

Impact of Information Technology Investment on Financial Performance of Nigerian Pension Fund Administrators

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ABSTRACT

The paper examined impact of information technology investment on the financial performance of Pension Fund Administrators (PFAs) in Nigeria using panel dataset over the period 2010 - 2025. The paper adopted a dynamic panel approach using System GMM to address endogeneity and dynamic effects. Findings revealed that IT investment has a negative and significant short-term effect on financial performance ($\beta = -0.0151$, $p < 0.01$), indicating that initial technology costs may reduce profitability. Digitalization displayed a positive but weakly significant effect ($\beta = 0.0493$, $p < 0.10$), suggesting that digital transformation yields gradual financial gains. Firm size had a strong positive effect ($\beta = 0.5068$, $p < 0.01$), while interest rate also positively influenced performance. The model demonstrated robust explanatory power ($R^2 = 0.97$). The paper concludes that while IT investment imposes short-term costs, sustained digitalization and scale expansion are crucial for long-term PFA profitability. The paper recommends that PFAs should adopt long-term IT investment strategies, improve the use of digital platforms, and pursue scale efficiencies. Regulators should foster a supportive environment for technological innovation in the pension sector.

Keywords: Information technology investment, digitalization, financial performance, pension fund administrators, fixed effects model

INTRODUCTION

The pension industry has become a critical component of financial sector development and long-term capital formation, particularly in emerging economies. In Nigeria, the introduction of the Contributory Pension Scheme (CPS) under the Pension Reform Act has significantly enhanced transparency, accountability, and efficiency in pension fund management. Pension Fund Administrators (PFAs) play a central role in this structure, managing retirement savings and investing funds across diverse asset classes to generate returns. In recent years, the financial services sector has undergone rapid transformation driven by advances in information and communication technologies. The increasing adoption of digital tools has been reshaping operational processes, improving service delivery, and strengthening decision-making capabilities.

In addition, empirical studies consistently highlight that IT investment contributes significantly to firm productivity, efficiency, and profitability. For instance, Bharadwaj et al. (2022) demonstrate how IT capabilities enhance organizational performance, while Nwankwo and Eze (2023) provide evidence from Nigerian financial institutions showing that digitalization improves efficiency and profitability. These studies underscore the relevance of technology adoption in the pension sector.

Within the pension industry, digitalization manifests in online platforms, automated systems, and data analytics tools designed to boost operational efficiency and customer engagement. Nigerian PFAs have embraced innovations such as mobile applications, online account management systems, electronic contribution platforms, automated contribution reconciliation systems, and digital claims processing to enhance transparency and service

delivery. However, despite these developments, the relationship between IT investment, digitalization, and financial performance in Nigerian PFAs remains underexplored. Existing research has largely focused on governance, asset allocation, and regulatory compliance, with limited attention to technology-driven performance outcomes.

Despite growing technological adoption, many Nigerian PFAs still face operational inefficiencies, high administrative costs, delayed contribution reconciliation, weak customer engagement, and regulatory compliance challenges. PenCom (2025) and PenOp (2026) report persistent service delays and rising operating expenses, especially among smaller PFAs. Although IT investment and digitalization are expected to improve efficiency and profitability, evidence on their actual effect on financial performance remains inconclusive. The 2010–2025 period is appropriate because it captures major reforms, including PenCom’s 2010 digital compliance drive, the Pension Reform Act 2014, the 2018 RSA Transfer System, and post-COVID digital acceleration across pension operations and customer service delivery.

Thus, this paper seeks to address these gaps by examining the impact of IT investment on the financial performance of Nigerian PFAs using robust econometric techniques. By doing so, it contributes to the broader discourse on how technology adoption can strengthen institutional performance and support sustainable growth in the pension industry. Hence, the paper covers the period of 16 years (2010–2025) by analyzing the activities of 13 licensed PFAs in Nigeria. The study is guided by the following research questions:

- i. What is the effect of information technology investment on the financial performance of Pension Fund Administrators in Nigeria?
- ii. To what extent does digitalization influence the financial performance of Pension Fund Administrators in Nigeria?
- iii. How do firm size and interest rate affect the relationship between technology adoption and financial performance of PFAs in Nigeria?

Consequently, the paper is organized into five sections: section one presents the introduction, section two deals with the literature review, section three discusses the methodology, section four presents results and discussions, while section five contains conclusions and policy recommendations.

LITERATURE REVIEW

This section presents review of relevant literature and it is divided into three sub sections which include conceptual review, review of empirical literature and gaps in the empirical studies, and theoretical framework.

Concept of Information Technology Investment

Information technology investment is broadly defined across firms but typically includes people, application software, system software, and hardware as core components of a management information system (Ji, et.al, 2024). In other words, IT investment refers to the allocation of financial resources toward acquiring, developing, and maintaining technological infrastructure, including hardware, software, and digital systems (Andrayani, 2014).

IT investment has been conceptualized to mean an organization’s allocation of financial and managerial resources to acquire, develop, deploy, and maintain IT assets and capabilities including hardware, software, systems, services, and IT labour with the intent to support business processes, enable strategy, and improve firm performance (Mahamad, et al, 2020). Mahamad further emphasizes that IT investment is not just capital expenditure on technology, but a portfolio of decisions covering transactional, informational, and strategic IT assets that must align with business goals and governance to yield value.

According to Porter (2007), IT investment provides competitive advantage for companies and that the strategic alignment between business strategy and IT strategy agreed upon is very influential on the return on IT

investment. Therefore, IT investment refers to firms' ability to invest in IT to automate operations, inform decision-making, and/or transform business models. However, the risk and return profile differs by industry type in the process of automation, informing, as well as transforming. Thus, definitions vary, with a trend toward broadening scope beyond traditional infrastructure. For Pension Fund Administrators (PFAs), IT investment includes pension management software, cybersecurity, contribution reconciliation, RSA management, regulatory reporting, customer portals, and real-time valuation. Aligning digital capabilities with organizational goals (Bharadwaj et al., 2022) enhances compliance, efficiency, and customer satisfaction. Thus, IT investment enables PFAs to automate operations, improve transparency, manage risk, and boost long-term financial performance.

Concept of Digitalization

Digitalization has been defined from different view: From the process and value view O'Leary (2023) defines digitalization as using digital technologies to change business process, thereby positioning it between digitization and digital transformation. AbaziChauzi and Veseli-Kurtishi (2024) from organizational change view describes digitalization as the process that reshapes operations, strategies, and interactions driven by technological advancements, market competition, and evolving customer expectations. Contrary to this, Abdul-aty and Negri (2024) conceptualized digitalization from manufacturing and smart systems view through the digital thread, emphasizing interactions of data across product life-cycles to enable new capabilities. Whereas from the sociocultural view Sunberg (2024) views digitalization as a measure of level of sociocultural change, where digitization, digitalization, and digital transformation form a hierarchy of learning and organizational maturity.

Digitalization is the strategic integration of digital technologies into the organizational processes, business models, and social practices to create new value, alter interactions, and enable data-driven decision-making, extending beyond technical conversion to encompasses operational and cultural. In essence, digitalization involves the integration of digital technologies into organizational processes to enhance efficiency, innovation, and value creation. Recent studies highlight that digitalization improves operational efficiency, reduces transaction costs, and enhances service delivery in financial institutions (Dogru et al., 2023). In the pension sector, digital platforms enable real-time account monitoring, automated contributions, and improved communication with contributors.

Financial Performance of Pension Fund Administrators

Financial performance in the pension industry is typically measured using indicators such as return on assets (ROA), return on investment (ROI), net asset value (NAV), and fund growth. Empirical studies shows that PFAs' performance is influenced by investment strategies, asset allocation, and market conditions. This study adopts Return on Assets (ROA) to measure financial performance for PFAs, which earn asset-based management fees rather than equity returns. ROA captures managerial efficiency in utilizing managed assets. Performance is influenced by fee structure, contribution density, portfolio diversification, and compliance, making ROA more suitable than ROE or ROI.

For instance, Ogunbade et al., (2022) found a positive relationship between investment returns and pension fund performance in Nigeria, suggesting that improved portfolio management enhances financial outcomes, the study indicate that asset allocation decisions significantly influence PFAs' profitability and sustainability. Recent industry data also indicate that Nigerian PFAs have recorded strong returns despite macroeconomic challenges, with average returns reaching over 16% in 2025 (PENCOM, 2026). This performance reflects improvements in investment strategies and diversification. Nigerian PFAs recorded nominal returns above 16% in 2025, but real returns are lower after inflation and costs, highlighting the need to examine operational efficiency alongside investment returns.

Information Technology Investment and Financial Performance

The relationship between technology investment and financial performance is well established in the literature. IT enhances productivity, improves decision-making, and facilitates innovation, thereby contributing to firm performance. In financial institutions, IT adoption has been shown to improve operational efficiency and service

quality. For instance, studies in the banking industry such as Luka (2012), Prasetyo and Marselina (2020), and Bello (2024) demonstrate that IT deployment leads to improved competitiveness and customer satisfaction, ultimately enhancing financial performance. Banking studies are relevant because both banks and PFAs operate in regulated environments where technology supports compliance and risk. But PFAs' different revenue and regulations require sector-specific investigation. In the pension industry, IT investment supports efficient fund management, risk assessment, and compliance with regulatory requirements (PENCOM, 2026). It also enables PFAs to process transactions more efficiently and reduce operational costs.

Some studies for instance, Brynjolfsson and Hitt (1996) and Dedrick et al. (2003) find short-term IT investments may reduce profitability due to costs and delayed returns, introducing contrary evidence and supporting possible negative short-run effects in pension administration. According to Ogungbade, et al (2022) execution of diversified strategies on IT investment requires robust IT portfolio for monitoring, valuation, and reporting and this has a positive significant influence in PFA's financial performance. This is in line research by Bello (2024) which states that IT investment has a positive effect on profitability of banks. Thus, this study hypothesizes that therefore, this study proposes the directional alternative hypothesis that: H1: Information technology investment has a significant effect on the financial performance of PFAs in Nigeria.

Digitalization and Financial Performance

Digitalization has transformed pension fund administration by enabling automation, transparency, and improved customer experience. Furthermore, digitalization improves financial performance by changing business processes, enabling new revenue streams, and increasing operational efficiency (Nguyen, 2024). The relationship is well-studied across sectors and regions with most recent evidence showing a positive impact, aligning with the resource view where IT governance and digital capabilities are strategic resources that align technology with financial objectives, manage risk, and optimize resources. Digitalization improves PFA performance by reducing transaction costs, accelerating remittance, minimizing errors, lowering acquisition costs, improving retention, and strengthening compliance boosting profitability and sustainability.

According to Hernando and Nieto, the use of internet as a bank distribution channel has a positive impact on financial performance. This is in line with the Bello (2024) studies which shows that banks with internet banking have a better financial performance compared with banks without internet banking. Therefore, this research wants to know whether digitalization have a positive influence on financial performance of PFAs' in Nigeria. Thus, the study proposes the directional alternative hypothesis that H2: Digitalization has a significant positive effect on the financial performance of PFAs in Nigeria.

Review of Empirical Studies

The review focused on the aspect of IT investment and digitalization in pension industry and it was carried out in descending order based on recency and relevancy of the studies. To begin with, Chiazor and Ogunyemi (2025) assessed the impact of pension funds administration on Nigeria's economic development, focusing specifically on factors such as automation and transparency. The paper utilized a descriptive survey design with cross-sectional data collected in 2025. Through Pearson correlation and multiple regression analysis. The findings indicated that technological development, particularly automation, emerged as the strongest predictor of pension system effectiveness, with a strong correlation ($r = 0.73$) observed between pension fund effectiveness and GDP stimulation. Although their findings showed automation as the strongest predictor, the use of cross-sectional survey design limits causal inference because perceptions of respondents cannot adequately establish long-run financial effects on PFAs.

Similarly, Oyerinde, et al. (2025) examined the impact of contribution levels on the performance of pension funds in Nigeria using panel data spanning 2012 to 2023. The paper applied purposive sampling and regression analysis. The key finding was that contribution levels do not directly determine performance; instead, governance quality, management efficiency, and broader economic conditions play a more significant role. In the same token, Oyerinde, et al. (2024) investigated the impact of macroeconomic factors and assets/liabilities management on the performance of Nigerian PFAs. Using an ex post facto design with panel data from 2010 to 2021, the authors employed regression analysis and the Hausman test to select a random effects model. The main

finding showed that the real GDP growth rate had a negative and insignificant relationship with PFA performance, leading the authors to recommend that PFAs focus on creative asset/liability management to sustain performance irrespective of macroeconomic fluctuations.

In Addition, Afolabi, et al. (2024) scrutinized the factors influencing the financial sustainability of PFAs in Nigeria, with a focus on corporate governance mechanisms and investment policy. The paper employed a cross-sectional survey design in 2024 and used Partial Least Squares Structural Equation Modeling (PLS-SEM) for analysis. Contrary to expectations, the paper found that both governance mechanisms and investment policy exhibited negligible impacts on financial sustainability, suggesting that other factors such as technology adoption and operational efficiency may be more critical drivers of sustainability. Their panel structure provides stronger explanatory power than survey studies, but the paper focused more on governance quality than direct IT investment, leaving the technology-performance relationship insufficiently explored.

In furtherance, Ajibade (2024) aimed to identify the effective roles of PFAs, the challenges affecting them, and potential solutions, with a particular emphasis on employee motivation. Using a descriptive survey and cross-sectional data collected in 2024, the paper applied Pearson correlation analysis. The findings revealed a weak positive relationship ($r = 0.186$) between PFAs' effective roles and employee motivation. The paper recommended that PFAs employ appropriate information technology for training and communication to strengthen this relationship. However, descriptive survey methods are weak for establishing causal relationships between technology adoption and firm performance because they rely heavily on subjective responses rather than audited financial indicators.

Besides, Otekunrin and Nwanji (2024) examined the determinants of investment performance among Nigerian PFAs. Using panel data from 2014 to 2023, the authors applied Generalized Least Squares (GLS) regression to evaluate the connection between four financial assets that Nigerian PFAs invest in and investment returns. The main findings revealed that contribution density, idle contribution, contribution size, total pension fund assets, and leverage are all critical in determining investment performance. Notably, a positive coefficient was reported for contribution density, implying that selected PFAs could improve their performance considerably if greater attention is given to contribution density, as it serves as a major key driver of PFA performance.

Finally, Boloupremo and Akwarandu (2023) conducted a paper in Nigeria to investigate the impact of risk management, liquidity management, technological innovation, and corporate governance on the financial stability of Pension Fund Administrators (PFAs). Using a cross-sectional survey dataset (the period was not specified), they employed quantitative survey methods and multilinear regression analysis. Their key variables included financial stability as the dependent variable, with technological innovation, risk management, liquidity management, and corporate governance as independent variables. The main finding revealed that technological innovation was the most influential factor for financial stability, highlighting its critical role in enhancing operational efficiency; corporate governance also showed a significant positive impact.

Based on the studies review, the major gap in the literature is methodological, conceptual, and contextual. Methodologically, studies such as Oyerinde et al. (2024) and Otekunrin and Nwanji (2024) used panel techniques, while Chiazor and Ogunyemi (2025), Ajibade (2024), and Boloupremo and Akwarandu (2023) relied mainly on descriptive surveys, limiting causal inference and failing to address endogeneity. Few studies applied dynamic panel methods like System GMM. Conceptually, most studies do not distinguish IT investment from digitalization as separate constructs. Contextually, evidence is largely drawn from banking studies rather than Nigerian PFAs, despite differences in regulation, operations, and revenue structure.

THEORETICAL FRAMEWORK

A theoretical framework provides the foundation upon which research is constructed. This study is anchored on the Resource-Based View (RBV) and Technology Acceptance Model (TAM). Resource-Based View (RBV), popularized by Barney (1991), posits that firms achieve sustainable competitive advantage through valuable, rare, inimitable, and non-substitutable resources. In PFAs, such resources include pension management software, automated contribution reconciliation systems, cybersecurity infrastructure, regulatory reporting platforms, customer relationship management systems, and real-time RSA valuation tools. These digital assets are valuable

because they improve efficiency, rare because smaller PFAs may not possess them, and difficult to imitate due to cost, expertise, and regulatory complexity.

Technology Acceptance Model (TAM), developed by Davis (1989), explains technology adoption based on perceived usefulness and perceived ease of use. For PFAs, perceived usefulness is reflected in how contributors and employees view digital pension platforms as improving speed, accessibility, transparency, and retirement planning, while ease of use relates to the simplicity of online account access, mobile applications, and automated service platforms. RBV explains why IT investment matters strategically, while TAM explains how actual adoption determines effectiveness. The inclusion of lagged financial performance in the System GMM model is theoretically supported by RBV because strategic technology resources generate benefits over time, creating performance persistence rather than immediate outcomes. Institutional theory and contingency theory were considered but excluded because this study focuses primarily on firm-level financial outcomes rather than regulatory pressure or organizational contingencies. RBV and TAM are sufficient because they jointly explain both strategic resource allocation and technology usage behavior.

The integration of RBV and TAM strengthens the framework by combining organizational and behavioral perspectives. RBV explains why IT investment and digitalization matter for competitive advantage, while TAM explains how these technologies are adopted and used to achieve desired outcomes. This dual perspective ensures that both resource allocation and user engagement are considered in evaluating financial performance. This theoretical framework aligns directly with the paper's objectives of examining the impact of IT investment and digitalization on the financial performance of Nigerian PFAs. The combined insights of RBV and TAM provide a strong theoretical basis for examining the ways in which technology adoption and resource utilization shape financial performance in Nigerian PFAs.

RESEARCH METHODOLOGY

Research Design

The paper adopts a longitudinal panel data research design, which involves the use of existing data to examine the relationship between information technology investment, digitalization, and financial performance of PFAs in Nigeria. By combining cross-sectional dimension of multiple PFAs and time-series dimension over 2010–2025 the paper capture firm-specific differences, analyze changes over time, and improve estimation efficiency and reliability. The panel design is preferred because it controls for unobserved heterogeneity across PFAs such as differences in management quality, organizational culture, and risk appetite; it reduces omitted variable bias, it captures dynamic behavior of IT investment and performance. It provides more robust and efficient estimates compared to pure cross-section or time-series.

Population and Sample Size

The population of the study comprises all the 20 licensed Pension Fund Administrators (PFAs) in Nigeria as at December 2025 (PenCom, 2026). These PFAs are responsible for the management and administration of Retirement Savings Accounts (RSAs) on behalf of contributors under the Contributory Pension Scheme (CPS). The key PFAs that constitute the population is presented in table 3.1 the list represents the major players in the sector, which collectively hold the majority of pension assets under management and serve the largest number of contributors nationwide.

Table 3.1: Summary of Population of the Study

eSN	Pension Fund Administrator	Year of Incorporation	Source
1	ARM Pension Managers Limited	2005	Founded in December 2005
2	Stanbic IBTC Pension Managers Limited	2004	Incorporated on 19 May 2004
3	Leadway Pensure PFA Limited	2004	Incorporated on August 25, 2004

4	NLPC Pension Fund Administrators Limited	2005	Incorporated on January 19, 2005
5	Oak Pensions Limited	2006	Incorporated on March 30, 2006
6	Trustfund Pensions Plc	2007	Incorporated in November 2005
7	CrusaderSterling Pensions Limited	2004	Incorporated on October 12, 2004
8	FCMB Pensions Limited	2005	Incorporated on April 5, 2005
9	Fidelity Pension Managers Limited	2004	Incorporated on September 22, 2004
10	NPF Pensions Limited	2013	Incorporated on October 21, 2013
11	Sigma Pensions Limited	2004	Incorporated in August 2004
12	Veritas Glanvills Pensions Limited	2007	Incorporation in June 21, 2007
13	IEI-Anchor Pensions Managers Limited	2004	Incorporated in November 2004

Source: Author's Computation, Pencom 2026

The sample consists of licensed Pension Fund Administrators (PFAs) in Nigeria with complete consecutive annual data from 2010 to 2025, selected using purposive sampling technique. This criterion ensures balanced panel data suitable for longitudinal econometric techniques. For instance, fixed effects and random effect model, which minimizes missing data bias, captures key industry developments, including post-crisis reforms and digitalization. Based on the predetermined sampling criteria, 13 PFAs met the sample selection criteria, while 7 PFAs were excluded due to incomplete data, missing consecutive observations, or incorporation after 2010. PFAs incorporated after 2010 (e.g., NPF Pensions Limited, incorporated 2013) were included only from their first full year of data availability (2014 onwards), maintaining an unbalanced panel structure for those firms. However, the paper acknowledges that purposive sampling may introduce selection bias. Thus, the selected sampled PFAs collectively hold approximately 92% of the total industry assets under management, and they also represent majority of the PFAs in Nigeria with over 5% market share. The adoption of a panel data technique over the period 2010–2025 is justified by its ability to control for unobserved heterogeneity, capture dynamic relationships, improve estimation efficiency, and reflect the evolving digital and regulatory landscape of the Nigerian pension industry. The data was source from Annual reports of PFAs, National Pension Commission (PenCom), Nigerian Exchange (NGX), and financial statements.

Variables and their Measurement

The study utilized three set of variables such as the dependent, independent and control variables

Dependent Variable

The dependent variable is performance of Pension Fund Administrators (PFAs) measured with Return on Assets (ROA), which captures the efficiency with which PFAs utilize assets to generate profit. ROA (Net Profit After Tax divided by Total Assets X 100%).

Independent Variables

The independent variables in this study are Information Technology Investment (ITI), and Digitalization (DIG).

i. Information Technology Investment (ITI)

Information Technology Investment (ITI) is measured as annual total expenditure on technology (including both capital expenditure and operational expenses such as software subscriptions, cloud services, and IT staff salaries) divided by total assets, multiplied by 100%. This broader measure avoids conflating IT investment with IT intensity and captures both capital and operational IT outlays relevant for digitalization.

ii. Digitalization (DIG).

Digitalization (DIG) measured using a composite index consisting of mobile application availability, online RSA access platform, e-payment and automated contribution systems, customer self-service portals, and digital claims processing. This provides a broader representation of digital transformation than merely counting digital platforms. DIG (Composite Index of the six items divided by six)

The Control Variables

The control variables employed in the paper are interest rate and firm size.

i. Interest Rate (INT)

Considering the role of PFAs in funds and investment portfolio management which is influenced by government monetary policy rate issued by Central Bank of Nigeria (CBN), as such the study takes in account the interest rate as one of the control variables. Interest Rate (INT), is measured as prevailing annual monetary policy rate from the CBN.

ii. Firm Size (FSZ)

Firm size was included because large companies are more likely to increase their financial performance, such as investing heavily on software acquisition, cybersecurity systems, data management platforms, and automation systems so as enjoy competitive strategies. Firm Size (FSZ) was measured as the natural logarithm of total assets investments.

Model Specifications

This paper adapt model with slight modification which is in conformity with the work of Oyerinde, et al. (2024). The functional equation is specified as:

$$FP = f(ITI, DIG, INFL, FZS) \dots\dots\dots (3.1)$$

Where “FP” represents financial performance, “ITI” denote information technology investment, “DIG” is digitization, “INFL” connote inflation, and “FZS” represents firm size. The above functional equation is restated into mathematical equation as:

$$FP_{it} = \beta_0 + \beta_1 FP_{it} + \beta_2 ITI_{it} + \beta_3 DIG_{it} + \beta_4 INFL_{it} + \beta_5 FZS_{it} \dots\dots\dots (3.2)$$

Where: β_0 is Intercept, $\beta_1 - \beta_4$ represents coefficients of the parameters to be estimated, i represents the cross-sectional unit and t represents the time period. The mathematical equation is restated in to econometric equation to capture the error term or disturbance term.

$$FP_{it} = \beta_0 + \beta_1 FP_{it} + \beta_2 ITI_{it} + \beta_3 DIG_{it} + \beta_4 INFL_{it} + \beta_5 FZS_{it} + \mu_{it} \dots\dots\dots (3.3)$$

Where: μ represents error term or disturbance term, the error term (or disturbance term) in econometrics represents the portion of variation in the dependent variable that is not explained by the independent variables in a regression model. It captures random noise, omitted factors, measurement errors, and other influences outside the model’s specification.

$$FP_{it} = \beta_0 + \beta_1 FP_{it} + \beta_2 ITI_{it} + \beta_3 DIG_{it} + \beta_4 INFL_{it} + \beta_5 FZS_{it} + \mu_{it} \dots\dots\dots (3.4)$$

Where “FP” represents logarithm of financial performance, “ITI” denote logarithm of information technology investment, “DIG” is logarithm of digitization, “INFL” connote logarithm of inflation, and “FZS” represents logarithm of firm size. The above functional equation is restated into mathematical equation as: Taking logarithms of variables allows for easier interpretation (elasticities), reduces statistical problems (skewness, heteroskedasticity), and aligns with the multiplicative nature of many economic relationships.

A Priori Expectations

A priori expectations guide the anticipated relationships in the model. Information Technology Investment (ITI) is expected to positively affect Pension Fund Administrators' (PFAs) financial performance, measured by Return on Assets (ROA). This is based on the idea that capital expenditure on technology enhances efficiency, reduces costs, improves data management, and strengthens decision-making. However, following Brynjolfsson and Hitt (1996) and Dedrick et al. (2003), short-term effects may be negative due to implementation costs and delayed returns.

Similarly, Digitalization (DIG) is expected to improve ROA by promoting transparency, customer engagement, and confidence through platforms such as mobile applications and online portals, which can increase inflows. Firm size (FSZ) and firm age (AGE) are all expected to have positive effects due to economies of scale, learning effects, and market power respectively. The effect of interest rate (INT) is theoretically ambiguous: while higher rates may boost returns on fixed-income securities, they can also discourage investment and slow economic activity, making the coefficient either positive or negative depending on conditions. On balance, given PFAs' large holdings of government bonds, the expected sign is positive.

Table 3.2: Summary of A Priori Expectations

Variable	Variable Type	Measurement	Expected Sign	Source	Theoretical Justification
Financial Performance (FP)	Dependent Variable	Return on Assets (ROA)	N/A	Annual Reports of PFAs (2025)	Measures profitability and efficiency of PFAs
Information Technology Investment (ITI)	Independent Variable	Capital expenditure on technology	Positive (+)	Annual Reports of PFAs (2025)	Enhances efficiency, reduces cost, and improves decision-making
Digitization (DIG)	Independent Variable	Composite Index	Positive (+)	Annual Reports of PFAs (2025)	Improves service delivery, transparency, and customer engagement
Interest Rate (INR)	Control Variable	Prevailing interest rate	Positive (+)/Negative (-)	Central Bank of Nigeria (CBN) (2025)	Improves service delivery, transparency, and customer engagement
Firm Size (FZS)	Control Variable	log of Total asset investment or Total Credit Granted	Positive (+)	Annual Reports of PFAs (2025)	Larger firms benefit from economies of scale, better resource access, and improved performance

Source: Author's Compilation (2026)

This paper employed both descriptive and inferential statistics analysis for the assessment of impact of information technology investment on financial performance of Nigerian pension fund administrators.

The descriptive statistics includes mean, median, min, max, standard deviation, skewness, kurtosis) simplify complex data, enabling meaningful conclusions. As Jaggi (2012) and Field (2013) emphasize, they provide a foundation for advanced analysis.

Inferential statistics enable conclusions about a population from the sample data, testing hypotheses and making predictions (Gujarati & Porter, 2009). Unlike descriptive statistics, it helps in generalizing finding. The paper employs multicollinearity tests, system GMM, and diagnostic tests. The analysis involved three phases. Pre-estimation which include multicollinearity tests which ensured variable reliability. System GMM was used for the estimation because financial performance is dynamic and IT investment may be endogenous; it suits large-N, small-T panels, controls unobserved heterogeneity, and addresses endogeneity. Post-estimation include

Arellano-Bond test for no second-order serial correlation, Hansen J test for instrument validity, and Difference-in-Hansen test for instrument subsets. The system GMM is specified as:

$$Y_{it} = \alpha Y_{i,t-1} + \beta X_{it} + \mu_i + \varepsilon_{it} \dots \dots \dots (3.4)$$

Where Y_{it} represent financial performance of pension fund administrator i at time t , $Y_{i,t-1}$ denote lagged dependent variable (captures persistence/dynamics), X_{it} is explanatory variables (IT investment, digitalization), μ_i represent unobserved firm-specific effects, and ε_{it} = idiosyncratic error term. The System GMM estimates this by combining equations in first differences (to remove μ_i) and in levels (to improve efficiency), using lagged values of Y and X as instruments.

RESULTS AND DISCUSSIONS

This section presents results and discussion on impact of information technology on financial performance of Nigerian pension fund administrators. The discussion was carried out in two parts, first with descriptive statistics followed by inferential statistics results. The results of the descriptive statistics on impact of information technology investment and digitalization on financial performance of Nigerian pension fund administrators is presented in Table 4.1.

Table 4.1: Results of the Descriptive Statistics

Varbs.	Mean	Media	Max	Min	Std.Dev.	Skew.	Kurt.	Obs
FP	2.737	2.900	5.100	0.700	1.143	-0.130	1.882	195
LOG_ITI	2.721	2.666	3.871	1.386	0.587	0.120	2.450	195
DIG_NORM	0.258	0.333	0.500	0.000	0.185	-0.154	1.683	195
INR	11.28	11.50	14.00	8.500	1.851	-0.077	1.587	195
FSZ	8.932	9.010	10.45	7.600	0.657	-0.108	2.248	195

Source: Field Survey 2026, E-views 12

Table 4.1 presents descriptive statistics for Nigerian Pension Fund Administrators (PFAs) from 2010–2025, covering 195 firm-year observations. The dependent variable, ROA, averages 2.735% with a median of 2.900%, showing slight left skew and ranging between 0.700% and 5.100%, reflecting performance heterogeneity. LOG_ITI (natural log of winsorized technology expenditure-to-assets ratio) has a mean of 2.721 and standard deviation 0.587, supporting elasticity interpretation. DIG_NORM (normalized digitalization index, 0–1) averages 0.2588, with 23.1% of observations recording zero platforms in early years and 19.2% reaching 0.5 (three platforms), indicating gradual digital adoption. INR, the monetary policy rate, averages 11.275% with minimal skewness and a stable range of 8.5–14.0%, showing limited annual fluctuations. FSZ, measured as log of total assets, has a mean of 8.93, standard deviation 0.64, and near-normal distribution, confirming moderate variation in firm size.

Overall, the dataset is balanced, transformations ensure normality, and variable distributions are appropriate for dynamic panel estimation. These characteristics justify the use of econometric techniques such as system GMM to examine the impact of IT investment and digitalization on PFAs' financial performance.

Pre Estimation test

Table 4.2: Results of the Multicollinearity Test

Variable	VIF	1/VIF
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LOG_ITI	2.12	0.472
DIG_NORM	2.88	0.347
FZS	2.76	0.363
INR	1.32	0.755
Mean VIF = 2.27		

Source: Author's Computation, STATA 20

Table 4.2 presents the results of the multicollinearity test based on a Variance Inflation Factor (VIF). All VIF values are well below the conventional threshold of 10, with a mean VIF of 2.27. This indicates that multicollinearity is not a serious issue in the model, and the explanatory variables are sufficiently independent for reliable regression estimation.

Estimation Test (Estimation Procedure)

Table 4.3: Results of the System GMM

Dependent Variable: Financial Performance (FP)				
Ind. Variables	Coefficient	Standard Error	z-Statistics	P-value
L. FP(lagged ROA) _{i,t}	0.7802	0.0511	15.28	0.000***
LOG_ITI _{i,t}	-0.0151	0.0032	-4.66	0.000***
DIG_NORM _{i,t}	0.0493	0.0279	1.77	0.077*
INR _{i,t}	0.0055	0.0019	2.91	0.004***
FSZ _{i,t}	0.5068	0.1906	2.66	0.008***
C _{i,t}	-3.6453	1.5178	-2.40	0.016**
No. of Obs. = 195, No. of Group = 13, No. of Instruments = 42				

Source: Author's Computation, 2026, STATA 20 Note: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$

Table 4.3 presents the results of the system GMM used to assess the impact of information technology investment on the financial performance of Nigerian pension fund administrators. The System GMM results show that the lagged dependent variable (L.ROA) has a positive and highly significant coefficient ($\beta = 0.7802$, $p < 0.01$), indicating strong persistence in financial performance among Pension Fund Administrators (PFAs). This suggests that previous profitability significantly influences current profitability. The findings show that financial performance among Nigerian Pension Fund Administrators (PFAs) is strongly influenced by past profitability, technology decisions, and firm-specific characteristics. The positive and significant coefficient of the lagged dependent variable confirms that profitability is persistent over time, meaning PFAs that performed well previously are more likely to remain profitable. This supports Oyerinde et al. (2025), who found that governance quality and management efficiency are stronger drivers of performance than contribution levels alone.

Information Technology Investment (LOG_ITI) shows a negative and statistically significant effect on financial performance ($\beta = -0.0151$, $p < 0.01$). Because LOG_ITI is in natural log form, the coefficient represents elasticity: a 1% increase in IT investment (as a share of assets) is associated with a 0.0151% decrease in ROA in the short run. This implies that short-run technology investments may initially reduce profitability due to high implementation costs, maintenance expenses, and adjustment costs before long-term gains are realized. This suggest that heavy spending on technology may reduce profitability in the short run. This is likely due to high setup costs, software acquisition, training, maintenance, and system integration expenses. This finding agrees with Oyerinde et al. (2024), who emphasized that PFAs need strong asset and liability management to remain profitable despite operational challenges. However, it disagrees with Chiazor and Ogunyemi (2025) and

Boloupremo and Akwarandu (2023), who found that automation and technological innovation improve pension system effectiveness and financial stability. The difference may be explained by sample period, those studies examined longer horizons (10+ years) or used efficiency metrics (cost-to-income ratio), whereas this paper captures short-term profitability using ROA with a 16-year panel (2010–2025). Additionally, the negative coefficient reflects the immediate expensing of IT capex, while benefits (e.g., reduced transaction costs) accrue with lags not fully captured in the one-year lag structure.

Digitalization (DIG_NORM) has a positive and weakly significant relationship with financial performance ($\beta = 0.0493$, $p < 0.10$), suggesting that digital transformation contributes positively to profitability, although the effect remains relatively small and gradual. Since DIG_NORM ranges from 0 to 1, the coefficient implies that moving from no digital platforms to full digitalization (a 1-unit change) increases ROA by about 4.93 percentage points, *ceteris paribus*. This aligns with Ajibade (2024), who recommended the use of IT systems for communication and staff efficiency, and Afolabi et al. (2024), who emphasized technology adoption over traditional governance mechanisms.

Interest Rate (INR) exhibits a positive and significant effect ($\beta = 0.0055$, $p < 0.01$), indicating that favorable interest rate conditions may improve returns from fixed-income securities, which constitute a major portion of pension fund investments. Firm Size (FZS) also has a positive and significant impact ($\beta = 0.5068$, $p < 0.01$). Because FSZ is in logs, the elasticity is 0.5068: a 1% increase in total assets is associated with a 0.51% increase in ROA. Suggesting that larger PFAs benefit from economies of scale, stronger diversification, and better financial resilience. This supports Adekoya et al. (2022) and Otekunrin and Nwanji (2024). Firm size also positively affects performance, indicating that larger PFAs benefit from economies of scale, diversification, and stronger financial resilience, which agrees with existing empirical studies.

Post estimation and Specification Test

Table 4.4: Results of Diagnostic and Specification Test

Test	Statistic	Probability
Wald Chi-square	192193.18	0.000***
AR (1) Test	-2.65	0.008***
AR (2) Test	-1.21	0.226
Sargan Test	18.30	0.214
Hansen Test	17.85	0.241
Difference-in-Hansen Test	2.11	0.146

Source: Author’s Compilation, STATA 20

Table 4.4 presents the diagnostic and specification tests for the System GMM model examining the impact of information technology investment on the financial performance of Nigerian PFAs. The results collectively confirm the robustness and validity of the model. Serial correlation tests, the AR (1) test is significant ($p = 0.008$), which is expected in first-differenced dynamic panels and does not indicate model misspecification. More importantly, the AR (2) test is insignificant ($p = 0.226$), confirming the absence of second-order serial correlation in the differenced residuals. This satisfies a key identification condition of the System GMM estimator. Over-identification tests, both the Sargan test ($p = 0.214$) and the Hansen test ($p = 0.241$) fail to reject the null hypothesis that the instruments are valid (i.e., uncorrelated with the error term). Although the Hansen test is preferred under heteroskedasticity, the close agreement between the two statistics reinforces instrument validity. The Difference-in-Hansen test ($p = 0.146$) further supports the validity of the instrument subsets (e.g., GMM-style vs. IV-style instruments).

Joint significance, the Wald Chi-square statistic (192193.18, $p < 0.01$) is highly significant, indicating that the explanatory variables (lagged performance, IT investment, digitalization, interest rate, and firm size) jointly

explain variations in financial performance. Instrument count, the model uses 42 instruments for 13 groups and 195 observations. While this number is above the ideal rule of thumb (instruments $\leq$ groups), the diagnostic tests show no evidence of over-fitting or instrument proliferation bias. The reported p-values for the Hansen and Difference-in-Hansen tests remain non-significant, suggesting that the instrument set is still appropriate. In summary, the post-estimation diagnostics confirm that the System GMM model is well specified, statistically reliable, and suitable for analyzing the relationship between IT investment, digitalization, and the financial performance of PFAs in Nigeria.

CONCLUSION AND RECOMMENDATIONS

The paper concludes that IT investment and digitalization are associated with PFAs' financial performance, though effects differ. IT investment shows a negative short-run relationship with ROA ($\beta = -0.0151$, $p < 0.01$), while digitalization exhibits a positive but weakly significant relationship ($\beta = 0.0493$, $p < 0.10$). The lagged dependent variable confirms strong profitability persistence, though causal inference requires caution. The negative IT association may reflect high implementation costs and delayed returns, but unobserved factors could also contribute. Digitalization may gradually improve efficiency and service delivery, but weak significance calls for cautious interpretation. Interest rate is positively associated with performance, suggesting PFAs benefit from higher fixed-income returns. Firm size also shows a strong positive association, indicating economies of scale and better resilience. Overall, the paper finds that IT investment correlates with reduced short-term profitability, while sustained digitalization and institutional strength correlate with long-term performance. These findings remain correlational due to inherent limitations of dynamic panel methods. This study has six limitations: small sample (13 PFAs, 2010–2025) excluding smaller/newer PFAs; IT investment measure ignores quality/timing; digitalization index reflects availability not usage; 16 years may miss long-term effects; System GMM does not establish causality; weak digitalization significance ($p < 0.10$) demands larger samples or better measures.

Based on the findings and within the acknowledged limitations, the following recommendations are proposed for relevant stakeholders. Pension Fund Administrators (PFAs) should adopt a phased approach to IT investment, establish clear 3–5-year return on investment (ROI) targets, strengthen digitalization strategies, and consider strategic mergers or collaborations to achieve economies of scale. The National Pension Commission (PenCom) should provide regulatory incentives for technology adoption, require separate disclosure of IT-related expenditures, and support the development of shared digital infrastructure across the industry. Similarly, the Pension Fund Operators Association of Nigeria (PENOP) should promote knowledge sharing among PFAs and advocate for tax amortization policies on IT capital expenditure to reduce investment burdens. Given the measurement issues, weak significance, and short-term negative effect of IT investment, future research should extend time horizons to 20–25 years, refine digitalization measures (usage, not just availability), use qualitative case studies, add controls (age, contributor growth), test alternative metrics (cost-to-income), and examine non-linear IT effects.

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