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Electronic Payment Systems And Economic Development In Nigeria.

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ABSTRACT: *The study investigated the relationship between electronic payment systems and economic development in Nigeria. The study utilized an ex-post facto research design. The population of this study was the entire Nigerian economy where the data items used in this research were obtained specifically from Central Bank of Nigeria and World Bank. The study employed judgemental sampling technique over a 16-year period (2009-2024) to explore the relationship between electronic payment systems (ATM, POS), key economic development indicators (gross domestic product, human development index) and the moderating effect of digital literacy rate. Data were sourced from Central Bank of Nigeria and World Bank reports, analyzed using Eviews-9 statistical package and SPSS version, 25, employing descriptive statistics and Ordinary Least Squares (OLS) regression. Results confirmed a positive significant relationships between Automated Teller Machine (ATM), Point of Sales (POS) Terminals, and Gross Domestic Product (GDP). The result also, disclosed a positive significant relationship between Automated Teller Machine (ATM), Point of Sales (POS) Terminals, and Human Development Index (HDI). More so, the result indicated a positive significant moderating effect of Digital Literacy Rate (DLR) on electronic payment systems and economic development in Nigeria. Hence, the investigator concluded that there is a substantial and meaningful relationship between electronic payment systems and economic development in Nigeria. The study further suggested that policymakers should work towards increasing accessibility of ATM and POS terminals, especially in underserved areas, and ensuring the efficiency of these electronic payment channels. Policymakers should also collaborate with relevant stakeholders to design and implement programs that enhance digital literacy, with a specific focus on utilizing electronic payment systems amongst other things.*

Keywords*: Electronic payment systems, economic development, gross domestic product (GDP)*

INTRODUCTION

Background to the study

Economic development in Nigeria faces a complex landscape marked by a mix of challenges and opportunities. Despite being Africa's largest economy, Nigeria grapples with issues such as widespread poverty, inadequate infrastructure, corruption, and over-reliance on oil revenue, leaving it vulnerable to global market fluctuations. However, recent efforts have focused on diversification, particularly in sectors like agriculture, manufacturing, and technology, aiming to reduce dependency on oil and foster sustainable growth. Initiatives such as the Economic Recovery and Growth Plan (ERGP) and reforms in the business environment strive to attract investment and stimulate entrepreneurship. Furthermore, the country's youthful population presents a demographic dividend that, if harnessed effectively through education and job creation, could drive innovation and productivity.

Economic development in Nigeria has had a significant impact on the evolution and adoption of electronic payment systems. As the country has experienced economic growth and modernization, the demand for efficient and technologically advanced financial services has increased. As more individuals and businesses become part of the formal economy, there is a growing need for accessible and convenient financial services. Electronic payment systems, including automated teller machines (ATMs), point of sale (POS), online banking, and payment via mobile device, have played a crucial role in bringing financial services to a broader population, especially in remote or underserved areas. However, this study is delimited to only automated teller machine (ATM) and point of sale (POS) as proxies for electronic payment systems.

Economic development in Nigeria has been accompanied by urbanization and changing lifestyles. Urban centers often drive the demand for more advanced financial solutions (Eke et al., 2023). Electronic payment systems, such as point of sale (POS) terminals and online transactions, cater to the needs of urban populations who seek faster and more convenient ways to conduct financial transactions. Economic development often involves improvements in technological infrastructure. Nigeria has witnessed advancements in telecommunications and internet connectivity, which are essential for the functioning of electronic payment systems (Odukwu et al., 2023). The availability of robust technology infrastructure facilitates the widespread adoption of digital payment methods. Economic development is frequently supported by government initiatives aimed at modernizing the financial sector.

The Central Bank of Nigeria's (CBN) actions and regulatory assistance have been instrumental in advancing electronic payment systems in Nigeria. Policies and regulatory frameworks have been established to promote the use of digital financial services. Consumer confidence in digital financial services tends to rise as the economy grows (Suleiman et al., 2023). In Nigeria, a burgeoning middle class and a more technologically literate populace have helped to increase the acceptance of electronic payment

methods. Widespread adoption of these technologies depends on confidence in their dependability and security. By decreasing the need for cash transactions and increasing transaction speed overall, electronic payment solutions help businesses operate more efficiently. In turn, this promotes a more effective and transparent financial environment, which boosts economic growth. Innovation and entrepreneurship are encouraged by economic progress. The fintech industry has exploded in Nigeria, bringing cutting-edge electronic payment solutions. Fintech and startup businesses have been essential in growing the market for online financial services.

Sustainable economic performance is a key focus for responsible government financial and economic policies, acting as an indicator of a nation's economic health. Central to economic performance is the efficiency of the financial payment system. In today's competitive marketplace, various Electronic Payment Systems (EPS) have emerged to simplify and speed up payments. Zwingina et al. (2023), opined that electronic payments system is crucial in the economy, serving as the route through which financial resources move between different parts. In Nigeria, just like other modern economies, several electronic payment platforms have been introduced, such as automated teller machine (ATM), point of sale (POS), Internet transactions, Mobile Payments, Instant Payments, Nigeria Inter Bank Settlement System (NIBSS), and Electronic Fund Transfer (NEFT). Though services like ATM, POS, internet payments, and mobile payments have been around since 2006, NIBSS instant payments and NEFT were introduced in 2012 (Musa & Onipe, 2022). Despite this, the use of electronic payment systems in Nigeria has significantly increased.

Electronic payment systems, utilizing internet and mobile technologies, reduce the need for cash and physical bank branches. They connect people and companies to a digitalized national payment infrastructure, facilitating smooth transactions. However, stakeholders like banks, mobile network providers, regulators, intermediaries, and customers must collaborate.

Improving electronic payment system mechanisms requires enhancements in infrastructure to ensure user-friendly, secure, and cost-effective services. Notably, electronic payment systems significantly contribute to overcoming obstacles related to transactions outside traditional banking halls, thereby fostering national economic growth and financial inclusion.

Statement of the Problem

In recent years, Nigeria has experienced a notable improvement in its economic growth trajectory, with Gross Domestic Product (GDP) showing a consistent upward trend despite global economic headwinds (National Bureau of Statistics, 2024). This sustained growth demonstrates resilience in the country's productive sectors, thereby shifting GDP from being a critical economic concern to a relatively stable indicator of performance. Consequently, the focus of contemporary economic discourse in Nigeria has moved beyond GDP as the primary measure of economic well-being, redirecting attention toward persistent structural and macroeconomic challenges.

Despite the upward GDP trend, inflationary pressures, exchange rate volatility, widening fiscal deficits, and sector-specific productivity constraints remain pressing issues that hinder the attainment of broader socio-economic objectives (Central Bank of Nigeria, 2024). These challenges undermine household purchasing power, elevate the cost of doing business, and strain public finances, threatening the sustainability of current growth patterns. Addressing them requires targeted policy interventions capable of fostering macroeconomic stability, improving institutional efficiency, and ensuring that economic growth translates into tangible improvements in living standards.

Against this backdrop, numerous scholars have examined the role of electronic payment systems in addressing some of Nigeria's economic and financial bottlenecks. The adoption of legislative and regulatory measures—including currency redesigns, withdrawal limits, and the introduction of Neobanks—was intended to modernize transactions, enhance financial inclusion, and strengthen the formal economy (Saidi, 2018). Electronic payment systems theoretically promise faster transactions, reduced cash handling risks, and improved revenue collection for the government, making them an attractive tool for economic transformation.

However, persistent operational and consumer-related challenges have limited the effectiveness of these systems. Studies, such as those by Iluno, Alikwu, and Atser (2018), have reported issues including malfunctioning ATMs, network outages, online fraud, hidden charges, obligatory acquisition of ATM cards, unavailability of financial services, and the refusal of Nigerian cards for international transactions. These limitations raise critical questions about whether electronic payment systems are truly delivering their intended economic benefits or inadvertently exacerbating existing inefficiencies. This study seeks to bridge this gap by empirically examining the impact of electronic payment systems on Nigeria's economic development, with a focus on both their potential contributions and the persistent challenges undermining their effectiveness.

Aims/Objective of the study

The aim of this study was to investigate the relationship between electronic payment systems and economic development in Nigeria. However, specifically, the study sought to:

i Investigate the relationship between Automated Teller Machine and gross domestic product in Nigeria.
ii Determine the relationship between Automated Teller Machine and human development index in Nigeria.
iii Assess the relationship between Point of Sale (POS) and gross domestic product in Nigeria.

iv Investigate the relationship between Point of Sale (POS) and human development index in Nigeria.

v Determine the moderating effect of digital literacy rate on electronic payment systems and economic development in Nigeria.

Research Questions

The following research question were answered;

i What is the relationship between Automated Teller Machine and gross domestic product in Nigeria?

ii What is the relationship between Automated Teller Machine and human development index in Nigeria?

iii What is the relationship between Point of Sale (POS) and gross domestic product in Nigeria?

iv What is the relationship between Point of Sale (POS) and human development index in Nigeria?

v What is the moderating effect of digital literacy rate on electronic payment systems and economic development in Nigeria?

Research Hypotheses

The study tested the following research null hypotheses;

H_{01}: There is no significant relationship between Automated Teller Machine and gross domestic product in Nigeria.

H_{02}: There is no significant relationship between Automated Teller Machine and human development index in Nigeria.

H_{03}: There is no significant relationship between Point of Sale (POS) and gross domestic product in Nigeria.

H_{04}: There is no significant relationship between Point of Sale (POS) and human development index in Nigeria.

H_{05}: There is no significant moderating effect of digital literacy rate on electronic payment systems and economic development in Nigeria.

Significance of the Study

The significance of the study on the relationship between electronic payment systems and economic development in Nigeria has implications for various stakeholders, including policymakers, financial institutions, technology companies, and the general population. Here are some key points highlighting the significance of the study to relevant stakeholders:

Policymakers: Policymakers can use the study findings to inform strategic decisions related to economic development. The study suggests that expanding and optimizing electronic payment infrastructure, improving digital literacy, and supporting financial technology innovations can have positive effects on GDP per capita and human development indicators. Policymakers can design targeted interventions and initiatives based on these recommendations.

Financial Institutions: The study emphasizes the importance of expanding and optimizing ATM, POS and mobile payment infrastructure. Financial institutions can leverage this information to enhance their electronic payment services, improving accessibility and efficiency. Additionally, the encouragement of financial technology innovations aligns with the interests of banks and other financial institutions looking to stay competitive in the digital era.

Technology Companies: Technology companies, particularly those involved in developing electronic payment solutions and financial technologies, can benefit from the study's recommendations. The call for user-friendly mobile payment applications aligns with the interests of technology companies seeking to innovate and offer solutions that meet the needs of a growing market.

Digital Literacy Advocates: Organizations and individuals advocating for digital literacy will find significance in the study's emphasis on integrated digital literacy initiatives. This information can be used to strengthen the case for educational programs and awareness campaigns that focus on enhancing digital literacy, especially in the context of utilizing electronic payment systems.

Educational Institutions: Educational institutions can take note of the study's suggestion for a comprehensive national digital literacy strategy. This highlights the importance of incorporating digital literacy into educational curricula and developing skill development programs to prepare individuals for a digitally literate future.

General Population: The study's findings are ultimately relevant to the general population in Nigeria. As electronic payment systems play a role in economic development, individuals stand to benefit from increased accessibility, efficiency, and security in financial transactions. Moreover, the study emphasizes the potential positive impact on human development indicators, such as education and healthcare.

Innovators and Entrepreneurs: Innovators and entrepreneurs in the financial technology sector can find motivation and support in the study's recommendation for policymakers to provide incentives for innovations in financial technology. This encourages the development of new and secure solutions, contributing to the growth of the digital economy.

Scope of the Study

The subject matter of this study was to determine the relationship between electronic payment systems and economic development in Nigeria. The scope of the study is viewed from the perspective of geographical scope, content scope, and unit of analysis.

Geographical Scope: The geographic area covered by this study is Nigeria.

Content Scope: The study is framed to cover conceptual, theoretical and empirical literature reviews on the relationship between electronic payment systems and economic development in Nigeria. electronic payment systems is proxied by Automated teller machine and Point of Sales, and that of economic development is proxied by GDP per Capita and Human Development Index moderated by digital literacy (digital literacy rate).

Unit of Analysis: This study covered the macro level analysis (the entire economy) since it is based on the secondary data obtained from the annual report of Central Bank of Nigeria statistical bulletin and World Bank Statistics.

LITERATURE REVIEW

Theoretical framework

Innovation Diffusion Theory

The Diffusion of Innovation theory (DOI) by Rogers (1976) is a core theory that explains the causality between variables in adopting new technologies. It posits that adopting innovations involves reducing uncertainty by gathering and combining information on the latest technologies (Rogers, 1995). This process produces opinions about using technology, leading to the decision to accept or reject it. The theory is influenced by five key concepts: reliability, trial ability, intricacy, observability, or and relative advantage. This theory explains why people choose new technologies over conventional ones (Isibor et al., 2018).

In exploring the dynamics of electronic payment systems and their impact on economic development in Nigeria, it's crucial to delve into the multifaceted layers that characterize this intersection. Nigeria, as a developing economy, has witnessed a surge in the adoption of electronic payment systems, driven by technological advancements, changing consumer behaviors, and government initiatives.

One of the driving forces behind the widespread adoption of electronic payment systems is the increasing need for financial inclusion. Nigeria, like many other countries, recognizes the importance of bringing more people into the formal financial sector. Electronic payment systems, ranging from mobile banking to online transactions, play a pivotal role in achieving this goal. They provide individuals, even in remote areas, with access to financial services, allowing them to participate more actively in economic activities. Moreover, the diffusion of electronic payment systems aligns with the broader narrative of technological innovation as a catalyst for economic development. The convenience and efficiency offered by these systems contribute to a more seamless flow of transactions, fostering entrepreneurship and economic activities. Small businesses, in particular, benefit from the ease of receiving payments and managing finances through digital channels.

The government plays a crucial role in promoting electronic payment systems, promoting digital transactions, and reducing cash reliance. These initiatives aim to enhance transparency, reduce corruption, and stimulate economic growth. However, security concerns like cyber fraud and data breaches pose threats, necessitating continuous efforts to enhance cybersecurity measures and raise user awareness.

Electronic payment systems in Nigeria are transforming the economy, influencing consumer behavior and promoting a cashless culture. FinTech companies are driving the evolution of these systems, and collaboration between traditional institutions and FinTech disruptors is driving financial inclusion and innovation. The integration of these systems presents opportunities and challenges, but the collaborative efforts of government, businesses, and consumers will shape economic development and create a more inclusive and technologically vibrant future.

New Growth Theory

Paul Romer introduced the new growth theory in 1990, which suggests that economic expansion is driven by the ambitions and wants of individuals (Rashid, 2022). According to this theory, individuals' pursuit of maximizing profits leads to an increase in real GDP per capita. The theory emphasizes the importance of entrepreneurship, innovation, knowledge, and technology as catalysts for economic progress, challenging the notion that economic growth comes solely from external factors. The new growth hypothesis argues that information is a valuable resource for economic growth and is not subject to decreasing returns. It posits that innovation and the adoption of new technologies are driven by the pursuit of knowledge and human capital, aiming for better profits. E-payment systems, which facilitate domestic spending, are seen as an endogenous catalyst for economic growth (Saidi, 2018; Romer & Lane, 2022). The study proposes to examine the interconnection between e-payment systems, human capital, and technical expertise to establish a foundation for successful implementation in Nigeria, leading to increased consumption and long-term economic growth.

Electronic Payment Systems

Amin et al. (2018) define e-payment systems as automated procedures that facilitate the exchange and transfer of money over ICT networks in business transactions. “In Nigeria, e-payment refers to the process of transferring payment electronically from one party

to another using electronic devices (computers, smartphones, iPads and other tablet devices) without the need for any manual interaction beyond entering the payment information (Udeghi & Hanzace, 2018)".

The e-payment system has emerged as a handy means of circulating monetary transactions, particularly in developing economies like Nigeria where carrying physical cash is common. It has played a crucial role in establishing a modern market economy in Nigeria, with significant implications for financial stability, monetary policy, and total economic activity (Aduda & Kingoo, 2018).

The CBN implemented a payment system in 2002 that enabled electronic payments. The Nigeria Automated Clearing System (NACS) was implemented as an effective platform for the advancement of electronic payment and to decrease the time required for clearing cheques. Interswitch deployed ATMs in 2003 and implemented Real Time Gross Settlement in 2006. The migration to the new uniform accounting system (NUBAN) took place in 2010. “In early 2011, the Nigerian Inter-bank Settlement System introduced instant payment services and released the initial batch of cash deposit ATMs” (Andrea et al., 2022).

Automated Teller Machine (ATM)

According to Edet (2019), an automated telecommunications system known as an ATM allows customers to perform financial transactions without the assistance of a human clerk or bank teller. Customers can use ATMs to withdraw cash and check their account balance. These transactions require authorization from the card issuer or another authorizing organization through a communications network. Some financial institutions charge fees for using ATMs, with fees in Nigeria ranging from ₦100 to ₦150 for Not-on-us transactions. ATMs offer various features such as cash withdrawals, balance inquiries, mini-statement requests, funds transfers, and purchases. The volume of ATM transactions in Nigeria has exhibited significant growth over the years, as evidenced by the data provided (Edet, 2019). From 2009 to 2024, there's been a remarkable increase from 1,939,548.6 to 1,506,991,903.00, reflecting the evolving landscape of financial transactions facilitated by automated telecommunications systems. Akinuli (2018) highlights the multifaceted benefits that ATMs offer to both customers and banks, including enhanced convenience, reduced risk of robbery, and increased profitability through customer charges. Despite occasional fluctuations, such as the dip in transaction volume observed in 2017 and 2018, likely influenced by various factors including economic conditions and regulatory changes, the overall trend underscores the integral role that ATMs play in modern banking operations in Nigeria.

Point of Sale (POS)

The volume of Point of Sale (POS) transactions in Nigeria has experienced a substantial increase over the years, as indicated by the data provided (John, 2019). From 83,919.22 to 3,885,782,065, there's been a notable escalation, illustrating the growing reliance on electronic payment systems within the retail sector. POS machines serve as integral tools in facilitating transactions, offering convenience, efficiency, and enhanced security for both retailers and customers. They enable various functions such as micro statements, balance inquiries, and purchase payments, contributing to operational effectiveness and revenue generation. Additionally, POS systems play a crucial role in reducing the reliance on cash transactions, thereby mitigating the risks associated with cash handling and offering a practical payment method that aligns with modern consumer preferences.

Economic development

Economic development pertains to the creation of wealth that is derived from the advantageous progress and betterment of society. This phenomenon is not limited solely to discrete development projects, but rather extends to the overall progress of the economy in relation to other criteria such as education, resource accessibility, and living standards. The concept of economic development include the expansion and improvement of educational institutions, recreational parks, and public safety infrastructure (Odukwu et al., 2022). The significance of economic development resides in the enhancement of the overall welfare of the populace. The efficient allocation of resources is a crucial factor in driving economic development, which may be attributed as one of the reasons for the sluggish growth observed in growing economies (Agbo et al., 2020).

Gross Domestic Product

Gross domestic product (GDP) is a comprehensive measure of a country's economic well-being, representing the total monetary worth of all final goods and services produced inside its boundaries during a certain period of time (Clive, 2017). The elements comprising a nation's GDP encompass private and public consumption, government expenditures, investments, changes in private inventories, building expenses, and the international trade balance (Isibar, 2018). The trade balance between countries, an essential factor, has a substantial impact on determining a nation's Gross Domestic Product (GDP). A trade surplus occurs when the value of goods and services sold by domestic producers to foreign countries surpasses the value of foreign goods and services purchased by domestic consumers.

Electronic payment systems in Nigeria have a significant impact on the country's GDP. They enhance efficiency and transparency in financial transactions, potentially affecting trade balances, trade surpluses, consumer spending, and investment activities. Governments' use of these systems also contributes to efficient resource allocation, boosting GDP. The development of secure and

efficient payment systems fosters infrastructure growth, further boosting GDP. Furthermore, the expansion of electronic payment systems contributes to financial inclusion, promoting more economic activities and potentially influencing GDP. As these systems continue to evolve, their influence on Nigeria's overall economic health will become increasingly significant.

Human Development Index

The human development index (HDI) is a composite statistic that ranks countries based on key dimensions of human development, including health, education, and standard of living (Eke et al., 2023). In Nigeria, the HDI is a key metric for assessing population progress. Electronic payment systems, particularly mobile technology, can help expand financial inclusion, alleviate poverty, and improve living standards. The widespread adoption of mobile banking and payment services in Nigeria has facilitated the growth of these systems, particularly in remote areas. This promotes entrepreneurship and positively impacts income levels, contributing to the HDI's economic dimension.

The Nigerian government is promoting electronic payment systems and digital financial services through initiatives like the Cashless Policy and the National Financial Inclusion Strategy. However, challenges like inequality and digital divide persist, including urban-rural disparities, limited access to technology, and security concerns (Odukwu et al., 2023). Enhancing digital literacy is crucial for full benefits, while integrating electronic payment systems into healthcare can improve access and streamline payments. Additionally, electronic payment systems facilitate international transactions, influencing Nigeria's global position and contributing to economic activities.

The moderating effect of digital literacy rate

Digital literacy refers to the ability of individuals to use digital technologies effectively and encompasses skills such as using electronic payment platforms, navigating online interfaces, and understanding the implications of digital transactions (Gillwald & Mothobi, 2019; Supriati, 2023). In the context of the present study, the digital literacy rate serves as a moderating variable, influencing the relationship between electronic payment systems (ATM, POS) and economic indicators (GDP, HDI). The moderating effect of digital literacy rate on electronic payment systems and economic development in Nigeria suggests that the level of digital literacy among the population plays a crucial role in determining the extent to which electronic payment systems contribute to economic development.

Investing in digital literacy initiatives and educational programs is crucial for Nigeria's economic development. A more digitally literate population is more likely to adopt electronic payment methods, leading to increased financial inclusion, transaction efficiency, and overall economic development (Gautam et al., 2022; Riggs, 2022). Strategies like training programs, workshops, and awareness campaigns can help address the moderating effect of digital literacy rate, promoting a more inclusive and technologically empowered society.

Empirical review

Nambie, Ocansey, and Amoh (2025) studied the impact of electronic payments—"specifically mobile money and internet-based transactions—on Ghana's foreign exchange stabilization and economic integration. Using an Autoregressive Distributed Lag (ARDL) model on data from 2012 to 2023, they found that e-payments significantly improve transaction efficiency, reduce cash dependency, and formalize remittance flows. These effects help stabilize forex demand while supporting domestic economic activity. Challenges include limited broadband access in rural areas and digital literacy constraints. The authors recommend expanding rural network coverage and conducting digital literacy campaigns for sustained inclusion.

Kounouwewa and Hounkou (2025) investigated how e-money access influences financial inclusion in WAEMU nations, using cross-country comparative regression analysis. Their study, benchmarked against South Asian examples (Bangladesh, Pakistan, India), demonstrated that broader e-money availability significantly boosts inclusion—especially across rural and female demographics—and lowers cross-border remittance costs. The main obstacles identified were inconsistent regulatory frameworks and limited interoperability. They recommend harmonizing fintech regulations and adopting unified e-money standards to maximize regional benefits.

Badrawani (2025) evaluated Indonesia's QRIS (Quick Response Indonesian Standard) rollout during the COVID-19 era using UTAUT (Unified Theory of Acceptance and Use of Technology) surveys with 572 respondents. Structural Equation Modeling (SEM) analysis revealed that central bank policy design—especially incentives and streamlined onboarding—was critical for QRIS adoption, leading to increased digital transaction volume and economic resilience amid the pandemic. However, weaker compatibility of the QRIS tech with older smartphones was noted. The author recommends subsidies or technology upgrades and ongoing user training to broaden the system's reach.

Aguilar et al. (2024), analyzed the relationship between digital payment adoption and economic growth across 101 economies from 2014 to 2019. The findings suggest that increased use of digital payments is associated with higher GDP per capita growth and a reduction in informal sector employment. The study finds that a one-percentage-point increase in digital payment usage correlates

with a 0.10 percentage point increase in GDP per capita growth over two years and a 0.06 percentage point decrease in informal employment share.

In their study, Suleiman et al. (2023), examined the influence of e-payment systems on the economic development of Nigeria. The analysis utilised quarterly time series data spanning from 2012Q1 to 2021Q4. The Philip Perron test, Johansen cointegration test, Vector Error Correction Model (VECM), and Dynamic Ordinary Least Square regression were employed. The findings indicate that point-of-sale and mobile payment channels have a substantial beneficial influence on economic growth, while web pay channels have a negligible impact.

Zwingina et al. (2023) studied the connection between Nigeria's economic expansion and e-payment systems between 2009 and 2018. The Auto Regressive Distributed Lag (ARDL) Model, correlation analysis, and descriptive statistics were all used in the study. The results showed that electronic payment systems have a positive impact on economic growth.

Andrea et al. (2022), investigated the impact of e-payment systems on Nigeria's gross domestic product (GDP). The research design utilised was ex-post facto, and the ARDL Model was employed. The findings revealed a substantial beneficial impact of automated teller machines (ATMs), point of sale (POS) systems, and mobile application payment systems on economic growth.

In their study, Isamade et al. (2022), examined the relationship between E-payment systems and the gross domestic product (GDP) in Nigeria. The research design utilised was ex-post facto, and the ARDL Model was employed. The findings revealed a substantial and beneficial influence of ATM, POS, and mobile application payment systems on the growth of the economy.

John (2019), examined the correlation between electronic payment methods and the economic expansion in Nigeria throughout the period of 2012-2017. The Autoregressive Distributed Lag (ARDL) regression model was utilised. The findings revealed a noteworthy positive correlation with substantial influence from ATMs, POS, and web-based transactions, whereas mobile payment had a detrimental effect.

In their study, Njoku et al. (2020), examined the influence of electronic banking on the economic growth of Nigeria from 2009 to 2018. The Vector Error Correction Model (VECM) was utilised. The findings demonstrated a substantial influence of electronic banking on economic growth, with varying effects on individuals.

Ogbeide et al. (2016), conducted a study to examine the influence of electronic banking on the economic growth of Nigeria during the period of 2009-2014. The Autoregressive Distributed Lag (ARDL) bond testing technique was utilised. The research findings demonstrated that E-banking exerted a substantial influence on economic growth, with distinct effects observed from ATMs, mobile banking, web banking, and point-of-sale transactions.

In their study, Musa and Onipe (2022), examined the correlation between electronic payment systems and economic performance in Nigeria. The utilisation of both descriptive and inferential statistics was implemented. The findings revealed a direct relationship between the use of electronic payment systems and economic success. It was determined that the external reserve plays a significant role in this link.

Omiunu's 2019 study found that the profitability of women-owned SMEs in Southwestern Nigeria is linked to ICT adoption, primarily influenced by e-literacy and business information strategies. The study suggests that proficiency in digital literacy and the development of a strategic plan for utilizing business information are important for integrating ICT and improving performance.

Okagbue et al. (2023) investigated the effects of the COVID-19 epidemic on Nigeria's school system and proposed remedies. The study included a cross-sectional online survey involving 82 learners. Demographic data was analysed using SPSS. The COVID-19 pandemic exposed shortcomings in online education, web-based learning, and information and communication technology (ICT) infrastructure, resulting in significant educational difficulties. The absence of digital capabilities among students and teachers had an impact on how digital education was seen and accepted.

Gautam et al. (2022), explored the impact of financial technology on the digital literacy rate in India, with poverty score as a moderating variable. The study used panel data analysis using data from 29 states and 2 union territories over three financial years. Results indicate that Kisan Credit Cards positively associated with literacy rate, ATMs negatively associated. Positive impact of KCCs and ATMs on literacy when interacting with poverty scores.

Gillwald and Mothobi (2019), examined ICT access and use in African countries based on the 2018 After Access ICT Access and Use Survey. The study used survey conducted in 10 African countries, Internet penetration rates assessed. Results showed that internet penetration rates vary across countries, highlighting existing inequalities". Low usage attributed to factors such as unaffordability of data and limited broadband extension in some countries. The cost of devices identified as a major barrier to uptake in several nations.

GAP in literature

The identified gaps in these studies include the following:

1. Fragmented Focus: Previous studies often focused on specific aspects of electronic payment systems, such as individual channels or economic growth, without providing a comprehensive analysis of their interconnected impact on multiple economic indicators.
2. Limited Time-based Scope: Some studies had limited time-based scopes, missing the opportunity to capture long-term trends and potential changes in the relationships over time.
3. Variable Moderation Factors: While several studies explored electronic payment systems, few incorporated moderating factors such as digital literacy, hindering a holistic understanding of the nuanced relationships.
4. Sector-Specific Analyses: The majority of previous studies primarily focused on the economic sector, neglecting the broader implications for human development.
5. The gap in terms of theory identified in previous studies was the lack of a comprehensive and integrative theoretical framework that could effectively capture the multifaceted relationships between electronic payment systems, economic indicators, and societal development. Many studies, including Suleiman et al. (2023), Zwingina et al. (2023), Andrea et al. (2022), Isamade et al. (2022), John (2019), Njoku et al. (2020), Ogbeide et al. (2016), Musa and Onipe (2022), Omiunu (2019), Okagbue et al. (2023), Gautam et al. (2022), and Gillwald and Mothobi (2019), employed specific theories relevant to their individual scopes, such as economic growth theories, adoption models, or ICT adoption frameworks.

The present study addressed these gaps by adopting a broad and inclusive research design that encompassed multiple economic indicators over a 16-year period. It explored the moderating role of digital literacy and considered the interplay between electronic payment systems and various aspects of economic development, filling crucial knowledge voids in the existing literature. The utilization of Eviews-9 and SPSS25 for a rigorous statistical analysis further strengthened the robustness of the findings. The present study addressed the theoretical gap by explicitly adopting and applying the Diffusion of Innovation theory and the New Growth Theory. This allowed for a more holistic understanding of how innovations in electronic payment systems diffuse through a society and contribute to economic growth and human development. Overall, the present study provides a comprehensive understanding of the multifaceted impact of electronic payment systems on the Nigerian economy, human development, and digital literacy, bridging gaps left by previous fragmented and sector-specific investigations.

METHODOLOGY

The design for this study was an ex-post-facto. This design uses existing data in analyzing the correlation between the variables of study such that the data cannot be manipulated by the researcher. The population of this study was the entire Nigerian economy where the data items utilised in this research were sourced. The study employed a judgemental sampling technique to select a sample over a 16-year period, specifically from 2009 to 2024. The utilisation of the judgemental sampling technique was chosen for this study due to its cost-effectiveness, convenience, efficiency, and suitability for an exploratory research design. However, the World Bank and the CBN Statistical Bulletins provided pertinent secondary data for the study. To evaluate the effect of the predictor factors on the criterion variables, the multiple regression technique was used. Descriptive statistics were used in this study's approximated approach. Data analysis was done using the statistics tool for Social Sciences version, 25 (SPSS25) and the Eview-9 statistics tool. The statistical analysis for estimating the parameter comprises several key tests, such as the coefficient of determination (R2), the Durbin-Watson statistic (DW), the F-ratio, and the t-test. The hypothesis was accepted at a significance level of 5% (0.05).

Model Specification

In accordance with the existing scholarly discourse, the electronic payment systems model can be delineated as follows:

GDP = f (ATM, POS) ….....1

HDI = f (ATM, POS) .....……2

GPD= f (ATM, POS X DLR) ….....3

GDP = Gross domestic product as a measure of economic development

HDI = Human development index as a measure of economic development

POS = Point of sale as a proxy for electronic payment systems

ATM = Automated teller machine as a proxy for electronic payment systems

DLR= Digital Literacy Rate as a moderator.

RESULTS AND FINDINGS

Data analyzed here are the properties of electronic payment systems (Automated teller machine, Point of sale), economic development (GDP and HDI) and moderating effect of digital literacy rate in Nigeria.

Table 4.1 Descriptive Statistics

	ATM	POS	GDP	HDI	DLR
Mean	4.209203	3.424973	4.818269	0.515143	0.370731
Median	3.648378	2.766007	4.838399	0.518500	0.365720
Maximum	7.154203	7.465135	4.879491	0.538000	0.548300
Minimum	2.601745	1.042576	4.703844	0.482000	0.095230
Std. Dev.	1.618557	2.318590	0.051144	0.019744	0.153088
Skewness	1.192240	0.989628	-0.962408	-0.447098	-0.303042
Kurtosis	2.754907	2.519593	2.854004	1.813548	1.700907
Jarque-Bera	3.351725	2.419812	2.173637	1.287566	1.198739
Probability	0.187147	0.298225	0.337288	0.525301	0.549158
Sum	58.92884	47.94962	67.45577	7.212000	5.190240
Sum Sq. Dev.	34.05644	69.88620	0.034004	0.005068	0.304669
Observations	16	16	16	16	16

Source: computed using Eview9

The Mean, Median, Maximum, and Minimum of Automated Teller Machine were 4.209203 BN, 3.648378 BN, 7.154203 BN, and 2.601745 BN respectively. The Mean, Median, Maximum, and Minimum of Point of Sale were 3.424973 BN, 2.766007 BN, 7.465135 BN, and 1.042576 BN.

The Mean, Median, Maximum, and Minimum of Gross Domestic Product were 4.818269 BN, 4.838399 BN, 4.879491 BN, and 4.703844 BN respectively. The Mean, Median, Maximum, and Minimum of Human Development Index were 0.515143, 0.518500, 0.538000, and 0.482000 respectively. The Mean, Median, Maximum, and Minimum of Digital Literacy Rate were 0.370731, 0.365720, 0.548300, and 0.095230 respectively. Standard Deviation indicates the amount of variation or dispersion in the data. Highest for POS, indicating greater variability. Positive skewness for ATM and POS indicates a right-tailed distribution. Negative skewness for GDP, HDI, and DLR indicates a left-tailed distribution. All variables have positive kurtosis, indicating relatively heavy tails. The p-values of the Jarque-Bera Test are greater than 0.05 for all variables, indicating no significant departure from normality.

In summary, the descriptive statistics give a thorough synopsis of the central tendency, variability, and distribution characteristics of the data. The skewness and kurtosis values suggest deviations from normality, which is confirmed by the Jarque-Bera test.

Understanding these statistics is crucial for making inferences and drawing conclusions about the dataset.

Table 4.2 Dependent Variable: GDP

Method: Least Squares
Date: 12/03/25 Time: 21:31
Sample: 1 16
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.947763	0.063315	78.14549	0.0000
ATM	0.100713	0.033575	2.999652	0.0121
POS	0.085965	0.023438	3.667787	0.0037

R-squared	0.752645	Mean dependent var	4.818269
Adjusted R-squared	0.707671	S.D. dependent var	0.051144
S.E. of regression	0.027652	Akaike info criterion	-4.150815
Sum squared resid	0.008411	Schwarz criterion	-4.013874
Log likelihood	32.05571	Hannan-Quinn criter.	-4.163492
F-statistic	16.73521	Durbin-Watson stat	0.530932
Prob(F-statistic)	0.000461		

Source: computed using Eview9

The regression results indicates GDP as the criterion variable and predictor variables as a constant ATM, and POS. ATM Coefficient = 0.100713 with a t-statistic of -2.999652 (p-value = 0.0121). POS Coefficient = 0.085965 with a t-statistic of 3.667787 (p-value = 0.0037). When all other variables are held constant, the coefficients show an estimated variation in GDP for a one-unit variation in the corresponding independent factor. R-squared = 0.752645. Adjusted R-squared = 0.707671. According to the R-squared value, the model can account for about 75.26% of the variation in GDP. The adjusted R-squared penalises for extraneous variables and takes the number of predictors into account.

Standard Error of Regression (S.E.) = 0.027652. F-statistic = 16.73521 with a p-value of 0.000461. The standard error of the regression measures the average distance between the observed and predicted values. The F-statistic tests the overall significance of the model, and the low p-value suggests that at least one independent variable is significantly related to the dependent variable. Durbin-Watson Statistic = - 0.530932. The Durbin-Watson statistic tests for autocorrelation in the residuals. A value close to 2 suggests no significant autocorrelation, while values far from 2 may indicate a potential issue.

Hypothesis Testing:

-H01 (Null Hypothesis): There is no significant relationship between Automated Teller Machine (ATM) and gross domestic product in Nigeria.

-H03 (Null Hypothesis): There is no significant relationship between Point of Sale (POS) and gross domestic product in Nigeria.

-Both hypotheses are rejected based on the p-values associated with ATM and POS coefficients (p-value < 0.05). Therefore, there is evidence to suggest that both ATM and POS have a significant relationship with GDP in Nigeria.

In conclusion, the regression analysis indicates that there is a significant relationship between ATM, POS, and GDP in Nigeria. The model explains a substantial portion of the variability in GDP, and both ATM and POS are found to be significant predictors. However, further analysis and consideration of model assumptions are advisable. Additionally, the low Durbin-Watson statistic may indicate autocorrelation, and this should be explored further to ensure the reliability of the model.

Table 4.3 Dependent Variable: HDI

Method: Least Squares
Date: 12/03/25 Time: 21:33
Sample: 1 16
Included observations: 16

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.574186	0.015816	36.30312	0.0000
ATM	0.044616	0.008387	-5.319449	0.0002
POS	0.037592	0.005855	6.420606	0.0000

R-squared	0.896427	Mean dependent var	0.515143
Adjusted R-squared	0.877596	S.D. dependent var	0.019744
S.E. of regression	0.006908	Akaike info criterion	-6.924953
Sum squared resid	0.000525	Schwarz criterion	-6.788012
Log likelihood	51.47467	Hannan-Quinn criter.	-6.937629
F-statistic	47.60265	Durbin-Watson stat	1.322210
Prob(F-statistic)	0.000004		

Source: computed using Eview9

The regression results show a model with the dependent variable as HDI (Human Development Index) and the independent variables as a constant (C), ATM, and POS. ATM Coefficient = 0.044616 with a t-statistic of -5.319449 (p-value = 0.0002). POS Coefficient = 0.037592 with a t-statistic of 6.420606 (p-value = 0.0000). When all other variables are held constant, the coefficients show an estimated variation in HDI for a one-unit variation in the corresponding independent factor. R-squared = 0.896427. Adjusted R-squared = 0.877596. According to the R-squared value, the model can account for about 89.64% of the variability in HDI. The adjusted R-squared penalises for extraneous variables and takes the number of predictors into account. Standard Error of Regression (S.E.) = 0.006908. F-statistic = 47.60265 with a p-value of 0.000004. The standard error of the regression measures the average distance between the observed and predicted values. The F-statistic tests the overall significance of the model, and the low p-value suggests that at least one independent variable is significantly related to the dependent variable. Durbin-Watson Statistic = -1.322210. The Durbin-Watson statistic tests for autocorrelation in the residuals. A value close to 2 suggests no significant autocorrelation, and the value here is reasonably close.

Hypothesis Testing:

-H02 (Null Hypothesis): There is no significant relationship between Automated Teller Machine (ATM) and the human development index in Nigeria.

-H04 (Null Hypothesis): There is no significant relationship between Point of Sale (POS) and the human development index in Nigeria.

Both hypotheses are rejected based on the p-values associated with ATM and POS coefficients (p-value < 0.05). Therefore, there is evidence to suggest that both ATM and POS have a significant relationship with the human development index in Nigeria.

In conclusion, the regression analysis indicates that there is a significant relationship between ATM, POS, and HDI in Nigeria. The model explains a substantial portion of the variability in HDI, and both ATM and POS are found to be significant predictors. However, further analysis and consideration of model assumptions are advisable. There may not be any significant autocorrelation because the Durbin-Watson statistic is near to 2. Overall, the model appears to be a good fit for the data.

Moderated Multiple Regression

Table 4.4 Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.986[a]	.972	.959	.03101

a. Predictors: (Constant), HDI, ATM, GDP, POS

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	.296	4	.074	76.978	.000[b]
	Residual	.009	9	.001		
	Total	.305	13			

a. Dependent Variable: DLR

b. Predictors: (Constant), HDI, ATM, GDP, POS

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.613	1.896		1.378	.001
	ATM	.101	.075	.120	.152	.002
	POS	.105	.060	-.081	-.089	.031
	GDP	1.703	.552	-.569	-3.087	.013
	HDI	11.523	2.209	1.486	5.217	.001

a. Dependent Variable: DLR

Source: computed using SPSS25

Moderated multiple regression model of Digital Literacy Rate and the predictors HDI, ATM, GDP, POS. R = 0.986. R Square = 0.972. The model summary reveals that the predictors significantly account for the variance in the criterion variable, DLR, with high R-squared values. The low p-value suggests substantial correlation between at least one predictor and the criterion variable, as indicated by the coefficients.

Hypothesis Testing (H05):

-H05 (Null Hypothesis): There is no significant moderating effect of digital literacy rate on electronic payment systems (ATM, POS) and economic development (GDP, HDI) in Nigeria.

The hypothesis is rejected based on the p-values associated with ATM, POS, GDP, HDI coefficients p-value < 0.05). Therefore, there is evidence to suggest that ATM, POS, GDP, and HDI have a significant relationship with the Digital Literacy Rate in Nigeria.

Discussion of findings

The examination of H01 and H03 reveals a significant and positive relationship between both ATM and POS with GDP in Nigeria. This is consistent with previous research, which supports the economic impact of electronic payment systems. Suleiman et al. (2023) found a significant positive effect of point-of-sale and mobile payment channels on Nigeria's GDP, whereas the impact of online pay channels was negligible. Zwingina et al. (2023) also supported the positive impact of POS and mobile payment channels on GDP. Andrea et al. (2022) further confirmed the positive effect of ATM, POS, and payment methods for mobile applications on economic expansion. Isamade et al. (2022) also contributed to this discussion. The findings suggest that policymakers and stakeholders should recognize the role of electronic payment systems in fostering economic growth. Investments in enhancing ATM and POS infrastructure and promoting mobile payment channels can be strategic for driving economic development. The study also suggests that attention should be directed towards optimizing and innovating electronic payment systems to maximize their positive impact on GDP.

The examination of H02 and H04 reveals a substantial and significant relationship between both ATM and POS with the human development index (HDI) in Nigeria. This is consistent with previous research by John (2019), Njoku et al. (2020), Ogbeide et al. (2016), and Musa and Onipe (2022). These studies highlight the significant impact of electronic payment systems on economic growth, with varying effects from ATMs, mobile banking, web banking, and point-of-sale transactions. Musa and Onipe's (2022) findings also show a positive correlation between electronic payment systems and economic performance, with external reserves being a dominant factor. These findings highlight the crucial role of electronic payment systems in shaping both human development and economic performance in Nigeria. The findings suggest the need for continued investment and enhancement of electronic payment infrastructure to foster economic development and improve the overall quality of life. The findings underscore the importance of electronic payment systems in shaping a country's human development index.

The test of H05 indicates a noteworthy finding that ATM, POS, GDP, and HDI have a significant relationship with the Digital Literacy Rate in Nigeria. This aligns with Omiunu's (2019) study, which emphasizes the importance of e-literacy and business information strategies for ICT adoption, particularly in women-owned SMEs. The study suggests providing grants and sponsorships to facilitate ICT workshops and training to enhance e-literacy and skills among women-owned SMEs. Okagbue et al.'s (2023) research highlights the challenges posed by the COVID-19 pandemic on Nigeria's education system, emphasizing the need to address digital competencies among students and teachers. Gautam et al.'s (2022) findings highlight the impact of financial technology on digital literacy in India, with Kisan Credit Cards positively influencing literacy rates and ATMs negatively. Gillwald and Mothobi's (2019) study highlights the existing inequalities in internet penetration rates in African countries, highlighting the need for comprehensive policies to promote equitable access to digital resources. These findings highlight the multifaceted nature of digital literacy and its impact on various sectors, including education, financial technology, and internet access. Policymakers and stakeholders should consider these insights to formulate targeted interventions aimed at enhancing digital literacy, addressing inequalities, and fostering inclusive technological development.

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The study looked on the association between Nigeria's economic growth and electronic payment methods. In order to investigate the relationship between electronic payment systems (ATM, POS) and important economic indicators (gross domestic product, human development index), as well as the moderating influence of the rate of digital literacy, the study used an ex-post facto research design and judgemental sampling over a 14-year period (2009–2022). Using Ordinary Least Squares (OLS) regression. Findings showed a strong correlation between Nigeria's digital literacy rate, GDP, HDI, POS, and ATM. According to the study's findings, Nigeria's economic progress and electronic payment systems are significantly and meaningfully related. Additionally, the study indicated that;

1. Given the significant relationships observed between ATM, POS, and both economic and human development indicators, there should be a concerted effort to expand and optimize the existing ATM and POS infrastructure. Policymakers should work towards increasing accessibility, especially in underserved areas, and ensuring the efficiency of these electronic payment channels.
2. Recognizing the interplay between ATM, POS, and digital literacy, there is a need for integrated digital literacy initiatives. Policymakers should collaborate with relevant stakeholders to design and implement programs that enhance digital literacy, with a specific focus on utilizing electronic payment systems.
3. Policymakers should consider providing incentives and support for innovations in financial technology. Encouraging the development of secure and user-friendly mobile payment applications can further strengthen the link between digital transactions, economic growth, and human development.
4. Acknowledging the evidence of the significant relationship between electronic payment systems and human development, policymakers should design targeted interventions aimed at improving key human development indicators. These interventions can include educational programs, healthcare initiatives, and measures to enhance overall quality of life.
5. To address the multifaceted nature of digital literacy and its connection to economic and human development, there is a need for a comprehensive national digital literacy strategy. This strategy should encompass educational curricula, awareness campaigns, and skill development programs to ensure a digitally literate population capable of leveraging electronic payment systems for personal and societal advancement.

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