American Journal of Financial Technology and Innovation (AJFTI)

ISSN: 2996-0975 (ONLINE)

VOLUME 4 ISSUE 1 (2026)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

American Journal of Financial Technology and Innovation (AJFTI)

Volume 4 Issue 1, Year 2026
ISSN: 2996-0975 (Online)
DOI: https://doi.org/10.54536/ajfti.v4i1.3564
https://journals.e-palli.com/home/index.php/ajfti

Digital Financial Services and the Growth of Manufacturing Sector in Selected Regions of Sub-Saharan Africa

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Article Information

Received: July 25, 2024

Accepted: August 30, 2024

Published: January 19, 2026

Keywords

Digital finance, Instant Pay Transactions, Internet Transactions, Manufacturing Sector, Mobile Payment Transactions

ABSTRACT

This study examined the impact of digital financial services on the growth of the manufacturing sector in selected Sub-Saharan African countries, with the aim of addressing the problem of inconsistent manufacturing sector development in the region. The primary objective was to determine how Instant Pay Transactions, Internet Transactions, and Mobile Payment Transactions influence the manufacturing sector's contribution to GDP from 2012Q1-2023Q4. The study utilized a Fully Modified Ordinary Least Squares (FMOLS) regression model, effectively deals with in dealing with potential endogeneity and serial correlation issues in panel data analysis. The findings revealed a dynamic relationship between digital financial services and manufacturing growth. Instant Pay Transactions were found to have a negative but statistically significant impact on the manufacturing sector, suggesting that while these transactions facilitate quick payments, they may introduce inefficiencies in production processes. Similarly, Internet Transactions had a negative and statistically significant effect, indicating that the shift toward digital platforms might divert resources away from traditional manufacturing investments. Conversely, Mobile Payment Transactions demonstrated a positive and statistically significant impact, highlighting their role in enhancing financial inclusion, reducing transaction costs, and supporting the growth of manufacturing firms. Based on these findings, the study recommended that central banks, such as the Central Bank of Nigeria (CBN) and the South African Reserve Bank (SARB), collaborate with commercial banks to tailor instant payment systems to the specific needs of manufacturers. Additionally, industry and trade ministries in Kenya and Ghana were advised to develop policies that integrate internet-based financial services with manufacturing investments. Finally, telecommunications regulators were urged to expand mobile network infrastructure and encourage the development of mobile-based financial products that support manufacturing growth. These targeted recommendations aim to optimize the benefits of digital financial services for the manufacturing sector, thereby fostering sustainable economic development in Sub-Saharan Africa.

INTRODUCTION

The rapid advancement of technology has revolutionized the financial sector, giving rise to digital financial services (DFS) that have transformed the way individuals and businesses conduct financial transactions. These services, encompassing instant pay transactions, internet transactions, and mobile payments, have gained significant traction globally, offering unprecedented convenience, accessibility, and efficiency in financial operations.

Instant pay transactions facilitate the immediate transfer of funds between parties, eliminating delays and providing real-time confirmation and access to funds. This technology has dramatically reduced transaction times, improving liquidity and cash flow management for businesses and individuals alike. Internet transactions, facilitated through online banking platforms, digital transfers and e-commerce systems, have become ubiquitous, enabling seamless financial operations across geographical boundaries (Ezie *et al.*, 2023). Perhaps most transformative, especially in developing economies, has been the rise of mobile payments. Mobile payments, conducted through mobile devices, include mobile money, mobile banking apps, and near-field communication (NFC) payments. This technology leverages the widespread adoption of mobile phones to provide financial services to previously underserved populations, effectively bridging the gap in traditional banking infrastructure.

The global digital payments market, which encompasses these services, has experienced remarkable growth, with transaction values reaching $5.4 trillion in 2022 and projections indicating a compound annual growth rate (CAGR) of 11.8% from 2023 to 2030 (Grand View Research, 2023).

In Sub-Saharan Africa, particularly in countries like Nigeria, South Africa, Kenya, and Ghana, the adoption and integration of DFS have been instrumental in transforming economic dynamics. These countries have experienced substantial growth in digital financial transactions. For instance, Kenya, with its pioneering mobile payment system M-Pesa, reported over 1.91 billion transactions worth KES 3.98 trillion in 2021 alone (Communications Authority of Kenya, 2022). Nigeria saw a significant rise in mobile transactions, reaching 300 million in volume in 2020, a notable increase from previous years (Nigeria Inter-Bank Settlement System,

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2021). South Africa and Ghana have also experienced similar upward trends, with significant increases in both the volume and value of digital transactions, indicating a broader acceptance and reliance on DFS (South African Reserve Bank, 2021; Bank of Ghana, 2021).

While digital financial services have been expanding, the manufacturing sector's growth, often measured by Manufacturing, Value Added (% of GDP), presents another critical economic indicator. The manufacturing sector is widely recognized as a crucial engine of economic growth, a solution to unemployment, and a generator of wealth. It plays a pivotal role in driving innovation, fostering technological advancements, and creating high-value jobs that contribute significantly to a nation's economic development (UNIDO, 2020). In an ideal scenario, a robust and thriving manufacturing sector should contribute substantially to a country's GDP, stimulate exports, and serve as a catalyst for overall economic prosperity.

However, the reality in many Sub-Saharan African countries, including Nigeria, South Africa, Kenya, and Ghana, falls short of this ideal. The manufacturing sector in these nations has been underperforming, with its contribution to GDP remaining stagnant or declining over the years. For instance, in Nigeria, the manufacturing sector's contribution to GDP decreased from 9.5% in 2015 to 8.7% in 2021 (World Bank, 2023). Similarly, South Africa's manufacturing sector, despite being one of the most developed in the region, has seen its share of GDP decline from 14.8% in 2005 to 12.1% in 2021 (World Bank, 2023). Kenya and Ghana have also struggled to significantly increase their manufacturing sector's contribution to GDP, with figures hovering around 7.4% and 11.4% respectively in 2021 (World Bank, 2023).

In light of these challenges, policymakers in these countries have implemented various strategies to enhance the performance of the manufacturing sector. These measures have included tax incentives, subsidies, infrastructure development, and policies aimed at improving the ease of doing business. For example, Nigeria introduced the Economic Recovery and Growth Plan (ERGP) in 2017, which prioritized the manufacturing sector as a key driver of economic diversification (Ministry of Budget and National Planning, Nigeria, 2017). South Africa launched its Industrial Policy Action Plan (IPAP) to support manufacturing growth and increase its global competitiveness (Department of Trade and Industry, South Africa, 2018).

Despite these policy interventions, the manufacturing sector in these countries has not shown significant improvement. In fact, the sector continues to face numerous challenges, including inadequate infrastructure, limited access to finance, and technological constraints. The COVID-19 pandemic has further exacerbated these issues, with the manufacturing sector in Sub-Saharan Africa experiencing a sharp contraction. According to the African Development Bank (2021), the region's industrial GDP growth fell from 3.2% in 2019 to -1.3% in 2020, highlighting the sector's vulnerability to external shocks.

The consequences of this underperformance are far-reaching. The manufacturing sector's inability to expand its operations and increase output has led to limited job creation, reduced wealth generation, and constrained economic growth. This situation is particularly concerning given the region's rapidly growing labour force and the urgent need for job creation. The International Labour Organization (2020) reports that Sub-Saharan Africa needs to create approximately 18 million jobs annually to absorb new entrants into the labour market, a goal that becomes increasingly challenging with a stagnating manufacturing sector.

Given that manufacturing sectors are well-known catalysts for real growth and development in any nation, their underperformance clearly portends significant risks for these economies. It is of interest in this study to conduct an analysis on how digital financial services have impacted the growth of the manufacturing sector in selected regions of Sub-Saharan Africa, which are Nigeria, South Africa, Kenya, and Ghana.

LITERATURE REVIEW

The theoretical underpinning for this study is the Diffusion of Innovations (DOI) Theory, propounded by Everett M. Rogers in 1962. This theory explores how new ideas, technologies, and practices spread within societies or organizations. According to Rogers, the adoption of innovations is influenced by several key factors: relative advantage, compatibility, complexity, trialability, and observability. These factors determine the rate and extent to which innovations are embraced by individuals and groups, impacting the diffusion process across different regions and sectors. The theory emphasizes the importance of communication channels, social systems, and time in facilitating the spread of innovations, making it crucial for understanding adoption dynamics.

Rogers' DOI theory is particularly relevant for studying the impact of digital financial services on the manufacturing sector, as it provides a framework for understanding how these services can be integrated into economic systems to drive growth. By analysing the diffusion process, the theory sheds light on the social and cultural dynamics influencing the adoption of digital financial services, especially in the diverse context of Sub-Saharan Africa. The theory's macro-level perspective allows for the analysis of regional and global factors that influence the adoption of digital technologies, making it ideal for examining cross-country comparisons.

One of the key strengths of the DOI theory is its broad applicability across different fields and its ability to capture the dynamic interactions between various factors that influence the adoption of innovations. It provides a comprehensive framework for understanding how new technologies can lead to economic transformations, enhancing financial inclusion and accessibility. This is particularly significant for the present study, as it examines the role of digital financial services—such as

instant pay transactions, internet transactions, and mobile payments—in fostering growth within the manufacturing sector in selected regions of Sub-Saharan Africa.

However, the DOI theory has faced some criticisms. Critics argue that the theory may not adequately address individual user behaviours and specific operational implications. Additionally, the DOI theory tends to emphasize macro-level factors, potentially overlooking individual decision-making processes and the role of institutional structures in facilitating or hindering adoption.

Despite these limitations, the DOI theory remains a robust tool for analysing the broader economic implications of digital financial services. By understanding the diffusion process, the study can identify strategic opportunities to accelerate the adoption of digital financial services, thereby supporting manufacturing growth and economic development in Sub-Saharan Africa. This understanding can guide policymakers in designing interventions that enhance the diffusion of digital innovations, leveraging their potential to transform the manufacturing sector and contribute to overall economic progress.

Several empirical reviews have provided valuable insights into the real-world implications of digital financial services on the growth of the manufacturing sector. These studies often use robust methodologies to analyse data and derive conclusions that can inform policy and practice.

Beck *et al.* (2018) examined the impact of mobile financial services on the performance of small and medium-sized enterprises (SMEs) in Kenya. The study utilized a mixed-method approach, combining quantitative data analysis with qualitative interviews to capture a comprehensive view of the phenomenon. The researchers found that mobile financial services significantly improved the financial inclusion of SMEs, which in turn enhanced their operational efficiency and growth. They observed that SMEs utilizing mobile payments were able to manage their cash flows better, access credit more easily, and reduce transaction costs. However, the study was criticized for its limited geographic scope, focusing only on urban areas, which might not fully represent the experiences of rural SMEs where infrastructure and adoption rates differ significantly. This limitation suggests that future research should include a more diverse sample to ensure broader generalizability of the findings.

In another related study, Vieira *et al.* (2020) investigated the role of digital financial services in enhancing the productivity of the manufacturing sector in South Africa. Using panel data analysis from 2005 to 2018, the researchers assessed how internet transactions and mobile payments influenced manufacturing output. Their findings indicated a positive correlation between the adoption of digital financial services and the growth of the manufacturing sector. The study highlighted that internet transactions facilitated smoother supply chain management and reduced delays in payments, which boosted overall productivity. Furthermore, mobile payments provided manufacturers with flexible and efficient payment solutions, contributing to improved financial management. Despite these positive findings, the study faced criticism for not considering the potential negative impacts of digital financial services, such as cybersecurity risks and the digital divide, which could affect smaller manufacturers disproportionately. The study's reliance on secondary data also raised concerns about the accuracy and completeness of the data used.

Moreover, a study by Mishra and Bisht (2019) analyzed the effects of internet-based financial services on the manufacturing sector in India. Using time-series data from 2010 to 2018 and employing econometric modeling, they investigated how the proliferation of internet transactions influenced manufacturing output. The study found that internet financial services significantly enhanced manufacturing productivity by streamlining procurement processes and facilitating real-time financial management. These services enabled manufacturers to reduce operational costs and improve supply chain efficiency. Despite these positive outcomes, the study faced criticism for its potential selection bias, as it predominantly included larger manufacturing firms that were more likely to adopt internet financial services. Smaller firms, which might face barriers to adopting such technologies, were underrepresented in the sample, potentially skewing the results.

Moreover, in another related study, Kou *et al.* (2020) explored the influence of digital financial services on the manufacturing sector in China. The research utilized a combination of panel data analysis and case studies from 2010 to 2019 to examine how internet transactions and mobile payments affected manufacturing firms' growth and innovation. The study found a strong positive correlation between the use of digital financial services and improvements in manufacturing productivity and innovation. Digital transactions enabled firms to streamline their financial operations, reduce costs, and invest more in research and development activities. However, the study faced criticism for not adequately addressing the potential drawbacks of digital financial services, such as data privacy concerns and the digital divide between urban and rural areas. Additionally, the reliance on firm-level data from larger cities may have overlooked the experiences of smaller firms in less developed regions.

Furthermore, Nyaga and Onyango (2020) examined the role of mobile money services in enhancing the performance of the manufacturing sector in Kenya. Using panel data from 2010 to 2019 and employing fixed-effects regression analysis, the study explored how the adoption of mobile money influenced manufacturing firms' efficiency and output. The results indicated that mobile money services significantly improved cash flow management and reduced transaction costs, leading to higher productivity and output. Additionally, mobile money facilitated easier access to credit, enabling firms to invest in new technologies and expand their operations.

However, the study was critiqued for its limited consideration of the potential challenges associated with mobile money, such as network reliability issues and regulatory hurdles. The focus on a single country also limits the generalizability of the findings to other contexts with different economic and regulatory environments.

Additionally, Awunyo-Vitor and Abor (2019) conducted an empirical investigation into the impact of internet banking on the manufacturing sector in Ghana. The study used a combination of survey data from 250 manufacturing firms and econometric modeling to analyse the effects of internet banking on firm performance. The findings revealed that firms utilizing internet banking experienced significant improvements in operational efficiency and financial management. Internet banking facilitated faster and more secure transactions, better financial record-keeping, and improved access to financial information, all of which contributed to enhanced productivity and profitability. However, the study faced criticism for its potential sample bias, as it predominantly included larger firms that were more likely to adopt internet banking. Smaller firms, which might face greater barriers to adoption, were underrepresented in the sample, potentially skewing the results. Additionally, the study did not sufficiently address the potential cybersecurity risks associated with internet banking, which could impact firm performance.

In addition, Boateng *et al.* (2020) conducted a comprehensive study on the impact of mobile banking on the productivity of the manufacturing sector in Ghana. Using a mixed-methods approach, which included quantitative data analysis from 300 manufacturing firms and qualitative interviews with industry stakeholders, the study assessed how mobile banking adoption influenced various performance metrics. The findings indicated that mobile banking significantly enhanced firms' access to finance, improved transaction speeds, and reduced operational costs. These improvements were particularly pronounced among small and medium-sized enterprises (SMEs), which often face greater challenges in accessing traditional banking services. However, the study was criticized for not adequately addressing the potential digital literacy barriers that could hinder the widespread adoption of mobile banking among less tech-savvy business owners. Moreover, the study's reliance on self-reported data raised concerns about the accuracy and reliability of the findings.

Aker and Mbiti (2015) conducted a comprehensive analysis to examine the role of mobile phones in driving economic development across Africa. Utilizing a blend of empirical data and case studies, the authors assessed how the widespread adoption of mobile phones has influenced various economic sectors, including agriculture, finance, and labour markets. Their findings highlighted that mobile phones significantly improved access to information, reduced transaction costs, and facilitated financial inclusion through mobile banking services. The study particularly emphasized the transformative impact of mobile money, noting that it had enhanced savings, credit accessibility, and overall economic participation among previously unbanked populations. However, the study primarily focused on the benefits of mobile technology, potentially underestimating the infrastructural challenges and inequalities that could limit its broader applicability across diverse African regions. While the positive impacts are clear, the unequal access to mobile technology in rural versus urban areas and among different socio-economic groups could temper the extent of mobile phones' benefits across the continent.

Asongu and Nwachukwu (2018) explored the relationship between mobile banking and human development in developing countries, using a threshold regression model to determine the conditions under which mobile banking contributes most effectively to pro-poor growth. Their analysis revealed that mobile banking has a significant positive impact on human development, particularly in countries where financial inclusion is low but the penetration of mobile technology is high. The study highlighted that mobile banking serves as a critical tool for poverty reduction by providing financial services to underserved populations, thereby enabling them to save, invest, and access credit. Despite these positive findings, the study's reliance on aggregated data might inhibit the unique differences in mobile banking's impact across various demographic groups within countries. The differential impacts based on gender, income levels, and geographic location could have been explored further to provide a more comprehensive understanding of how mobile banking affects different segments of the population.

Beck *et al.* (2014) provided an overview of financial inclusion and innovation in Africa, using a combination of descriptive analysis and cross-country comparisons. The authors highlighted that financial inclusion in Africa has been significantly boosted by innovations such as mobile money and agent banking. They found that these financial innovations have played a pivotal role in expanding access to financial services among the unbanked population, particularly in rural areas where traditional banking infrastructure is lacking. However, the study also pointed out that despite these advances, the regulatory environment in many African countries remains underdeveloped, potentially hindering the sustainability and scalability of financial innovations. Additionally, while mobile financial services have indeed expanded access, the quality and range of services provided remain limited, often failing to meet the broader financial needs of the population.

Jack and Suri (2014) conducted a detailed empirical analysis of Kenya's mobile money system, M-Pesa, using household survey data and regression analysis to assess the system's impact on risk sharing and transaction costs. Their findings showed that M-Pesa significantly reduced transaction costs and increased the efficiency of financial transactions, allowing users to transfer money quickly and securely across long distances. This, in turn, enhanced

economic resilience by enabling households to manage risks better and cope with financial shocks. However, while the study convincingly demonstrated the benefits of M-Pesa, it also highlighted that the system's success was partly due to Kenya's unique regulatory and market environment. This raises questions about the replicability of Kenya's experience in other countries with different regulatory frameworks or market conditions. The success of mobile money in Kenya may not necessarily translate to other contexts where the necessary supporting infrastructure and regulatory environments are lacking.

MATERIALS AND METHODS

Data Sources and Model Specification

This study utilized secondary data to analyse the impact of digital financial services on the growth of the manufacturing sector in Sub-Saharan Africa. The selected Sub-Saharan African countries—Nigeria, South Africa, Kenya, and Ghana—were chosen due to their significant economic influence in the region, diverse levels of industrialization, and varying degrees of digital financial service adoption, providing a comprehensive view of how these innovations impact manufacturing sector growth across different economic contexts.

Data were sourced from the Central Bank of Nigeria (CBN) statistical bulletin, which provides detailed financial and economic statistics, the National Bureau of Statistics (NBS) for comprehensive economic indicators, and the World Development Indicators (WDI) from the World Bank, offering global economic data. These sources provided robust and reliable datasets, encompassing metrics on digital financial transactions and manufacturing sector contributions to GDP, essential for a thorough empirical analysis.

For this study, the mathematical specification of the implicit model that expresses the relationship between digital financial services and the growth of the manufacturing sector in selected regions of Sub-Saharan Africa is expressed as:

$$MVA_{it}=f(IPT_{it},INT_{it},MPT_{it}) \quad (1)$$

Setting up equation (1) in a linear panel stochastic form is expressed as:

$$MVA_{it}=\varphi_0+\varphi_1 IPT_{it}+\varphi_2 INT_{it}+\varphi_3 MPT_{it}+\mu_t+\varepsilon_{it} \quad (2)$$

Where:

MVA = Manufacturing, Value Added (% of GDP)
IPT = Instant pay transaction
INT = Internet transaction
MPT = Mobile payment transaction
φ_0 = Constant term
φ_1-φ_3 = Coefficients of digital financial services
μ_i= unobserved individual effects (or fixed effect error term, or unobserved heterogeneity)
ε_{it}=is the error term and $\varepsilon^{it} \sim N(0,\sigma_\varepsilon^2)$

Table 1: Variable Description and Measurements

Variable	Acronym	Description	Measurement	Source
Instant pay transaction	IPT	Value of Instant Pay Transactions is a critical variable representing the total monetary value of immediate fund transfers conducted through digital platforms within a specific timeframe. This variable captures the economic scale of instant payments, reflecting the efficiency and adoption level of digital financial systems.	$' million	World Development Indicators (World Bank, 2024)
Internet transaction	INT	Value of Internet (Web) Transactions denotes the total monetary value of financial activities carried out over the internet. This variable encompasses various forms of online financial transactions, including e-commerce payments, online banking transfers, and digital sales.	$' million	World Development Indicators (World Bank, 2024)
Mobile payment transactions	MPT	Value of Mobile Payment Transactions is another crucial variable, indicating the total monetary value of financial transactions executed via mobile devices. This variable highlights the extent to which mobile technology is leveraged for financial activities. Mobile payments facilitate greater financial inclusion and accessibility, particularly in regions with limited traditional banking infrastructure.	$' million	World Development Indicators (World Bank, 2024)

Manufacturing, value added	MVA	Manufacturing sector growth captured as Manufacturing, value added, represents the contribution of the manufacturing sector to the overall economy. This variable reflects the net output of the manufacturing sector after adding up all outputs and subtracting intermediate inputs. It is a comprehensive measure of the sector's productivity and economic significance.	Manufacturing, value added (% of GDP)	World Development Indicators (World Bank, 2024)

Source: Authors' Computations.

Modelling procedure and estimation techniques

Cross-sectional dependence and unit root test

It is crucial to account for cross-sectional dependence, a phenomenon where error terms across different cross-sectional units (such as countries or firms) are correlated. Ignoring cross-sectional dependence can lead to biased estimates, spurious results, and unreliable inferences. For the cuwrrent study examining the impact of digital financial services on the growth of the manufacturing sector in selected regions of Sub-Saharan Africa, it is essential to test for cross-sectional dependence to ensure robust and accurate findings.

The Pesaran (2004) cross-sectional dependence test is a widely used method for detecting cross-sectional dependence in panel data models. This test is particularly suitable for panels with a large number of cross-sectional units (N) and time periods (T). It offers several advantages, including simplicity and robustness, even in the presence of heterogeneous and dynamic panels.

Mathematically, the Pesaran cross-sectional dependence test is based on the average of pairwise correlation coefficients of the residuals from individual regressions. The test statistic is given by:

$$CD = \sqrt{\frac{2T}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \qquad (3)$$

Where:

T is the number of time periods.

N is the number of cross-sectional units.

is the sample correlation of the residuals between cross-sections *i* and *j*.

where $\hat{\rho}_{ij}$ represents the sample estimate of the pairwise correlation of the residuals from the regression model for cross-sectional units *i* and *j*, N is the number of cross-sectional units, and T is the number of time periods. The test statistic CD follows a standard normal distribution under the null hypothesis of no cross-sectional dependence.

The decision rule for the Pesaran cross-sectional dependence test is: There is no cross-sectional dependence ($\hat{\rho}_{ij} = 0$ for all $i \neq j$); and the alternative, there is cross-sectional dependence ($\hat{\rho}_{ij} \neq 0$ for some $i \neq j$).

Non-stationary data can lead to spurious regression results, rendering the analysis unreliable. Traditional unit root tests like the Augmented Dickey-Fuller (ADF) test often fail to account for cross-sectional dependence in panel data. To address this limitation, second-generation unit root tests, such as the Pesaran Cross-Sectionally Augmented Im, Pesaran and Shin (CIPS) test, have been developed. This essay discusses the Pesaran CIPS unit root test, its mathematical specification, and its importance for the current study examining the impact of digital financial services on the growth of the manufacturing sector in selected Sub-Saharan African countries.

The Pesaran CIPS test is an extension of the Im, Pesaran, and Shin (IPS) test, designed to account for cross-sectional dependence in panel data. Cross-sectional dependence occurs when there are common shocks or interactions between cross-sectional units, such as countries or firms, which traditional unit root tests often overlook. The CIPS test mitigates this issue by incorporating cross-sectional averages into the unit root testing procedure, thereby providing more robust and reliable results.

Mathematically, the CIPS test involves augmenting the standard ADF regression with the cross-sectional averages of lagged levels and first differences of the individual series. The augmented regression for the iii-th cross-sectional unit is specified as:

$$\Delta y_{it} = \alpha_i + \beta_i y_{i,t-1} + \gamma_i \bar{y}_{t-1} + \Sigma_{j=1}^{p} \delta_{ij} \Delta y_{i,t-j} + \Sigma_{j=1}^{p} \phi_{ij} \Delta \bar{y}_{t-j} + \varepsilon_{it} \qquad (4)$$

where:

Δy_{it} is the first difference of the series y_{it} for unit *i* at time.

α_i is the individual-specific intercept.

β_i is the coefficient on the lagged level of y_{it} testing for a unit root.

γ_i is the coefficient on the cross-sectional average of the lagged level, $\bar{y}_{t-1}$.

δ_{ij} and Φ_{ij} are the coefficients on the lagged first differences of the individual series and the cross-sectional averages, respectively.

ε_{it} is the error term.

The test statistic for the CIPS test is the average of the individual cross-sectional ADF statistics, adjusted for cross-sectional dependence. The decision rule involves comparing the CIPS statistic to critical values provided by Pesaran (2007). If the CIPS statistic is less than the critical value, the null hypothesis of a unit root (non-stationarity) is rejected, indicating that the series is stationary.

Panel cointegration test

Testing for cointegration is crucial to determine whether a long-run equilibrium relationship exists between variables. Cointegration tests help to identify whether non-stationary series move together over time, implying

a stable, long-term relationship. For the current study examining the impact of digital financial services on the growth of the manufacturing sector in selected regions of Sub-Saharan Africa, it is essential to test for cointegration to ensure the validity of the long-run relationship between the variables under consideration.

The Pedroni cointegration test, developed by Peter Pedroni (1999, 2004), is a widely used method for testing cointegration in heterogeneous panel data. This test accommodates cross-sectional dependence and heterogeneity across panel units, making it suitable for panels with diverse characteristics. The Pedroni test offers several advantages, including the ability to test for multiple cointegrating vectors and to account for both within-dimension (panel) and between-dimension (group) dynamics.

Mathematically, the Pedroni cointegration test involves estimating the following regression model for each cross-sectional unit i:

$$y_{it} = \alpha_i + \delta_i t + \beta_1 x_{1,it} + \beta_2 x_{2,it} + \cdots + \beta_k x_{k,it} + u_{it} \quad (5)$$

where:

y_{it} is the dependent variable for unit iii at time t (manufacturing, value added).

$x_{k,it}$ are the independent variables for unit i at time t (values of instant pay transactions, internet transactions, and mobile payments).

α_i is the individual-specific intercept.

$\delta_i t$ is the deterministic trend.

β_k are the coefficients of the independent variables.

u_{it} is the error term.

The decision rule for the Pedroni cointegration test involves comparing the calculated test statistics to their corresponding critical values. If the test statistics are greater than the critical values in absolute terms, the null hypothesis of no cointegration is rejected, indicating the presence of a cointegrating relationship among the variables.

Panel Fully Modified Least Squares

Panel data often faces challenges such as serial correlation, endogeneity, and cross-sectional dependence, which can lead to biased and inconsistent parameter estimates. The Panel Fully Modified Ordinary Least Squares (FMOLS) method, developed by Phillips and Hansen (1990), addresses these issues by providing consistent and efficient estimates for long-run relationships in panel data settings. For the current study examining the impact of digital financial services on the growth of the manufacturing sector in selected regions of Sub-Saharan Africa, utilizing Panel FMOLS is necessary to ensure the robustness and reliability of the results.

The FMOLS estimator modifies the standard OLS regression to account for potential endogeneity and serial correlation in the error terms. The basic regression model for panel FMOLS can be specified as:

$$y_{i_t} = \alpha_i + \sum_{i=1}^{N}\sum_{t=1}^{T} \beta' x_{it}^{*} + u_{it} \quad (6)$$

where:

y_{it} represents the dependent variable for cross-sectional unit i at time t (e.g., manufacturing sector growth).

x_{it} is a vector of independent variables for unit iii at time t (e.g., values of instant pay transactions, internet transactions, and mobile payment transactions).

α_i is the individual-specific intercept.

β' is the vector of long-run coefficients.

u_{it} is the error term, which may exhibit serial correlation and endogeneity.

Building equation (2) into a panel FM-OLS model of equation (6), we have:

$$MVA_{it} = \varphi_0 + \sum_{i=1}^{N}\sum_{t=1}^{T} \varphi_1 IPT_{it}^{*} + \sum_{i=1}^{N}\sum_{t=1}^{T} \varphi_2 INT_{it}^{*} + \sum_{i=1}^{N}\sum_{t=1}^{T} \varphi_3 MPT_{it}^{*} + \mu_t + \varepsilon_{it} \quad (7)$$

Where IPT_{it}^{*}, INT_{it}^{*}, MPT_{it}^{*} are the transformed variables adjusted for endogeneity and serial correlation.

The choice of Panel FMOLS is crucial to accurately capture the long-run effects of digital financial services on manufacturing sector growth. The correction for endogeneity is particularly important given that the adoption of digital financial services and manufacturing growth may be simultaneously influenced by other macroeconomic factors such as economic policies, technological advancements, and global market conditions. By addressing these potential sources of bias, Panel FMOLS ensures that the estimated relationships are reflective of the true economic dynamics.

RESULTS AND DISCUSSIONS

Descriptive statistics and Pairwise Correlation Result

Descriptive statistics provide a summary of the key features of a dataset, giving insights into the central tendency, dispersion, and shape of the data distribution; while the correlation results offer valuable insights into the relationships between the independent variables. These statistics are crucial for analysing the impact of digital financial services on the growth of the manufacturing sector in selected regions of Sub-Saharan Africa.

The **mean** value represents the average over the observed period. The mean for Manufacturing, Value Added (MVA), expressed as a percentage of GDP, is 10.72%, indicating that, on average, the manufacturing sector contributed about 10.72% to the GDP in the selected regions. The mean value for Instant Pay Transactions (IPT) is USD 40.51 billion, reflecting the substantial volume of these transactions during the period. The mean value for Internet (Web) Transactions (INT) is USD 1.82 billion, which, although lower than IPT, still represents a significant contribution to digital financial activity. The mean for Mobile Payment Transactions (MPT) is USD 1.28 billion, highlighting the increasing importance of mobile payments in financial ecosystems.

Standard deviation measures the dispersion of data from the mean. The standard deviation for MVA is 1.96%, indicating moderate variability in the manufacturing sector's contribution to GDP over time. The IPT has a high standard deviation of USD 52.97

billion, suggesting significant fluctuations in the value of instant pay transactions, likely reflecting varying levels of adoption and economic activity across different periods and countries. The standard deviation for INT is USD 3.56 billion, indicating considerable variability, possibly due to the differential adoption rates and infrastructure challenges. Similarly, the standard deviation for MPT is USD 1.51 billion, showing that the value of mobile payment transactions has also experienced notable fluctuations, which could be tied to the pace of mobile

Table 1: Descriptive statistics and pairwise correlation

	MVA	**IPT**	**INT**	**MPT**
Mean	10.71567	40.50774	1.818648	1.282431
Std. Dev.	1.955935	52.96799	3.563885	1.507208
Skewness	-0.02014	1.897514	3.135443	1.727210
Kurtosis	2.419985	6.457623	13.81133	5.361330
Jarque-Bera	2.704321	210.8592	1249.671	140.0712
Probability	0.258681	0.000000	0.000000	0.000000
Observations	192	192	192	192
Pairwise correlations				
	MVA	**IPT**	**INT**	**MPT**
MVA	1			
IPT	0.4911*	1		
INT	0.3524**	-0.2733	1	
MPT	0.6378*	0.3559	0.2042	1

Note: *,** &*** significant at 1, 5 and 10 % respectively.
Source: Authors' Computations.

technology adoption and usage in financial services.

Skewness indicates the asymmetry of the data distribution. MVA has a skewness close to zero (-0.02), suggesting a nearly symmetrical distribution around the mean. IPT, with a skewness of 1.90, is positively skewed, indicating a distribution with a longer right tail; this suggests that while most periods had moderate values of IPT, there were instances of very high values. INT and MPT are also positively skewed, with skewness values of 3.14 and 1.73, respectively, indicating that in several periods, the value of these transactions was significantly higher than the median, possibly reflecting periods of rapid growth in digital financial services adoption.

Kurtosis measures the "tailedness" of the data distribution. MVA has a kurtosis of 2.42, close to the normal distribution's kurtosis of 3, indicating a distribution that is fairly normal with slightly fewer extreme values. IPT has a kurtosis of 6.46, indicating a leptokurtic distribution with heavy tails, suggesting frequent extreme values or spikes in instant pay transactions. INT, with a kurtosis of 13.81, also shows a leptokurtic distribution, reflecting extreme outliers likely due to significant events or rapid adoption phases. MPT's kurtosis of 5.36 also indicates a leptokurtic distribution, which is common in financial data where transactions can spike due to various factors, including policy changes or technological advancements.

The **Jarque-Bera test** assesses whether the data follows a normal distribution. For MVA, the Jarque-Bera statistic is 2.70 with a probability of 0.26, indicating that the null hypothesis of normality cannot be rejected, and thus the data is approximately normally distributed. However, for IPT, INT, and MPT, the Jarque-Bera statistics are 210.86, 1249.67, and 140.07, respectively, with probabilities of 0.000000, indicating that these variables significantly deviate from a normal distribution. This non-normality could be due to the presence of outliers or the inherent nature of financial data, which often exhibits extreme values due to market volatility or rapid technological adoption.

The correlation result showed that, the relationship between **MVA and IPT**, has a correlation coefficient of 0.4911 is statistically significant at the 1% level, indicating a moderately strong and positive relationship between these variables. This suggests that increases in the value of instant pay transactions are associated with higher contributions of the manufacturing sector to GDP. Instant pay transactions facilitate immediate and efficient financial exchanges, which can enhance the operational efficiency of manufacturing firms. This correlation supports the notion that digital financial services, particularly instant payments, play a crucial role in streamlining manufacturing processes, reducing transaction costs, and ultimately boosting sectoral growth.

The correlation between **MVA and INT** is 0.3524, which is statistically significant at the 5% level. This positive relationship, though weaker than that between MVA and IPT, suggests that higher values of internet transactions are also associated with an increase in the manufacturing sector's contribution to GDP. Internet transactions, which include online banking and e-commerce payments, likely provide manufacturers with greater access to financial services and markets, thereby enhancing their operational capabilities. However, the weaker correlation relative to

IPT might indicate that while internet transactions are beneficial, their impact on the manufacturing sector may be more indirect or dependent on other factors, such as internet infrastructure and the digital literacy of users.

The strongest positive correlation is observed between **MVA and MPT**, with a coefficient of 0.6378, significant at the 1% level. This robust relationship suggests that mobile payment transactions are highly influential in driving the growth of the manufacturing sector. Mobile payments, which offer convenience and accessibility, especially in regions with limited traditional banking infrastructure, seem to provide a significant boost to the financial inclusion of manufacturing firms. This enhanced inclusion likely translates into better cash flow management, easier access to credit, and reduced operational bottlenecks, all of which contribute to the sector's growth. The strong correlation highlights the pivotal role that mobile financial technologies play in transforming the manufacturing landscape in Sub-Saharan Africa.

CIPS Panel Unit Root and Pesaran (2004) CD Test

The results from the Pesaran CIPS Panel Unit Root Test and the Pesaran (2004) Cross-Sectional Dependence (CD) Test are crucial for understanding the underlying properties of the data used in the analysis of the impact of digital financial services on the growth of the manufacturing sector in selected regions of Sub-Saharan Africa. These tests provide insights into the stationarity of the variables and the presence of cross-sectional dependence, both of which are critical for ensuring the validity of the econometric models used in the study. Starting with the Pesaran CIPS Panel Unit Root Test results, we see that all variables—Manufacturing Value Added (MVA), Value of Instant Pay Transactions (IPT), Value of Internet Transactions (INT), and Value of Mobile Payment Transactions (MPT)—are non-stationary at levels but become stationary after taking the first difference, indicated by their respective CIPS statistics. Specifically, MVA has a CIPS statistic of -3.66514, significant at the 1% level, indicating that it is integrated of order one, I(1). Similarly, IPT, with a CIPS statistic of -2.80118, significant at the 10% level, is also I(1). INT shows a strong stationarity after first differencing, with a CIPS statistic of -7.53129, significant at the 1% level. MPT, with a CIPS statistic of -4.16314, also confirms stationarity at the 1% level after first differencing, making it I(1). These results imply that all the variables have unit roots in their levels but become stationary when differenced once, suggesting that they are suitable for inclusion in long-run econometric models such as cointegration analysis.

The need for first differencing indicates that these variables exhibit persistent trends over time, which aligns with the expected behavior of economic and financial data. For instance, manufacturing output (MVA) and the value of digital financial transactions (IPT, INT, and MPT) likely exhibit long-term trends driven by factors such as technological adoption, economic policies, and market dynamics. The fact that these variables are I(1) is essential for conducting further analyses like cointegration tests, which will assess whether a stable, long-term relationship exists between them.

Table 2: CIPS Panel Unit Root and Pesaran (2004) CD Test

Variables	**Pesaran CIPS**	**Decision**	
	First difference		
	Intercept & trend	**Order of Integration**	
MVA	-3.66514*	I(1)	
IPT	-2.80118***	I(1)	
INT	-7.53129*	I(1)	
MPT	-4.16314*	l(1)	
Critical Value			
	Constant & trend	Constant	
1%	-3.07	-2.55	
5%	-2.84	-2.33	
10%	-2.73	-2.21	
Pesaran (2004) CD Test			
MVA	IPT	INT	MPT
-2.099406**	16.04931*	0.456040	15.35061*

Note: *,** &*** significant at 1, 5 and 10 % respectively.
Source: Authors' Computations.

Turning to the **Pesaran (2004) Cross-Sectional Dependence (CD) Test** results, we observe mixed evidence of cross-sectional dependence among the variables. The CD statistic for MVA is -2.099406, significant at the 5% level, indicating weak cross-sectional dependence. This suggests that while there may be some shared shocks or common factors affecting the

manufacturing sectors across the selected countries, the impact is not overwhelmingly strong. On the other hand, IPT and MPT exhibit significant cross-sectional dependence, with CD statistics of 16.04931 and 15.35061, respectively, both significant at the 1% level. This indicates that the value of instant pay transactions and mobile payment transactions are highly correlated across the countries, possibly due to shared regional economic conditions, technological adoption patterns, or synchronized policy initiatives.

Interestingly, INT does not show significant cross-sectional dependence, with a CD statistic of 0.456040. This could imply that internet transactions are more influenced by country-specific factors, such as national internet infrastructure, regulatory environments, and local market conditions, rather than by regional or global trends.

These results highlight the importance of accounting for cross-sectional dependence in the analysis. The significant cross-sectional dependence observed in IPT and MPT suggests that these digital financial services may be subject to common regional influences, which could affect the robustness of the study's econometric models if not properly addressed. Ignoring this dependence could lead to biased estimates and incorrect inferences about the relationship between digital financial services and manufacturing sector growth.

Pedroni Cointegration Test Result

Cointegration tests are essential in econometric analysis, particularly when dealing with non-stationary time series data. They help determine whether a long-run equilibrium relationship exists between variables that are individually non-stationary but may move together over time.

The results of the Pedroni Residual Cointegration Test are presented in two dimensions: within-dimension (panel statistics) and between-dimension (group statistics). The focus here is on the statistics that are significant at the conventional levels of significance (1%, 5%, and 10%), as these indicate the presence of cointegration.

Starting with the **within-dimension panel statistics**, the **Panel PP-Statistic** is -2.08206, with a probability of 0.0187, indicating significance at the 5% level. This result suggests that there is evidence of cointegration among the variables within the panel, implying that digital financial services and manufacturing sector growth share a long-term equilibrium relationship when considered across the entire panel of countries. The weighted version of the Panel PP-Statistic reinforces this finding, with a slightly stronger result (-2.19668) and a probability of 0.0140,

Table 3: Pedroni Residual Cointegration Test

Alternative hypothesis: common AR coefs. (within-dimension)				
			Weighted	
	Statistic	**Prob.**	**Statistic**	**Prob.**
Panel v-Statistic	0.216406	0.4143	0.743925	0.2285
Panel rho-Statistic	-0.05456	0.4782	-0.58576	0.2790
Panel PP-Statistic	-2.08206**	0.0187	-2.19668	0.0140
Panel ADF-Statistic	-1.01375	0.1554	-1.468	0.0711
Alternative hypothesis: individual AR coefs. (between-dimension)				
	Statistic	**Prob.**		
Group rho-Statistic	0.178463	0.5708		
Group PP-Statistic	-1.83835**	0.0330		
Group ADF-Statistic	-1.62313***	0.0523		

Note: *,** &*** significant at 1, 5 and 10 % respectively.
Source: Authors' Computations.

also significant at the 5% level. The significance of these statistics supports the hypothesis that despite short-term fluctuations, the variables tend to move together over time, maintaining a stable long-term relationship.

Turning to the **between-dimension group statistics**, the **Group PP-Statistic** is -1.83835, with a probability of 0.0330, significant at the 5% level. This suggests that when considering each country individually, there is still evidence of cointegration between digital financial services and manufacturing growth. The significance of this statistic highlights the robustness of the long-term relationship across different countries, even when heterogeneity among them is taken into account.

Additionally, the **Group ADF-Statistic** is -1.62313, with a probability of 0.0523, significant at the 10% level. This weaker but still significant result further supports the presence of cointegration, suggesting that digital financial services and manufacturing growth maintain a long-term equilibrium relationship across the selected Sub-Saharan African countries.

Panel FMOLS Regression Results

The Fully Modified Ordinary Least Squares (FMOLS) regression results provide significant insights into the long-term relationship between digital financial services—represented by Instant Pay Transactions (IPT), Internet

Transactions (INT), and Mobile Payment Transactions (MPT)—and the growth of the manufacturing sector, measured as Manufacturing Value Added (MVA) as a percentage of GDP in selected Sub-Saharan African countries. The FMOLS method is particularly useful in this context as it corrects for potential issues of endogeneity and serial correlation, providing more reliable estimates of the long-run coefficients.

The coefficient for IPT is -0.0107, with a t-statistic of -3.2634 and a p-value of 0.0013, indicating a statistically significant relationship at the 1% level. However, the negative sign of the coefficient suggests that an increase in the value of instant pay transactions is associated with a decrease in the contribution of the manufacturing sector to GDP. This counterintuitive result may reflect specific challenges or unintended consequences of using instant payment systems in the manufacturing context. For instance, while instant payments facilitate quicker transactions, they may also lead to inefficiencies in resource allocation or impose higher operational costs, particularly in supply chains where longer-term financial planning is crucial. Another interpretation could be that firms heavily relying on instant pay transactions might prioritize liquidity management over long-term investments, which could negatively impact their overall productivity and contribution to the economy.

Table 4: Panel Fully Modified Least Squares (FMOLS) Result

Dependent Variable: MVA				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
IPT	-0.0107	0.0033	-3.2634	0.0013
INT	-0.0290	0.0107	-2.7099	0.0079
MPT	1.1538	0.1066	10.8233	0.0000
Reliability estimates				
R-squared	0.8401			
Adjusted R-squared	0.8348			
Wald stat.	43.2841			
Prob. Wald	0.0000			
Long-run variance	1.9673			

Source: Authors' Computations.

The coefficient for INT is -0.029, with a t-statistic of -2.7099 and a p-value of 0.0079, also indicating a statistically significant relationship at the 1% level. Similar to IPT, the negative coefficient here suggests that increases in the value of internet transactions are associated with a decrease in the manufacturing sector's share of GDP. This may imply that while internet transactions provide essential services for businesses, they do not directly translate into increased manufacturing output. One possible explanation is that as firms adopt more internet-based transactions, there may be a shift in focus towards digital or service-oriented business models, potentially at the expense of traditional manufacturing activities. Additionally, the infrastructure and technology investments required to support widespread internet transactions may divert resources away from core manufacturing operations, leading to a temporary reduction in manufacturing growth.

In contrast to the negative effects observed for IPT and INT, the coefficient for MPT is 1.1538, with an exceptionally high t-statistic of 10.8233 and a p-value of 0.0000, signifying a highly significant positive relationship at the 1% level. This strong positive coefficient indicates that increases in mobile payment transactions are strongly associated with higher contributions of the manufacturing sector to GDP. This result highlights the transformative role of mobile payments in the manufacturing sector, particularly in Sub-Saharan Africa. Mobile payment systems provide a critical financial infrastructure that enhances financial inclusion, reduces transaction costs, and improves the overall efficiency of financial operations. For manufacturing firms, especially small and medium-sized enterprises (SMEs), mobile payments facilitate smoother cash flow management, quicker access to credit, and more efficient procurement processes, all of which contribute to increased productivity and growth.

The reliability estimates provided by the Fully Modified Ordinary Least Squares (FMOLS) regression offer important insights into the robustness and overall explanatory power of the model used to analyse the impact of digital financial services on the growth of the manufacturing sector in selected Sub-Saharan African countries. These estimates, which include the R-squared, adjusted R-squared, Wald statistic, probability of the Wald statistic, and long-run variance, help in evaluating the goodness-of-fit of the model and the reliability of the results.

The **R-squared** value of 0.8401 indicates that the model explains approximately 84.01% of the variation in the dependent variable, Manufacturing Value Added (MVA) as a percentage of GDP. This high R-squared value suggests that the independent variables—Value of Instant Pay Transactions (IPT), Value of Internet Transactions (INT), and Value of Mobile Payment Transactions (MPT)—together account for a substantial portion of the changes in the manufacturing sector's contribution to GDP. In the

context of econometric modelling, an R-squared value above 80% generally indicates a strong model, suggesting that the selected digital financial services are indeed significant determinants of manufacturing sector growth in the region.

The **Adjusted R-squared**, which accounts for the number of predictors in the model and adjusts the R-squared value accordingly, is 0.8348. This value is slightly lower than the R-squared but remains high, reinforcing the model's strength. The adjusted R-squared provides a more accurate measure of the model's explanatory power by penalizing the addition of irrelevant variables. In this case, the minimal difference between the R-squared and adjusted R-squared values suggests that the included variables are relevant and contribute meaningfully to explaining the variance in the manufacturing sector's performance.

The **Wald statistic** of 43.2841 and its associated **probability value of 0.0000** further confirm the reliability of the model. The Wald test assesses the joint significance of the model's coefficients, testing whether all the coefficients are simultaneously equal to zero. A Wald statistic this high, combined with a p-value of 0.0000, indicates that the null hypothesis—that all coefficients are equal to zero—can be strongly rejected. This means that the independent variables (IPT, INT, MPT) have a statistically significant impact on the dependent variable (MVA) at the 1% significance level. The significance of the Wald statistic highlights the validity of the model and the importance of digital financial services in influencing manufacturing sector growth.

The **long-run variance** of 1.9673 provides an estimate of the model's variance in the context of long-run equilibrium relationships. In time-series and panel data analysis, long-run variance is crucial for understanding the persistence of shocks over time. A relatively low long-run variance, as seen here, suggests that the model is stable over the long term and that the relationships identified between the variables are consistent and reliable. This is particularly important in the context of the study, as it confirms that the estimated impact of digital financial services on manufacturing growth is not only significant but also stable over the long run.

Discussion of Findings

Findings from the study revealed that Instant Pay Transactions (IPT) have a negative but statistically significant impact on the growth of the manufacturing sector in selected Sub-Saharan African countries. This result implies that while instant payments streamline financial transactions by allowing immediate transfer of funds, they however introduce inefficiencies in the manufacturing sector. The negative impact could be attributed to the higher costs associated with maintaining the technological infrastructure required for instant payments, or to the potential for these systems to prioritize liquidity management over long-term investment in manufacturing processes. These findings align with the work of Beck, Senbet, and Simbanegavi (2014), who argued that financial innovations, while beneficial in certain contexts, can sometimes disrupt traditional sectors like manufacturing if not properly integrated. They found that in certain African contexts, the rapid adoption of financial technologies can create a mismatch between the needs of the manufacturing sector and the services provided by the financial system, leading to suboptimal outcomes.

Similarly, the study found that Internet Transactions (INT) have a negative but statistically significant impact on the growth of the manufacturing sector in these countries. This suggests that, although internet-based financial transactions are essential for facilitating global trade and e-commerce, they may not directly contribute to the expansion of the manufacturing sector. The negative impact could stem from the reallocation of resources towards digital infrastructure and online platforms at the expense of traditional manufacturing investments. This finding resonates with the research by Asongu and Nwachukwu (2018), who observed that in African economies, the surge in internet penetration and usage has not always translated into corresponding growth in traditional economic sectors like manufacturing. They posited that this could be due to the nascent stage of digital infrastructure, which might not yet be fully integrated with the needs of the manufacturing industry, leading to inefficiencies and reduced output.

On the other hand, the study highlighted that Mobile Payment Transactions (MPT) have a positive and statistically significant impact on the growth of the manufacturing sector in the selected Sub-Saharan African countries. This finding highlights the critical role of mobile payments in driving economic growth, particularly in regions with limited access to traditional banking services. Mobile payment systems enhance financial inclusion, reduce transaction costs, and improve the efficiency of financial operations, which are all crucial for the expansion and modernization of the manufacturing sector. This outcome is consistent with the findings of Jack and Suri (2014), who demonstrated that the widespread adoption of mobile money services like M-Pesa in Kenya significantly boosted economic activities, including manufacturing. They found that mobile payments facilitated smoother transactions and provided manufacturers with greater access to financial resources, thus enabling them to invest in productivity-enhancing technologies and expand their operations. Moreover, this result aligns with the work of Aker and Mbiti (2015), who highlighted that mobile financial services have a transformative impact on developing economies by lowering barriers to financial access and enabling more efficient business operations, which are particularly beneficial for sectors like manufacturing.

CONCLUSION

The study's main objective was to investigate the impact of digital financial services on the growth of

the manufacturing sector in selected Sub-Saharan African countries. The findings reveal a dynamic relationship between different types of digital financial services and manufacturing growth. The negative but statistically significant impact of Instant Pay Transactions suggests that while these services offer speed, they may introduce inefficiencies in the manufacturing sector. Similarly, Internet Transactions also negatively affect manufacturing growth, potentially due to the diversion of resources towards digital platforms rather than traditional manufacturing investments. Conversely, Mobile Payment Transactions positively and significantly contribute to manufacturing sector growth, highlighting their role in enhancing financial inclusion and operational efficiency. These results highlight the dynamic effects of digital financial services, indicating that while they can drive growth, their implementation must be aligned with the specific needs of the manufacturing sector to ensure positive outcomes.

Policy Recommendations

Based on the findings, the following recommendations were suggested:

i. To address the negative impact of Instant Pay Transactions on the manufacturing sector, it is essential for central banks, such as the Central Bank of Nigeria (CBN), the South African Reserve Bank (SARB), and other relevant financial regulatory bodies across Sub-Saharan Africa, to work closely with commercial banks and payment service providers. These institutions should ensure that instant payment systems are designed with the unique needs of the manufacturing sector in mind. This could involve reducing transaction fees for large-scale industrial payments, providing incentives for using instant payments in ways that enhance long-term investment, and offering tailored financial products that align with the liquidity management needs of manufacturers.

ii. The negative effect of Internet Transactions on manufacturing growth suggests that while digital infrastructure is crucial, there must be a balanced approach that does not detract from investments in physical manufacturing capabilities. Ministries of Industry and Trade, in collaboration with Information and Communications Technology (ICT) ministries in countries like Kenya and Ghana, should develop policies that encourage the integration of internet-based financial services with manufacturing activities. These policies could include subsidies or tax incentives for manufacturers who adopt digital technologies that directly enhance production processes, as well as initiatives to ensure that internet transactions support rather than replace manufacturing investments.

iii. Given the positive impact of Mobile Payment Transactions on the manufacturing sector, it is imperative that telecommunications regulators, such as the Communications Authority of Kenya and the Nigerian Communications Commission (NCC), continue to support and expand mobile payment systems. These institutions should focus on improving mobile network coverage, particularly in rural and industrial areas, to ensure that all manufacturers can access mobile financial services. Additionally, financial institutions, including mobile money operators and commercial banks, should develop more tailored financial products that leverage mobile payment systems to meet the specific needs of manufacturers, such as financing for equipment purchases or working capital.

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