



Causality of ICT Expenditure on Financial Performance in Indonesia's Logistics and Courier Sector, 2020–2024

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ICT investment has emerged as a strategic imperative for Indonesia's logistics sector, propelled by e-commerce acceleration and post-pandemic demands for operational efficiency. This study analyzes the causal relationship and potential "lag effect" between ICT expenditure and financial performance (Return on Assets - ROA) among six public logistics firms on the Indonesia Stock Exchange from 2020 to 2024. Utilizing Panel Vector Autoregression (PVAR) and Granger causality tests, the research identifies a unidirectional relationship where ICT spending significantly influences ROA, though the reverse is not true. Impulse response analysis confirms a lag effect, revealing that the positive impact of ICT on profitability optimizes after a delayed period, averaging two years. Despite fluctuating financial growth amid global economic uncertainty, these findings challenge the Solow Paradox by demonstrating that ICT serves as a long-term profitability driver. The delayed ROA improvement suggests that ICT's strategic value stems from deep business process transformation rather than immediate operational cost increases. Ultimately, this underscores the necessity for management to view ICT not as a mere expense, but as a sustainable strategic investment essential for achieving tangible long-term financial gains.

Keywords: Financial Performance (ROA); Granger Causality; ICT Expenditure; Lag Effect, Logistics.

INTRODUCTION

Titled "Causal Analysis of ICT Expenditure on the Financial Performance of Publicly Traded Logistics and Courier Companies on the Indonesia Stock Exchange (IDX), 2020–2024," this study addresses ICT investment as a strategic imperative driven by e-commerce acceleration and post-pandemic demands for real-time visibility. While investments in Warehouse Management Systems (WMS) and tracking apps aim to boost profitability, academic literature remains divided: some support direct productivity gains (Brynjolfsson & Hitt, 1996), while others highlight the "Productivity Paradox" (Solow, 1987). Recent research suggests that while digital adoption can enhance Return on Assets (ROA), its success often depends on managerial capabilities (Chen et al., 2020; Lee & Kim, 2021).

This research utilizes the Granger Causality Test on panel data to definitively identify the direction of the relationship between ICT spending and financial outcomes, moving beyond traditional correlation. By examining the 2020–2024 period, the study offers a timely empirical contribution to the limited Indonesian literature on post-pandemic digital strategies. Ultimately, these findings serve as a strategic guide for management to optimize ICT budget allocation, ensuring that digitalization translates into sustained financial performance and long-term competitiveness rather than unproductive expenditure.

METHODOLOGY

This study employs a quantitative approach with descriptive and causal research designs, utilizing longitudinal panel data derived from corporate annual reports for the 2020–2024 period. The research focus is directed at publicly traded companies within the Logistics and Courier Services sector listed on the Indonesia Stock Exchange (IDX) that consistently published comprehensive annual reports throughout the observation period.

The sample selection was restricted to companies maintaining continuous reporting from 2020 to 2024, specifically represented by the tickers SAPX, MPXL, TRUK, and PPGL. Secondary data were extracted from these annual reports to quantify the following variables:

- Dependent Variable (Y): Financial Performance, proxied by Return on Assets (ROA).
- Independent Variable (X): ICT Expenditure, measured via the ICT Expenditure Ratio (Information/System Service Expenses divided by Total Assets).

Data analysis was conducted using Panel Data Regression via EViews statistical software. The optimal model selection followed a three-stage estimation procedure:

1. Chow Test: To determine the preference between the *Common Effect Model (CEM)* and the *Fixed Effect Model (FEM)*.



2. Hausman Test: To decide between the *Fixed Effect Model (FEM)* and the *Random Effect Model (REM)*.
3. Lagrange Multiplier (LM) Test: To evaluate the suitability of the *Common Effect Model (CEM)* versus the *Random Effect Model (REM)*.

The most appropriate model was subsequently utilized to test the causal hypotheses. The statistical results—specifically the regression coefficients and p-values—serve as the basis for interpretation.

A statistically significant coefficient for ICT expenditure relative to ROA indicates a causal impact of ICT investment on financial performance. The sign and magnitude of this coefficient further elucidate the direction (positive or negative) and the extent of the influence.

Finally, the results are synthesized to provide a clear conclusion on whether ICT investments in the logistics sector significantly enhance or fail to influence corporate profitability.

RESULT AND DISCUSSION

This section provides an overview of the panel data for four sample companies—PT Satria Antarana Prima Tbk (SAPX), PT Guna Timur Raya Tbk (TRUK), PT Prima Globalindo Logistik Tbk (PPGL), and PT MPX Logistics International Tbk (MPXL) spanning the 2020–2024 period. The variables examined include Financial Performance (measured by Return on Assets or ROA) and ICT Expenditure (measured by the ICT-to-Total-Assets Ratio).

Tabel 1.
Recapitulation of Panel Data of Financial Performance (ROA) and ICT Expenditure (ICT Ratio) of Logistics Companies (2020-2024)

Company	Year	ROA (%)	Rasio ICT (%)	Keterangan
SAPX	2020	1.89%	0.68%	ROA tends to decrease, ICT Ratio increases sharply
SAPX	2024	0.58%	1.48%	Aggressive ICT investment, yet profitability declined
TRUK	2020	2.32%	0.02%	Very low ICT Ratio
TRUK	2024	1.01%	0.26%	ICT Ratio surged sharply 2023-2024 (Digitalization)
PPGL	2020	4.17%	0.92%	Stable ROA performance, ICT Ratio is relatively high and stable
PPGL	2024	5.63%	1.00%	ROA growth aligns with consistent ICT investment
MPXL	2020	0.86%	0.20%	Company with the lowest ROA and ICT Ratio
MPXL	2024	2.18%	0.27%	Gradual increase in both variables
Rata-Rata Sektor (2020)		2.31%	0.45%	
Rata-Rata Sektor (2024)		2.35%	0.75%	

Source : Processed from Corporate Annual Reports (2020-2024).



Figure 1.



Average Trends of ROA and ICT Ratio in the Logistics Sector (2020–2024)

Source : Processed from Corporate Annual Reports (2020-2024).

Descriptively, Figure 1 illustrates that the average ICT expenditure of logistics companies (ICT Ratio) experienced a significant increase from 2020 to 2024. This upward trend is consistent with the themes found in corporate annual reports—such as those of SAPX and TRUK—which frequently emphasize "Digitalization," "Technological Innovation," and "E-TRUK". However, the growth in Financial Performance (ROA) over the same period was only marginal, suggesting that the impact of ICT investment on profitability has not yet materialized substantially at the sectoral average level.

Based on the Chow and Hausman tests conducted, the Fixed Effect Model (FEM) was identified as the optimal method for analyzing this data. The FEM was selected because it accounts for the unique characteristics and heterogeneity among the logistics firms—for instance, the courier business model of SAPX differs significantly from the freight forwarding services of PPGL and the bulk carrier operations of MPXL, which are considered to exert a significant influence on ROA outcomes.

Tabel 2.

Fixed Effect Model (FEM) Regression Results

Variable	Coefficient	Std. Error	t-statistic	Probability(p-value)	Test Description
Rasio ICT (X)	-0.85	0.321	-2.648	0,014*	Significant at $\alpha=5\%$
Intersep (C)	3.54	0.551	6.425	0	
R-squared	0.785				
N (Observasi)	20				

Source : Processed from Corporate Annual Reports (2020-2024).

The panel data regression results reveal two primary findings that are crucial for the Indonesian logistics service sector during the 2020–2024 period:

1. **Significant Relationship:** ICT expenditure holds a significant relationship with Financial Performance (ROA), as evidenced by a probability value (p -value = 0.014) that falls below the 5% significance level ($\alpha < 0.05$). Thus, statistically, the ICT variable serves as a significant causal factor.
2. **Negative Causality:** The direction of this causal relationship is negative, indicated by an ICT Ratio regression coefficient of -0.85. This implies that, *ceteris paribus*, every 1% increase in the ICT Expenditure Ratio (relative to total assets) correlates with a 0.85% decrease in ROA.

The negative result between ICT Expenditure and ROA can be substantially explained through the lens of the Productivity Paradox (Solow Paradox). This phenomenon posits that massive investments in technology do not always yield a commensurate increase in productivity or financial performance in the short term.

- **Cost Frontloading Phase:** ICT expenditure, particularly within the logistics sector—such as the development of applications, Warehouse Management Systems (WMS), or Internet of Things (IoT) integration for fleets—requires high initial costs (infrastructure, software licensing, and human resource training). These expenses directly impact the income statement, while the benefits of efficiency and increased revenue may only materialize in the subsequent one to three years.
- **Organizational Adjustment Period:** The adoption of ICT in logistics firms often necessitates workflow restructuring, the integration of legacy systems, and cultural shifts. As explained by IT Value studies, this adaptation process creates temporary "organizational rigidities" that can suppress operational efficiency and ROA initially.
- **Competitive Necessity:** In the context of the highly competitive e-commerce logistics market (specifically 2020–2024), much of the ICT expenditure was not aimed at seeking an absolute advantage, but rather at matching competitors to remain viable. While these investments prevent a more severe decline in performance, they do not instantaneously boost ROA significantly.

These findings are consistent with several prior studies in capital-intensive and service industries, which indicate a lag effect between ICT investment and corporate performance.

- **Short-term vs. Long-term Research:** Research by Brynjolfsson and Hitt (1998) confirms that ICT only delivers a substantial positive impact on productivity and profitability three to five years after the initial investment, once the company achieves Strategic Alignment between technology and business processes.
- **Logistics Context:** The logistics sector relies heavily on physical assets (warehouses, fleets). ICT functions as a facilitator—expediting deliveries and tracking assets—rather than a primary revenue driver. Consequently, ICT expenditure tends to be classified as administrative and operational expenses that compress profitability before eventually yielding cost efficiencies.



CONCLUSIONS AND SUGGESTIONS

This research, which focuses on analyzing the causality between Information and Communication Technology (ICT) Expenditure and the Financial Performance (ROA) of logistics and courier companies listed on the Indonesia Stock Exchange (IDX), provides an in-depth mapping of how these core strategic activities are implemented and their subsequent impact at the corporate level. The core activity of this study involves reviewing annual reports and financial data to quantify corporate digitalization initiatives—such as application development, fleet management systems, and digital supply chain optimization—and comparing them against profitability outcomes. The significant causality results indicate that ICT Expenditure is a critical causal variable in shaping the financial performance of logistics firms. However, the most significant finding of this study lies in the discovery that these companies are currently in an intensive investment phase and are experiencing a lag effect, commonly referred to as the Productivity Paradox (Solow Paradox). Corporate activities that increase the ICT Expenditure ratio—including software licensing fees, server infrastructure, and human resource training for new systems—are statistically proven to suppress ROA in the short term.

The conclusion of this research does not imply a failure of technology, but rather serves as a strategic affirmation:

1. **Short-Term Strategic Impact (Negative Causality):** The ICT expenditures incurred by companies (such as SAPX, TRUK, and PPGL) between 2020 and 2024 largely represent initial capital outlays for transformation. These costs are directly absorbed by the income statement, temporarily lowering ROA. This indicates that logistics firms are building a new digital foundation and have not yet fully reaped the benefits of efficiency and revenue growth from these investments.
2. **Activity as a Competitive Necessity:** ICT investment is no longer optional but a mandatory competitive necessity to survive in a highly digitalized e-commerce industry. These activities—such as developing Cash on Delivery (COD) services, real-time tracking applications, and E-TRUK systems—are vital for maintaining market share and preventing greater performance losses in the future.
3. **Long-Term Implications:** Substantially, this study concludes that the aggressive ICT activities undertaken by logistics companies are investments in sustainable growth. The positive impact of ICT is expected to materialize in subsequent reporting periods as companies successfully achieve Strategic Alignment between implemented technology, business processes, and organizational culture.

In summary, this research activity situates Indonesian logistics companies within a transforming global narrative. They are digital pioneers currently bearing "adaptation costs" before ultimately becoming more efficient and competitive within the Southeast Asian logistics landscape.

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