2021. [Online]. Available: <https://data>
- [50] P. V. Okoye, K. Nwisiennyi, and O. A. Obi, "Emerging financial technological innovation and economic growth in Nigeria," *EPRA International Journal of Research and Development (IJRD)*, vol. 4, no. 9, pp. 1-10, 2019, doi: <https://doi.org/10.18408/ijrdt-2019-0091>.
- [51] I. B. Oluwatayo, "Gender dimensions of poverty and coping options among smallholder farmers in Eastern Nigeria," *Mediterranean Journal of Social Sciences*, vol. 5, no. 27, pp. 121-134, 2014, doi: <https://doi.org/10.5901/mjss.2014.v5n27p49>.
- [52] A. O. Omobowale, "Livelihood, agro ecological zones and poverty in rural Nigeria," *Journal of Agricultural Science*, vol. 6, no. 2, pp. 103-113, 2014, doi: <https://doi.org/10.5539/jas.v6n2p103>.
- [53] K. U. Omoyibo, "Leadership, governance, and poverty in Nigeria," vol. 4, pp. 29-36, 2013, doi: <https://doi.org/10.5901/mjss.2013.v4n6p29>.
- [54] O. Onuoha, T. Peregrino, and U. Isiavwe, "Fintech as the driver for growth in Africa's banking sector," DLA Piper, Apr. 2019. Accessed: May 11, 2023. [Online]. Available: <https://www.dlapiper.com/en/uk/insights/publications/2019/04/africa-connected-issue-2/fintech-as-the-driver/>
- [55] F. E. Orokpo, and O. Ngara, "ICT as alternative model for poverty reduction in Nigeria: An appraisal of the telecom revolution," *International Journal of Publication and Social Studies*, vol. 2, no. 1, pp. 14-22, 2017, doi: <https://doi.org/10.18488/journal.135.2017.21.14.22>.
- [56] S. Oshewolo, "Gallopings poverty in Nigeria: An appraisal of government interventionist policies," *Journal of Sustainable Development in Africa*, vol. 12, no. 6, pp. 264-274, 2010.
- [57] P. K. Ozili, "Impact of digital finance on financial inclusion and stability," *Borsa Istanbul Review*, vol. 18, no. 4, pp. 329-340, 2018, doi: <https://doi.org/10.1016/j.bir.2017.12.003>.
- [58] F. O. Ozoh, I. D. Nwaka, C. O. Igberi, and K. E. Uma, "The influence of investments on economic growth: The case of Nigeria," *International Journal of Research in Management, Economics and Commerce*, vol. 6, no. 10, pp. 29-39, 2016.
- [59] R. N. J. Pierre, "Information and communication technology (ICT) in banking operations in Nigeria – An evaluation of recent experiences," 2016. Accessed May 11, 2023. [Online]. Available: https://www.academia.edu/8415172/Information_and_Communication_Technology_ICT_in_Banking_Operations_in_Nigeria_An_Evaluation_of_Recent_Experiences
- [60] M. Prowse, "Towards a clearer understanding of 'vulnerability' in relation to chronic poverty," SSRN, 2003. [Online]. Available: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1754445
- [61] E. M. Rogers, *Diffusion of Innovations*, 5th ed. Free Press, 2003.
- [62] A. Sen, "Poor, relatively speaking," *Oxford Economic Papers*, vol. 35, no. 2, pp. 153-169, 1983, doi: <https://doi.org/10.1093/oxfordjournals.oep.a041740>.
- [63] S. Shahin, T. V. Tetyana, and R. Pavlo, "Fintech in economic growth: Cross-country analysis," in *55th International Scientific Conference on Economic and Social Development – Baku*, 2020.
- [64] A. Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*. Methuen and Co. Ltd., 1776.
- [65] S&P Global Market Intelligence, "An introduction to fintech: Key sectors and trends," 2016. [Online]. Available: <https://www.spglobal.com/marketintelligence/en/documents/an-introduction-to-fintech-key-sectors-and-trends.pdf>
- [66] T. Suri, and W. Jack, "The long-run poverty and gender impacts of mobile money," *Science*, vol. 354, no. 6317, pp. 1288-1292, 2016, doi: <https://doi.org/10.1126/science.aah5309>.
- [67] R. A. M. Titumir, "Poverty and inequality in Bangladesh," in M. A. Hossain (Ed.), *Development Issues in Bangladesh: A New Agenda*. Springer, 2021, pp. 139-166, doi: https://doi.org/10.1007/978-981-16-0658-8_5.
- [68] C. U. Uche, and A. E. Ehikwe, "Marketing of banking services in Nigeria," *Journal of Financial Services Marketing*, vol. 6, no. 2, pp. 133-146, 2001, doi: <https://doi.org/10.1057/palgrave.fsm.4770047>.
- [69] UNDP, "Human Development Report 2016," United Nations Development Programme, 2016. [Online]. Available: <https://www.undp.org/content/undp/en/home/librarypage/hdr/2016-human-development-report.html>
- [70] United Nations, "Envision2030: 17 Goals to Transform the World for Persons with Disabilities," United Nations Enable, 2015. [Online]. Available: <https://www.un.org/development/desa/disabilities/envision2030.html>
- [71] P. Varma, S. Nijjer, K. Sood, S. Grima, and R. Rupeika-Apoga, "Thematic analysis of financial technology (fintech) influence on the banking industry," *Risks*, vol. 10, no. 1, pp. 186, 2022, doi: <https://doi.org/10.3390/risks1010018>.
- [72] B. E. Whitacre, D. Meadowcroft, and R. Gallardo, "Firm and regional economic outcomes associated with a new, broad measure of business innovation,"

- Entrepreneurship & Regional Development*, vol. 31, no. 7-8, pp. 551-572, 2019, doi: <https://doi.org/10.1080/08985626.2019.1630486>.
- [73] J. C. Wood (Ed.), *Karl Marx's Economics: Critical Assessments*. Routledge, 1988.
- [74] World Bank, "Measuring poverty," 2016. [Online]. Available: <https://www.worldbank.org/en/topic/measuringpoverty>
- [75] World Poverty Clock, "The percentage of Nigerians living in extreme poverty could increase by 2030," 2018. [Online]. Available: <https://kamlafoundation.org/wp-content/uploads/2019/01/World-Poverty-Clock.pdf>
- [76] Y. Ye, S. Chen, and C. Li, "Financial technology as a driver of poverty alleviation in China: Evidence from an innovative regression approach," *Journal of Innovation & Knowledge*, vol. 7, no. 1, pp. 100164, 2022, doi: <https://doi.org/10.1016/j.jik.2022.100164>.
- [77] Zeidy, "Common market for Eastern and Southern Africa special report: The role of financial technology (FINTECH) in changing financial industry and increasing efficiency in the economy," 2022. [Online]. Available: <https://www.comesa.int/wp-content/uploads/2022/05/The-Role-of-Financial-Technology.pdf>
- [78] M. Woodford, *Interest & Price: Foundations of a Theory of Monetary Policy*. Princeton University Press, 2003.
- [79] CBN. "REMINDER: Nationwide implementation of cashless policy starts April 1st," *Nairametrics*, Mar. 6, 2020. [Online]. Available: <https://nairametrics.com/2020/03/06/reminder-nationwide-implementation-of-cashless-policy-starts-april-1st/>
- [80] C. Sutter, G. D. Bruton, and J. Chen, "Entrepreneurship as a solution to extreme poverty: A review and future research directions," *Journal of Business Venturing*, vol. 34, no. 1, pp. 197-214, 2019.
- [81] B. Chen, and C. Zhao, "Poverty reduction in rural China: Does the digital finance matter?," *PLoS ONE*, vol. 25, no. 16, 2010.
- [82] C. W. J. Granger, and P. Newbold, "Spurious regressions in econometrics," *Journal of Econometrics*, vol. 2, no. 2, pp. 111-120, 1974, doi: [https://doi.org/10.1016/0304-4076\(74\)90034-7](https://doi.org/10.1016/0304-4076(74)90034-7).
- [83] C. W. J. Granger, "Developments in the study of cointegrated economic variables," *Oxford Bulletin of Economics and Statistics*, vol. 48, no. 3, pp. 213-228, 1986, doi: <https://doi.org/10.1111/j.1468-0084.1986.mp48003002.x>.