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Information technology investment and return on assets: operational efficiency, IT governance, and digital transformation in Indonesian technology firms

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A b s t r a c t

This study examines the impact of Information Technology (IT) Investment on Return on Assets (ROA) by positioning Operational Efficiency as a mediating variable and IT Governance and Digital Transformation as moderating variables in technology firms. The objective is to explain the mechanism through which IT investment is converted into financial performance. A quantitative explanatory approach was applied using five-year (2021–2025) panel data from technology-sector companies listed on the Indonesia Stock Exchange, analyzed with the Fixed Effect Model, the Sobel Test, and Moderated Regression Analysis (MRA) using EViews 12 and Python. The results show that IT Investment significantly increases Operational Efficiency, which in turn enhances ROA, and that Operational Efficiency fully mediates the relationship between IT Investment and ROA. IT Governance and Digital Transformation significantly strengthen the link between investment and efficiency. The findings confirm that the economic value of IT depends on internal efficiency and structural readiness. It is therefore recommended that managers align technology spending with efficiency optimization, strengthen IT governance, and pursue an integrated digital transformation strategy to ensure sustainable financial performance. This research enriches the IT Business Value literature by providing a strategic mediation–moderation framework for the IT–ROA nexus.

Introduction

Companies operating in the technology sector face demands to increase operational efficiency and profitability through the proper use of technology. With increasing competition, these companies need to adapt to the latest trends and innovations to remain competitive in the global market (Anugrafianto et al., 2024; Esquivias & Harianto, 2020). Investment in information technology is generally believed to make a positive contribution to operational efficiency. Digital technologies, such as accounting information systems and Internet of Things (IoT)-based innovations, can improve the speed and accuracy of decision-making, which in turn has the potential to increase a company's ROA. Kamsariaty (2024) highlights the importance of human resource management and the adoption of modern technology in improving company performance, showing that investment in technology not only improves efficiency but also increases employee productivity (Judijanto, 2024; Kamsariaty, 2024).

In the context of Indonesian technology companies, diversifying investment into information technology can drive the development of innovations that support operational efficiency. For example, Judijanto et al. (2024) show that there is a positive relationship between IoT implementation and the efficiency and effectiveness of decision-making. By integrating digital technology, companies can optimize their internal processes, minimize errors, and accelerate their response to market needs (Judijanto et al., 2024; Murini et al., 2023).

The challenges that companies face in adopting new technologies cannot be ignored. Several studies have identified digital competency gaps and organizational cultural resistance as obstacles in the digital transformation process (Judijanto et al., 2024). Therefore, it is important for companies to implement effective change strategies, including training and development to upskill employees and to facilitate the adoption of new technologies. Proper training allows employees to make the most of technology, which affects operational efficiency and can ultimately improve a company's ROA.

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In terms of performance measurement, ROA is one of the main parameters for assessing a company's financial performance. Syahrir et al. (2019) prove that operational efficiency and innovation affect financial performance and company value in the pharmaceutical sector in Indonesia. This is relevant to the present research, in which the operational efficiency gained from information technology investment has the potential to increase a company's ROA. However, other studies show that not all companies experience the positive impact of such investment, indicating that managerial factors and careful financial planning play a major role in determining investment outcomes (Supriadi & Syahidah, 2018; Syahrir et al., 2019).

The importance of investing in information technology and operational efficiency lies not only in technical aspects but must also be considered from a broader business perspective. The integration of various aspects including investment policy, cost efficiency, and sales growth also contributes to the increase in ROA. Accordingly, companies need to create synergy between technology investment and overall business strategy to achieve the expected financial performance (Askurun & Andriani, 2021).

Future projections show that companies in the technology sector in Indonesia must continue to invest in new technologies and strive to improve operational efficiency to compete in the digital era. Many aspects must be considered, including the risks associated with investment, innovation management, and adaptation to constant changes in technology and market preferences. This research aims to provide deeper insight into the relationship between investment in information technology, operational efficiency, and their impact on the ROA of technology companies in Indonesia, so that it can contribute to strategic decision-making among stakeholders (Hirawan et al., 2025; Sumiati & Isnaini, 2024).

Despite the growing body of literature on IT investment and firm performance, several gaps remain. First, most prior studies examine the direct relationship between IT investment and financial performance, whereas the internal mechanism that transmits IT value—namely operational efficiency—has rarely been tested explicitly as a mediating variable in the Indonesian technology sector (Kurniawan, 2024; Yusnita, 2024). Second, existing studies tend to overlook the boundary conditions under which IT investment becomes effective; the moderating roles of IT governance and digital transformation remain underexplored in emerging-market contexts (Adnan et al., 2025; Tursina, 2025). Third, empirical evidence from Indonesian technology firms listed on the Indonesia Stock Exchange is still limited and inconclusive, as some firms do not experience the expected returns from IT spending (Supriadi & Syahidah, 2018). This inconsistency reflects an unresolved research problem: why does comparable IT investment produce different financial outcomes across firms? Accordingly, this study is positioned at the intersection of the Resource-Based View and IT Business Value theory by proposing an integrated mediation–moderation model. The research problem is formulated as follows: does IT investment improve ROA, and to what extent is this relationship mediated by operational efficiency and moderated by IT governance and digital transformation? The purpose of this study is therefore to examine the direct effect of IT investment on operational efficiency and ROA, to test the mediating role of operational efficiency, and to evaluate the moderating roles of IT governance and digital transformation among Indonesian technology companies.

Based on this background, it can be understood that investment in information technology and operational efficiency is a vital component for improving financial performance, especially ROA, in technology companies in Indonesia. Awareness of the challenges and opportunities in the market will help companies formulate better and more effective strategies in the future.

IT Investment as a Strategic Asset for Operational and Financial Excellence

As a strategic asset, IT investment is treated as the foundation of digital transformation initiatives that have the potential to improve operational efficiency, process accuracy, and managerial capabilities in technology companies. In general, the literature shows that increased IT investment is positively correlated with operational and financial performance through improved productivity, information quality, and more informed decision-making. In the Indonesian context, studies show a positive relationship between the implementation of information systems and financial performance, including ROA and ROE, indicating that IT investment has a positive effect on the operational efficiency and financial performance of technology companies in Indonesia. The general hypothesis derived is that IT investment has a positive effect on the operational efficiency and financial performance of technology companies in Indonesia (Ihsanuddin et al., 2024; Kurniawan, 2024; Yusnita, 2024).

H1 : Information Technology Investment has a Positive Effect on Operational Efficiency in Technology Companies in Indonesia

Operational Efficiency as a Mediating Mechanism

As an intermediary (mediating) mechanism, operational efficiency describes the ability of a company to use resources more effectively to produce output at a lower cost. Agency theory and resource-based theory show that IT functions as a mechanism for coordination, process automation, and increased operational visibility, which ultimately reduces processing costs and increases productivity. Research also shows that improvements in operational efficiency due to IT investment can be reflected in better financial performance indicators such as ROA and ROE. Therefore, operational efficiency acts as a mediator between IT investment and Return on Assets (ROA). The specific hypothesis is that operational efficiency mediates the influence of IT investment on the ROA of technology companies in Indonesia (Adnan et al., 2025; Kurniawan, 2024; Tursina, 2025; Yusnita, 2024).

H3 : Operational efficiency mediates the relationship between IT and ROA investments in technology companies in Indonesia

Return on Assets (ROA) as a Proxy for Financial Performance

As a measure of financial performance, ROA is a core indicator that relates profitability to assets, reflecting the effectiveness of using a company's assets to generate profits. Some studies show that IT investment that improves operational efficiency can increase ROA by raising output relative to total assets. In the context of technology companies that rely on IT hardware and infrastructure-related assets, improved operational efficiency through IT has the potential to increase ROA through higher operating margins and asset utilization. Therefore, the relationship among IT, operational efficiency, and ROA is the main focus of the theoretical explanation (Faizati & Hwihanus, 2024; Kurniawan, 2024).

H2: Operational efficiency has a positive effect on the ROA of technology companies in Indonesia

Contextual Determinants and Moderating Dynamics

Regarding industry context and specific moderating factors, studies show that IT's impact on financial performance can be influenced by contextual factors such as IT governance (GRC) and data quality. IT invested without good governance does not necessarily lead to improved performance; conversely, effective GRC-backed IT tends to reinforce the benefits of IT investment for financial efficiency and performance. In the Indonesian context, factors such as organizational culture and the adoption of data analytics also play an important role in the outcomes of IT investment on operational efficiency and ROA. Therefore, the theoretical model needs to consider the moderation of IT governance and the quality of IT implementation in this analysis. The moderation hypothesis is that effective IT governance strengthens the relationship between IT investment and operational efficiency, as well as between operational efficiency and ROA (Adnan et al., 2025; Kurniawan, 2024; Tursina, 2025; Yusnita, 2024).

H4 : Effective IT governance strengthens the relationship between IT Investment and Operational Efficiency

H5 : Digital transformation strengthens the effect of IT Investment on Operational Efficiency and ROA through improved process and data quality

Conceptual framework and hypothesis development

In synthesis, the conceptual framework places IT investment as the independent variable, operational efficiency as the mediator, and ROA as the dependent variable. The moderation of the relationships between IT investment → operational efficiency and operational efficiency → ROA is based on IT governance and the company's level of digital transformation. The five hypotheses (H1–H5) developed above are summarized in the conceptual framework presented in the following figure.

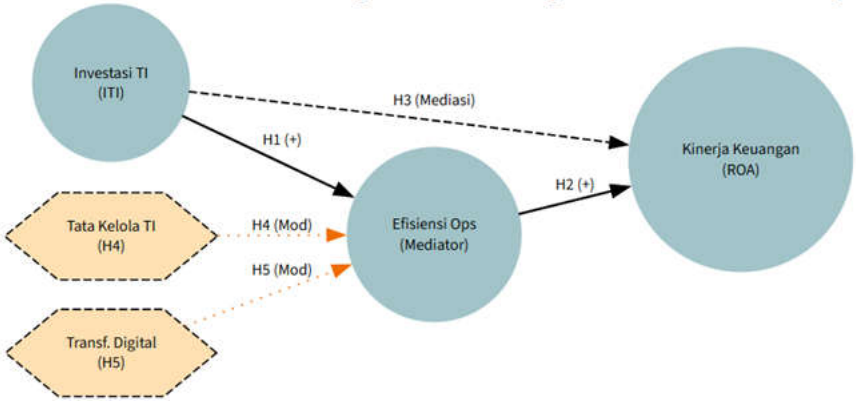


Figure 1. Research Model

Research Methods

Research Approach and Objective

This study applies a quantitative approach with an explanatory design to test the causality relationship between variables in the research model. The main focus of the analysis is to investigate the mechanism of value transmission from Information Technology (IT) Investment to financial performance (Return on Assets) through the intermediary of Operational Efficiency. In addition, this design integrates contingency factors in the form of IT Governance and Digital Transformation as moderation variables to understand the conditions under which IT investment can have an optimal impact on the company.

Object of Study and Data Structure

The research object includes technology sector companies that are listed on the Indonesia Stock Exchange (IDX) or have significant operations in Indonesia during the five-year observation period. The unit of analysis is set at the firm-level, with a data structure in the form of a data panel (unbalanced/balanced panel). The use of panel data allows researchers to capture the dynamics of changes over time while controlling for heterogeneity between firms that are not directly observed.

The research was conducted on companies in the technology sector listed on the Indonesia Stock Exchange (IDX) over a five-year observation period, namely 2021–2025. Data collection and processing were carried out in 2026. The population of this study comprises all companies classified under the technology sector on the IDX. The sample was selected using a purposive sampling technique based on the following criteria: (1) the company was consistently listed in the technology sector of the IDX throughout 2021–2025; (2) the company published complete and audited annual financial statements for the entire observation period; and (3) the company reported the financial and non-financial data required to measure all research variables. Based on these criteria, 10 companies were obtained as research subjects, resulting in $10 \times 5 = 50$ firm-year observations. The list of companies used as the research subjects is presented in Table 1.

Table 1. Research Subjects

No.	Stock Code	Company Name
1	MTDL	Metrodata Electronics Tbk
2	MLPT	Multipolar Technology Tbk
3	DMMX	Digital Mediatama Maxima Tbk
4	EMTK	Elang Mahkota Teknologi Tbk
5	NFCX	NFC Indonesia Tbk
6	DIVA	Distribusi Voucher Nusantara Tbk
7	KIOS	Kioson Komersial Indonesia Tbk
8	EDGE	Indointernet Tbk
9	WIFI	Solusi Sinergi Digital Tbk
10	GLVA	Galva Technologies Tbk

Source: Indonesia Stock Exchange (IDX), processed (2026)

Data Collection and Secondary Sources

Secondary data is collected through documentation techniques sourced from audited financial statements and officially published annual reports. The data extraction process is carried out with high precision to ensure the consistency, completeness, and comparability of data in each observation period. Other supporting documents are also used to construct a digital governance and transformation index to validate the depth of enterprise technology adoption.

Operationalization of Variables

The independent variable, IT Investment, is measured using the ratio of technology investment intensity to total assets, which reflects the company's resource commitment to the development of digital infrastructure. Operational Efficiency is measured through the operational cost ratio which describes managerial ability to optimize output, while Return on Assets (ROA) is used as a proxy for absolute profitability. For the moderation variable, this study constructs the IT Governance Index and the Digital Transformation Index based on industry best practices to measure the maturity level of management and technology integration in business processes.

Panel Data Estimation Techniques

Data analysis begins with descriptive statistics to map the distribution of data through mean parameters, standard deviation, and extreme values. The next crucial stage is the selection of the estimation model through a series of formal tests: The Chow Test is conducted to compare the Common Effect Model (CEM) with the Fixed Effect Model (FEM), followed by the Hausman Test to evaluate the consistency between the FEM and the Random Effect Model (REM). Based on statistical justification, the Fixed Effect Model is established as the primary estimation model to minimize potential parameter bias.

Econometric Diagnostics and Hypothesis Testing

The validity of the model was ensured through classical assumption tests that included residual normality tests, multicollinearity tests (VIF), and heteroscedasticity tests (Breusch–Pagan). Hypothesis testing was carried out through gradual panel regression for direct influence, the Sobel Test to prove the significance of the mediating effect, and Moderated Regression Analysis (MRA) through product interactions to test the role of moderation. This procedure guarantees that any relationship found is supported by a strong statistical foundation.

Robustness and Model Integrity

As a final stage to ensure the reliability of the findings, this study conducted a robustness check using Robust Standard Errors of the Driscoll–Kraay or HC3 type. This technique is specifically implemented to anticipate autocorrelation and heteroscedasticity issues that often arise in panel data. The consistency of the coefficients and the significance of the results at this stage confirm that the empirical model built is resilient and insensitive to the disruption of technical specifications of the data.

Software and Analytical Tools

All statistical analyses in this study—including descriptive statistics, the Chow Test and Hausman Test for panel model selection, the classical assumption tests (residual normality, multicollinearity/VIF, and heteroscedasticity), the panel regression under the Fixed Effect Model, the Sobel Test for the mediating effect, the Moderated Regression Analysis (MRA) for the moderating effects, and the robustness check were performed using the statistical software EViews 12 and the Python programming language (statsmodels and SciPy libraries). The same software was used to process the data presented in all tables and to generate the normality plot (Figure 2) and the heteroscedasticity scatterplot (Figure 3).

Results and Discussion

Result

Company Profile of the Research Sample

The research subjects consist of 10 technology-sector companies listed on the Indonesia Stock Exchange during the 2021–2025 period, yielding 50 firm-year observations. These companies represent a range of technology-based business activities, including IT distribution and services, digital platforms, data-center and internet infrastructure, and financial-technology services. The complete list of research subjects is presented in Table 1. In general, the sampled firms show diverse levels of IT investment intensity and operational efficiency, while most of them have adopted relatively mature IT governance and digital transformation practices. This profile provides the empirical basis for the subsequent descriptive and inferential analyses.

Descriptive Analysis

Table 2. Descriptive Analysis

	Mean	Std. dev	Min	Max
IT Investments (X)	0.0693	0.0562	0.0093	0.2736
Efficiency (M)	0.0954	0.1726	0.0044	1.0308
ROA (Y)	1.7005	0.6074	0.1113	3.1495
IT Governance (Mod 1)	6.0208	0.8118	5.0000	7.000
Transf. Digital (Mod 2)	0.6994	0.1557	0.4307	0.9329

Data processed (2026)

The IT Investment variable has a mean value of 0.0693 with a standard deviation of 0.0562, which indicates a relatively low level of data variation. The minimum value of 0.0093 and the maximum value

of 0.2736 indicate that the amount of IT investment between research objects varies, but in general it is still at a relatively small level. This shows that IT investment is not yet a large component of most research objects.

The efficiency has an average value of 0.0954 with a standard deviation of 0.1726, which is greater than the mean value. This condition shows that there is a fairly high data spread. The wide range of values, from 0.0044 to 1.0308, indicates a significant difference in efficiency between the research objects, where some objects are already highly efficient, while others are still not optimal.

ROA has an average value of 1.7005, which indicates that in general the research object is able to produce positive financial performance. The standard deviation of 0.6074 indicates variation in financial performance between objects. The minimum value of 0.1113 and the maximum value of 3.1495 indicate a fairly wide range of performance, reflecting differences in the companies' ability to utilize assets to generate profits.

IT Governance has a mean value of 6.0208 with a standard deviation of 0.8118. A minimum value of 5.0000 and a maximum of 7.0000 indicate that the level of implementation of IT governance is relatively high and relatively homogeneous. This indicates that most of the research objects have implemented fairly good and consistent IT governance practices.

The Digital Transformation variable has an average value of 0.6994 with a standard deviation of 0.1557. The range of values between 0.4307 to 0.9329 shows that the adoption rate of digital transformation in the research object is quite high with moderate variation. This indicates that the majority of research objects are at a relatively mature stage of digital transformation implementation.

In general, the data show that IT investment and efficiency still vary between research objects, while IT governance and digital transformation are at relatively high and stable levels. This condition is in line with financial performance (ROA) which tends to be positive, thus opening up opportunities for further analysis of the role of efficiency as a mediating variable as well as IT governance and digital transformation as a moderation variable in the relationship between IT investment and financial performance.

Best Model Selection Test

Determining the best estimation method:

a. Common Effect (OLS) vs Fixed Effect (FE) → Chow Test
b. Fixed Effect (FE) vs Random Effect (RE) → Hausman Test

Table 3. Model Test Results

	Indicator	Value
0	Chow Test (F-Statistic)	2.9651
1	Probability (p-value)	0.0054

Data processed (2026)

The selection of the panel data estimation model began with the Chow Test to compare between the Common Effect Model (CEM) and the Fixed Effect Model (FEM). Based on the calculation results, a probability value (P-Value) of 0.0055 was obtained. Given that this value is smaller than the significance of 0.05, the null (H0) hypothesis is rejected. Thus, the Fixed Effect model was chosen as a more precise estimation approach than the Common Effect.

Classical Assumption Test

1. Normality Test

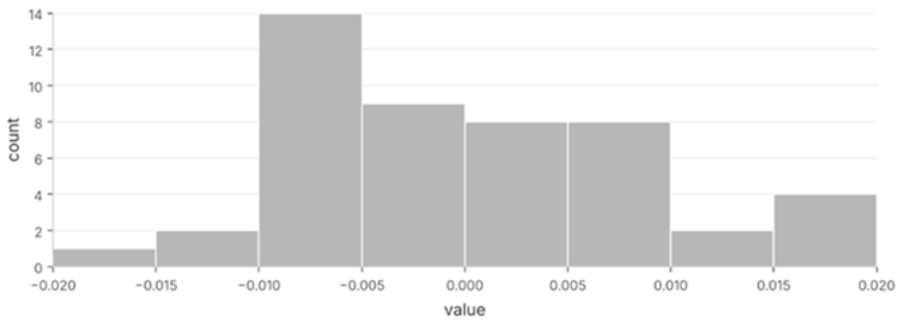


Figure 2. Normality Test Results

Table 4. Normality Test Results

	Test	Statistic	Probability
0	Jarque-Bera	1.4993	0.4725

Residual normality testing was carried out using the Jarque-Bera test. The test results showed a probability value of 0.4725. Since this value is greater than 0.05, it can be concluded that the residual model is normally distributed. This meets the normality assumptions required in OLS regression.

2. Multicollinearity Test

Table 5. Multicollinearity Test Results

	Variable	VIF
0	const	16.0860
1	Ln_RnD	1.6514
2	Ln_Efficiency	1.6514

The multicollinearity test was carried out by looking at the value of the Variance Inflation Factor (VIF). Based on the table above, all independent variables have a VIF value of less than 10. This shows that there is no strong correlation between independent variables, so that the regression model is free from the problem of multicollinearity.

3. Heteroscedasticity Test

Table 6. Heteroscedasticity Test Results

	LM Statistic	LM-Test p-value	F-Statistic	F-Test p-value
0	2.4217	0.2980	1.1955	0.3120

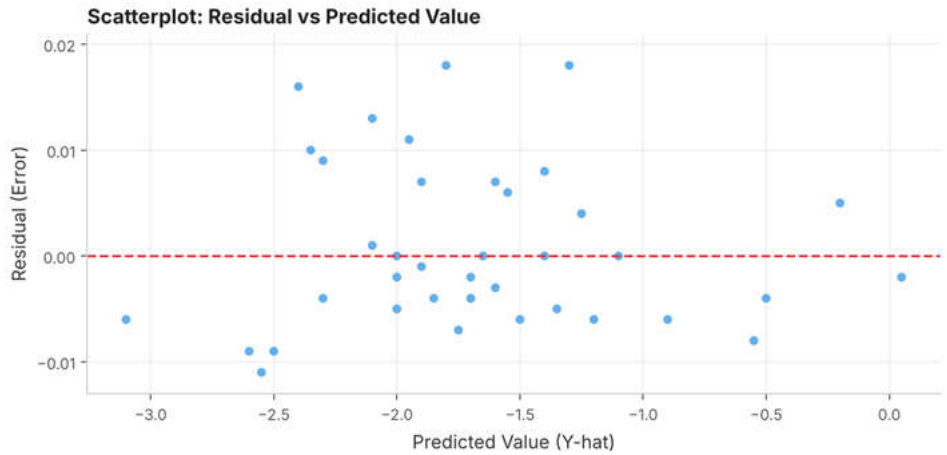


Figure 3. Heteroscedasticity Test Results

Heteroscedasticity testing using the Breusch-Pagan test yielded a p-value of 0.2980. Statistically, since this value is greater than 0.05, there is no heteroscedasticity problem. In addition, the scatterplot visualization (Residual vs Predicted) shows a random spread as a confirmation of the homoscedasticity assumption.

Hypothesis Test

Regression coefficient testing for H1 (Pathway A) and H2 (Pathway B).

Table 7. Hypothesis Test Results for H1 (Pathway A) and H2 (Pathway B)

	Coefficient	Std.error	t-Statistic	Probability
IT Investment → Operational Efficiency	0.8105	0.2316	3.4989	0.0005
Operational Efficiency → Financial Performance (ROA)	0.5979	0.00145	410.3349	0.0000

The results of the Hypothesis 1 test show that IT Investment has a coefficient of 0.8105 with a significance value of P-Value of 0.0005. Because the P value < 0.05, it can be concluded that IT Investment has a positive and significant effect on Operational Efficiency. Furthermore, the results of the Hypothesis 2 test show that Operational Efficiency also has a significant effect on ROA (Coefficient = 0.5980; P < 0.05). These findings support the assumption that improving technological capabilities and internal efficiency are crucial factors in driving a company's financial performance.

Table 8. H3 Hypothesis Test Results (Sobel Test)

Components	Coefficient	Std.error	P-value
Line A (X->M)	0.8105	0.2316	0.0005
Line B (M->Y)	0.5979	0.0014	0.0000
Sobel Statistic	3.4988		0.0005

Mediation effect testing was carried out using the Sobel Test to see the significance of the role of Operational Efficiency as a link between IT Investment and ROA. The calculation results show a Sobel statistical value of 3.4989 with a significance probability of 0.0005. Given the P-Value of < 0.05, the mediation hypothesis (H3) is accepted. This empirically proves that Operational Efficiency functions as a full mediating variable that transmits the impact of technology investment on financial performance.

Table 9. Results of H4 and H5 Hypothesis Test (Moderation Test)

Components	Coefficient	P-value
Interaksi (IT * Gov)	0.4269	0.0015
Interaksi (IT * DigTrans)	0.4676	0.0005

A moderation analysis was conducted to test whether IT Governance and Digital Transformation strengthen the relationship between IT Investment and Efficiency. The results of the moderation regression test (MRA) showed that the interaction variable of IT Governance had a significance value of P-Value of 0.0015. This means that IT Governance has managed to moderate independent relationships significantly. Similarly, for Digital Transformation (P=0.0005), the moderation effect was proven to be significant. These findings underscore the importance of governance aspects in amplifying the impact of technology investments.

Table 10. Robustness and Validity Test

Variable	Coefficient	Robust SE	P-Value
const	0.0964	0.0054	0.000

As a final validation step, a model resilience test (Robustness Check) was carried out using the Driscoll-Kraay/HC3 type Robust Standard Errors estimate. This approach is used to ensure that statistical inference remains valid despite the potential heteroscedasticity or autocorrelation in residuals. The results of robust estimation show that the key variables retain their significance (Consistent). This confirms the robustness of the built empirical model and the validity of the research conclusions.

Discussions

Information Technology Investment and Operational Efficiency

The results of the first hypothesis test show that IT Investment has a positive and significant effect on Operational Efficiency. These findings indicate that increasing resource allocation in IT can encourage companies to manage business processes more efficiently, both through automation, system integration, and improving information quality. Theoretically, this result is in line with the Resource-Based View (RBV), which views IT as a strategic resource that can create competitive advantage if managed appropriately. IT investment allows companies to reduce transaction costs, improve internal coordination, and accelerate managerial decision-making. International research by Bharadwaj (2000) and Melville et al. (2004) found that IT capabilities contribute significantly to operational efficiency and business process performance. In the Indonesian context, these findings are consistent with the results of Ihsanuddin et al. (2024) and Judijanto (2024), which show that the implementation of information systems and digital technology has a positive impact on a company's operational efficiency. Thus, the results of this study strengthen the empirical evidence that IT investment is an important prerequisite for creating internal efficiency, especially in technology-based companies.

Operational Efficiency and Financial Performance (ROA)

The results of the second hypothesis test show that Operational Efficiency has a positive and significant effect on ROA. These findings indicate that companies that are able to efficiently manage resources tend to be more effective in utilizing assets to generate profits. Conceptually, ROA reflects a company's ability to convert assets into profits. Operational efficiency plays a role in reducing production costs, minimizing waste, and increasing productivity, which ultimately has a direct impact on profitability. These findings are in line with international research by Weil (1985) and Start et al. (2013), which emphasize that process efficiency is a key factor in economic value creation. National research by Syahrir et al. (2019) and Supriadi & Syahidah (2018) also found that operational efficiency has a significant effect on financial performance and company value. Therefore, the results of this study confirm that operational efficiency is an important mechanism for improving the ROA of technology companies in Indonesia.

The Role of Operational Efficiency Mediation

The results of the Sobel test show that Operational Efficiency mediates the relationship between IT Investment and ROA. These findings have important theoretical implications, as they show that IT investments do not directly improve financial performance, but rather work through internal efficiency improvements first. These findings are in line with the IT Business Value Theory framework, which states that the benefits of IT are indirect and depend on how the technology is used to improve organizational processes. IT investment that is not accompanied by operational process improvement is less likely to result in significant improvements in financial performance (Melville et al., 2004). These results are also consistent with Devaraj & Kohli (2003) as well as national research by Kurniawan (2024) and Yusnita (2024), which found that operational efficiency is the main pathway in transforming IT investment into financial performance. Thus, this study strengthens the argument that operational efficiency is the "missing link" between IT and ROA.

The Role of IT Governance Moderation

The results of the moderation analysis show that IT Governance significantly strengthens the influence of IT Investment on Operational Efficiency. These findings confirm that IT investments will have optimal impact when supported by effective governance mechanisms, such as clarity of decision-making structures, IT risk controls, and alignment between IT and business strategies. Theoretically, these findings are in line with IT Governance Theory, which states that IT governance ensures that IT investment aligns with organizational goals and provides business value. research by Weill & Ross (2004) and Lunardi et al. (2014) also found that IT governance strengthens the relationship between IT capabilities and organizational performance. In the Indonesian context, these results are consistent with the findings of Adnan et al. (2025) and Tursina (2025), which show that the quality of IT governance plays an important role in optimizing the benefits of technology investment. Therefore, this study emphasizes that IT governance is not merely an administrative aspect but a strategic factor in the creation of IT value.

The Role of Digital Transformation Moderation

In addition to IT governance, the results of the study also show that Digital Transformation significantly moderates the relationship between IT Investment and Operational Efficiency. These findings indicate that companies that are at a more mature level of digital transformation are able to maximize the benefits of IT investment through process integration, data utilization, and technology-based innovation. These results are in line with international research by Vial (2019) and Verhoef et al. (2021), which emphasize that digital transformation enables companies to extract greater value from technology investment. At the national level, research by Murini et al. (2023) and Sumiati & Isnaini (2024) also shows that digital transformation plays an important role in improving company efficiency and performance. Thus, digital transformation acts as an accelerator that speeds up the conversion of IT investment into financial efficiency and performance.

Theoretical and Managerial Implications

Theoretically, this study contributes by strengthening the understanding that the relationship between IT investment and financial performance is indirect, and is strongly influenced by mediation and moderation factors. The integration of operational efficiency, IT governance, and digital transformation enriches the literature on the value of IT businesses, particularly in the context of technology companies in developing countries. In practical terms, these findings imply that it is not enough for company management to simply increase IT budgets, but must also ensure process improvements, strong IT

governance, and an integrated digital transformation strategy. Without these three aspects, IT investment has the potential to not result in optimal financial performance improvements.

Conclusion

This study aims to analyze the influence of Information Technology (IT) Investment on the financial performance of technology companies in Indonesia which is proxied by Return on Assets (ROA), by including Operational Efficiency as the mediation variable and IT Governance and Digital Transformation as the moderation variable. Based on the results of panel data analysis and hypothesis testing, several main conclusions were obtained.

First, information Technology Investment has been proven to have a positive and significant effect on Operational Efficiency. These findings show that increasing investment allocation in IT is able to drive business process improvement, automation of operational activities, and improved quality of information management, which ultimately improves the efficiency of the company's resource use.

Second, operational Efficiency has been proven to have a positive and significant effect on Return on Assets (ROA). These results indicate that companies that are able to efficiently manage assets and operational processes tend to have better ability to generate profits, thereby improving overall financial performance.

Third, operational Efficiency is proven to mediate the relationship between IT Investment and ROA. These findings confirm that the impact of IT Investment on financial performance is not direct, but is transmitted through improving the company's internal efficiency. In other words, IT investment will only make an optimal contribution to ROA if it can be implemented effectively in operational processes.

Fourth, IT Governance has been proven to strengthen the relationship between IT Investment and Operational Efficiency. This shows that the existence of a good IT governance mechanism including alignment of IT strategy with business strategy, risk control, and clarity of IT decision-making rights and responsibilities plays an important role in optimizing the benefits of technology investment.

Fifth, digital Transformation has also been proven to positively moderate the relationship between IT Investment and Operational Efficiency. These findings indicate that the maturity level of a company's digital transformation is a key factor in accelerating and magnifying the impact of IT investments on efficiency and, ultimately, financial performance.

Overall, this study concludes that IT Investment, Operational Efficiency, IT Governance, and Digital Transformation are interrelated elements in shaping the financial performance of technology companies in Indonesia. The main implication of this study is that it is not enough for companies to simply increase IT spending, but also to ensure effective IT management, continuous improvement of operational processes, and integrated digital transformation strategies in order for technology investments to truly generate optimal economic value.

Nevertheless, this study has several limitations that should be acknowledged. First, the sample is restricted to technology-sector companies listed on the Indonesia Stock Exchange during 2021–2025, so the findings may not be fully generalizable to other sectors or to non-listed firms. Second, IT investment, IT governance, and digital transformation were measured using secondary data and constructed indices derived from annual reports, which may not fully capture the qualitative dimensions of technology adoption. Third, the study relies on a relatively limited number of firm-year observations, which may affect the statistical power of the moderation analysis. Fourth, potential determinants of financial performance such as firm size, leverage, and macroeconomic conditions were not included as control variables.

Based on these limitations, future research is encouraged to extend the observation period and broaden the sample to include other sectors or cross-country comparisons in order to strengthen the generalizability of the findings. Future studies may also use primary data or mixed methods to measure IT governance and digital transformation more comprehensively, incorporate additional control variables, and apply alternative analytical approaches such as Structural Equation Modeling (SEM) to capture more complex relationships among variables. Practically, the findings imply that company management should not merely increase IT budgets but should also strengthen operational processes, IT governance, and integrated digital transformation strategies so that technology investment generates optimal and sustainable economic value.

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