

Operational Efficiency as a Mediator in the Relationship Between Digital Payment, Digital Customer Service, and Profitability in Indonesian Insurance Companies

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ABSTRACT

Backgrounds: InsurTech adoption, encompassing digital payment systems and digital customer service platforms, is growing rapidly in Indonesia's insurance industry, yet empirical evidence on how these digital initiatives translate into profitability through operational efficiency mechanisms remains limited among publicly listed general insurance companies.

Objectives: This study examines the mediating role of operational efficiency between InsurTech adoption and profitability in Indonesian general insurance companies, with InsurTech proxied by Digital Payment and Collection System and Digital Customer Service, operational efficiency measured by Expense Ratio, and profitability measured by Return on Equity (ROE).

Methodology: Using panel data from 11 general insurance companies listed on the Indonesia Stock Exchange during 2020-2024 (55 firm-year observations), the study applies multiple regression and bootstrapping mediation analysis (PROCESS Macro Model 4).

Findings: Digital Payment significantly and positively affects both ROE (H1) and Expense Ratio (H2), and full mediation by Expense Ratio is confirmed (H6), with the indirect effect remaining significant (BootLLCI = 0.0803; BootULCI = 0.2436) while the direct effect becomes insignificant. Digital Customer Service does not significantly influence ROE or Expense Ratio, either directly or indirectly (H3, H4, H7 not supported).

Conclusions: Internal process digitalization improves profitability only through operational efficiency, underscoring the importance of prioritizing digital investments that reduce operational costs. Customer-facing digital services, while valuable for service quality and loyalty, do not yet produce measurable short-term financial returns through efficiency channels.

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1. INTRODUCTION

The rapid development of financial technology has significantly transformed operational mechanisms in the insurance industry (Verhoef et al., 2021). InsurTech integrates digital technologies into premium collection, claims processing, underwriting, and customer service systems, enabling firms to improve efficiency and service delivery (Eling & Lehmann, 2018; Gatzert & Osterrieder, 2020). In Indonesia, digital financial services continue to expand; however, insurance penetration remains relatively low compared to other financial sectors. This condition raises questions about whether digital adoption effectively improves firm performance.

The Indonesian insurance industry currently exhibits complex characteristics combining structural challenges and growth opportunities. The insurance market structure is relatively concentrated, where several large companies dominate market share while smaller companies compete within limited space, reflecting a tight oligopolistic condition (Arintoko et al., 2021; Rokhim, 2017). Nevertheless, the level of competition remains high with significant market power in both the banking and insurance sectors (Rokhim, 2017). From a governance perspective, the establishment of a state-owned insurance holding company through Government Regulation No. 20 of 2020 has improved the efficiency and management of state-owned insurance companies, although governance challenges persist particularly in aspects of consumer protection and regulatory gaps (Amondaris et al., 2025; Hayamanysah et al., 2025; Tobing et al., 2022).

Furthermore, consumer trust remains a primary issue, particularly in life insurance, marked by low penetration rates and weak public financial literacy (Tobing et al., 2022). Cases of management failure and fraud, such as in AJB Bumiputera 1912, further reinforce the urgency of strengthening regulations and policyholder protection (Amondaris et al., 2025). In the health insurance sector, the National Health Insurance (JKN) program has indeed improved access to healthcare services, however membership coverage remains suboptimal, reaching only approximately 62.3%, with gaps based on demographic and socioeconomic factors (Sukartini et al., 2022). On the other hand, the development of sharia insurance also demonstrates growth potential alongside the growing Muslim population in Indonesia, although it remains constrained by low literacy and suboptimal marketing strategies (Nugraha et al., 2022). Overall, the Indonesian insurance industry also faces regulatory challenges that remain fragmented and not yet fully capable of accommodating modern risks such as digital fraud and data misuse, necessitating more comprehensive policy reform (Ariawan, 2025; Hayamanysah et al., 2025). Additionally, systemic risks exist such as the potential for liquidity crises due to weaknesses in existing crisis management mechanisms (Triggs et al., 2019).

Digital payment systems are expected to improve premium collection speed, reduce transaction costs, and enhance cash flow management, thereby positively influencing profitability (Arilesere et al., 2021; Calderon, 2025). At the operational level, payment automation reduces manual administrative costs and improves reconciliation accuracy, which is reflected in a lower Expense Ratio (Braun & Jia, 2025; Köhne & Köhne, 2024). In contrast, digital customer service platforms improve responsiveness and service accessibility but do not consistently translate into short-term profitability gains, as high fixed costs and hybrid service models may offset immediate financial benefits (Bankuoru Egala et al., 2021; S. H. Kim & Yang, 2025). Similarly, the impact of digital customer service on operational efficiency is not straightforward, given that technology integration costs can temporarily increase the Expense Ratio before efficiency gains materialize (Anshori, 2024). Regarding operational efficiency itself, a lower Expense Ratio is consistently associated with higher profitability in the insurance industry, establishing it as a critical link between digital adoption and financial performance (Nuhin & Suprayogi, 2022; Prasaja et al., 2023). Critically, digital transformation is increasingly recognized to affect profitability not directly, but through intermediate efficiency mechanisms, suggesting that without measurable cost improvements, digital investments may not yield significant financial returns (Jardak & Ben Hamad, 2022; Luo, 2023; Masoud & Basahel, 2023).

Previous research indicates that digital transformation does not automatically improve profitability. Rather, its impact frequently occurs through improvements in internal operational processes (Luo, 2023; Masoud & Basahel, 2023). In insurance companies, operational efficiency plays an important role in determining underwriting margins and overall financial performance (Nuhin & Suprayogi, 2022; Prasaja et al., 2023). Although a number of studies examine the relationship between digital transformation and company performance in the financial services sector in general, particularly in the banking industry, evidence specifically focusing on the insurance industry, especially in the Indonesian context, remains relatively limited. Furthermore, most existing research tends to emphasize direct relationships, without adequately explaining the indirect mechanisms through which digital transformation affects financial performance. Therefore, this study offers a novelty contribution by specifically highlighting the insurance industry in Indonesia and employing a structural approach that integrates digital transformation, operational efficiency, and financial performance within a single analytical framework. This approach enables a more

comprehensive understanding of the mediating role of operational efficiency, thereby filling gaps from both the industry context and methodological approach perspectives.

Despite the growing adoption of InsurTech, empirical evidence examining how digital initiatives influence profitability through operational mechanisms in general insurance companies remains limited. Therefore, this study aims to investigate whether operational efficiency mediates the relationship between InsurTech adoption and profitability in Indonesian general insurance companies listed on the Indonesia Stock Exchange.

2. LITERATURE REVIEW

2.1. Signal Theory

Signal Theory explains how organizations convey information regarding quality, capability, and strategic positioning to external stakeholders through observable actions (Spence, 1973). In financial markets, firms use operational and technological initiatives as signals to reduce information asymmetry and enhance stakeholder confidence. In the context of digital transformation, the adoption of structured digital systems such as automated payment platforms and integrated service portals can signal modernization, transparency, and managerial competence (Verhoef et al., 2021). Braun and Jia (2025) argue that InsurTech innovations enhance transparency across the insurance value chain by embedding digital traceability into underwriting and premium collection processes. These digital signals reduce uncertainty and strengthen investor perception regarding operational reliability. Furthermore, Śliwiński et al. (2025) emphasize that digital transformation in insurance reflects strategic innovation and organizational readiness to compete in technologically evolving markets. Thus, the implementation of digital payment systems and customer service platforms can function as credible signals of efficiency and competitiveness, potentially influencing financial performance outcomes.

2.2. Agency Theory

Agency Theory explains conflicts between principals (shareholders) and agents (management) arising from information asymmetry and divergent interests (Jensen & Meckling, 1976). In financial institutions, agency problems frequently occur in underwriting decisions, premium collection processes, and claims management due to limited monitoring mechanisms. Digital technologies reduce agency costs by enhancing transparency, traceability, and monitoring capabilities. Köhne and Köhne (2024) demonstrate that digitalization in insurance distribution improves operational monitoring and productivity, thereby reducing inefficiencies associated with manual processes. Similarly, Braun and Jia (2025) highlight that InsurTech applications minimize information gaps by automating transaction records and strengthening internal control systems. In the Indonesian insurance context, Harianja et al. (2024) note that digital transformation enhances accountability and governance mechanisms within insurance firms. By improving transaction traceability and process standardization, digital systems reduce opportunistic behavior and managerial inefficiencies. Consequently, digital adoption may improve operational efficiency and profitability by lowering agency costs.

2.3. Previous Research

Recent empirical studies highlight the growing importance of digital transformation in improving operational and financial performance in financial institutions. In the insurance industry, digital payment systems have been identified as a critical component of InsurTech innovation, particularly in enhancing premium collection efficiency, reducing transaction errors, and improving financial transparency. Braun and Jia (2025) explain that digital payment infrastructures improve traceability and reduce manual administrative costs across insurance value chains. Similarly, Köhne and Köhne (2024) find that digitalization significantly improves operational productivity and performance in insurance distribution systems. Their findings suggest that digital technologies primarily affect internal efficiency mechanisms before influencing financial outcomes.

In emerging markets, including Indonesia, digital transformation in insurance services has been shown to enhance service responsiveness and process efficiency (Harianja et al., 2024). Anshori (2024) further demonstrates that digital insurance technology improves claims processing

speed and reduces administrative inefficiencies. However, the direct financial impact of customer-facing digital services remains inconclusive, as improved service quality does not always translate into immediate profitability gains.

Regarding operational efficiency, prior research consistently emphasizes the role of cost control in determining profitability within insurance companies. Expense Ratio, commonly used as an efficiency indicator, reflects underwriting-related operational expenses relative to net premium income. Lower cost ratios are generally associated with improved financial performance (Nuhin & Suprayogi, 2022). Similarly, Prasaja et al. (2023) emphasize the importance of underwriting performance in determining financial performance within the insurance sector. Nevertheless, recent studies suggest that digital investment may temporarily increase operational expenses while enhancing long-term profitability through structural efficiency improvements (Harianja et al., 2024).

From a mediation perspective, digital transformation research increasingly recognizes that financial performance outcomes often occur through intermediate operational mechanisms rather than direct causal effects (Zhao et al., 2010). In line with this view, digital adoption may influence profitability indirectly through improvements in operational efficiency, cost management, and internal process optimization.

Despite the expanding body of literature on InsurTech and digital transformation, empirical studies examining the mediating role of operational efficiency between digital adoption and profitability in general insurance companies remain limited, particularly in emerging markets. Most prior studies focus on banking institutions, SMEs, or Islamic insurance sectors, leaving a research gap in understanding how digital payment systems and digital customer service platforms affect profitability through operational efficiency in publicly listed general insurance firms.

Therefore, building on previous research, this study empirically examines whether operational efficiency which measured by expense ratio mediates the link between digital payment, digital customer service, and profitability (as measured by ROE) within Indonesian general insurance companies.

2.4. Digital Payment & Collection System

Digital Payment refers to the use of digital systems in premium collection and financial transaction processing within insurance companies. In the context of InsurTech, digital payment platforms enhance transaction speed, accuracy, and traceability, thereby reducing administrative errors and operational inefficiencies (Braun & Jia, 2025). The implementation of automated payment systems improves financial transparency and strengthens internal monitoring mechanisms. Empirical studies indicate that digitalization enhances firm performance through improved operational productivity and distribution efficiency (Köhne & Köhne, 2024). In emerging markets, digital transformation in insurance services strengthens transaction transparency and cost management practices (Harianja et al., 2024). Therefore, digital payment adoption is expected to influence profitability directly.

H1: Digital Payment has a positive effect on profitability (ROE)

From an agency perspective, digital payment systems reduce information asymmetry and monitoring costs by providing real-time transaction records. The automation of payment processes improves reconciliation accuracy and minimizes manual operational expenses. Prior research demonstrates that digitalization improves operational performance before affecting financial outcomes (Köhne & Köhne, 2024). Thus, digital payment adoption is also expected to affect operational efficiency.

H2: Digital Payment has a significant effect on Operational Efficiency (Expense Ratio)

2.5. Digital Customer Service

Digital Customer Service refers to the use of digital platforms in claims submission, customer communication, and service monitoring. Through integrated digital systems, insurance companies can enhance responsiveness, reduce service delays, and improve customer accessibility (Śliwiński et al., 2025). Although improved customer service may strengthen firm reputation and competitive advantage, its direct financial impact depends on operational cost structures. Köhne and Köhne (2024) argue that customer-oriented digitalization does not always translate into immediate

profitability unless accompanied by internal efficiency restructuring. Therefore, digital customer service is expected to influence profitability.

H3: Digital Customer Service has a positive effect on profitability (ROE)

Furthermore, digital service platforms streamline claims processing and reduce procedural complexity. Anshori (2024) finds that digital insurance technology improves service efficiency and reduces administrative burdens. The automation of service activities may therefore influence operational cost management.

H4: Digital Customer Service has a significant effect on Operational Efficiency (Expense Ratio)

2.6. Operational Efficiency

The Expense Ratio serves as the standard measure of operational efficiency in the insurance industry, representing underwriting operational expenses as a percentage of net premium income. When this ratio is lower, it reflects superior cost control and more effective operations. Prior studies emphasize that operational efficiency is a key determinant of profitability in financial institutions (Nuhin & Suprayogi, 2022). Braun & Jia (2025) highlight that digital transformation enhances profitability primarily through internal efficiency restructuring. Similarly, Köhne and Köhne (2024) demonstrate that productivity improvements resulting from digitalization significantly affect financial performance. Therefore, operational efficiency is hypothesized to influence profitability.

H5: Operational Efficiency (Expense Ratio) has a significant effect on profitability (ROE)

2.7. Mediating Role of Operational Efficiency

Digital transformation outcomes often operate through intermediate mechanisms rather than direct financial effects. Improvements in cost control, transaction traceability, and process standardization may transmit the effects of digital adoption to financial performance. Empirical evidence suggests that productivity gains from digitalization improve profitability through operational restructuring (Köhne & Köhne, 2024). Therefore, operational efficiency is expected to mediate the relationship between digital adoption and profitability.

H6: Operational Efficiency mediates the relationship between Digital Payment and profitability.

H7: Operational Efficiency mediates the relationship between Digital Customer Service and profitability.

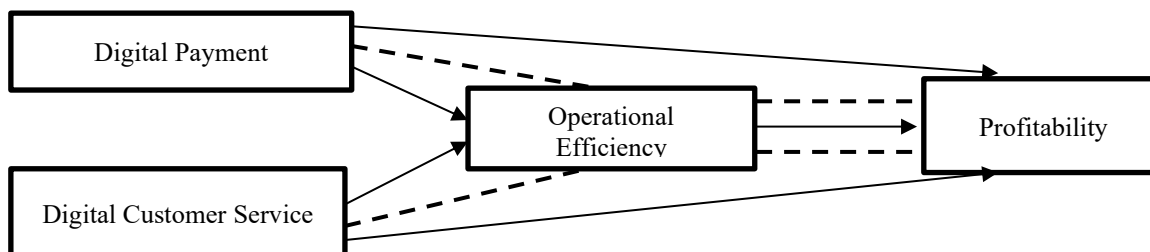


Figure 1. Framework of Thought

Referring to Figure 1, the conceptual framework in this study indicates that digital payment and digital customer service serve as factors influencing operational efficiency.

3. METHOD

A quantitative explanatory approach with panel data is employed in this study to test operational efficiency as a mediator between InsurTech adoption and profitability. The sample is drawn from general insurance firms listed on the Indonesia Stock Exchange (IDX) over the 2020-2024 timeframe, selected to capture the industry's post-digital-acceleration landscape. The population includes every general insurance company publicly traded on the IDX. Using purposive sampling, 11 companies met the following criteria: (1) continuously listed during 2020-2024, (2) published complete annual financial reports, and (3) disclosed digital initiatives related to payment systems and/or customer service. This resulted in 55 firm-year observations. Although the sample size is relatively small, it represents the entire eligible population of general insurance companies listed on the IDX that consistently met all selection criteria throughout the observation period. As

such, the sample captures a substantial and representative portion of the publicly listed general insurance market in Indonesia, and the use of panel data across five years strengthens the analytical robustness by increasing the number of observations and controlling for time-invariant firm characteristics (Gujarati & Porter, 2009; Wooldridge, 2010). Secondary data were collected from annual reports, financial statements, and official corporate websites. The data collection method follows a documentation technique commonly used in financial performance studies (Sugiyono, 2024).

3.1. Variable Measurement and Operationalization

Table 1. Operational Definition of Variables

| Variable | Measurement | Equation |
|--------------------------|------------------------|---|
| Digital Payment | Digital Index | Number of digital payment features / total indicators |
| Digital Customer Service | Digital Index | Number of digital payment features / total indicators |
| Operational Efficiency | Expense Ratio | (Claim Expenses + Commission Expenses) / Net Premium |
| Profitability | Return on Equity (ROE) | Net Income / Total Equity |

Table 1 explains that all research variables are measured using a ratio approach to describe empirical conditions quantitatively.

3.2. Data Analysis Technique

The study applies multiple linear regression and mediation analysis. The mediation framework follows the approach introduced by Baron & Kenny (1986), complemented by bootstrapping procedures using PROCESS Macro Model 4 (Hayes, 2022) to test indirect effects. Three regression equations are estimated:

Model 1 : $X_1 \ \& \ X_2 > Y$

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon \quad (1)$$

Model 2 - $X_1 \ \& \ X_2 > M$

$$M = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon \quad (2)$$

Model 3 -Mediation

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 M + \varepsilon \quad (3)$$

Significance for indirect effects is determined using bootstrapping (5,000 resamples) at a 95% confidence level. Following Hayes (2022), mediation is established when the confidence interval does not contain zero. To ensure the model's validity prior to hypothesis testing, a series of classical assumption checks were conducted, covering normality, multicollinearity, heteroscedasticity, and autocorrelation.

Data transformation (first difference and mean-centering) was applied solely for diagnostic purposes to ensure compliance with classical regression assumptions, particularly multicollinearity and autocorrelation. However, the main regression estimations and hypothesis testing were conducted using the original data to preserve the economic interpretability of coefficients and maintain the substantive meaning of the relationships among variables (Gujarati & Porter, 2009; Wooldridge, 2010).

4. RESULTS AND DISCUSSION

4.1. Research Results

Table 2 provides descriptive statistics that summarize the key characteristics of the study's variables. The data, comprising 55 observations from general insurance companies listed on the Indonesia Stock Exchange spanning 2020 to 2024, includes the minimum, maximum, mean, and standard deviation for Return on Equity (ROE), Digital Payment and Collection System (DP), Digital Customer Service (DCS), and Expense Ratio (ER). Considerable variability is evident across the sample. In the case of ROE, values range from 0.04 to 0.21, with an average of 0.099 and a standard deviation of 0.041, pointing to substantial differences in profitability performance among insurers. Digital Payment (DP) adoption ranges from 0.20 to 1.00, with an average of 0.629, reflecting varying levels of digital payment integration across firms. Some companies have fully implemented digital payment systems, while others remain partially digitalized.

Similarly, Digital Customer Service (DCS) ranges from 0.20 to 1.00, with a mean value of 0.666, suggesting that most firms have adopted several digital customer service features such as online claims and digital platforms. However, the variation indicates uneven digital maturity levels within the industry. Operational efficiency, measured by the Expense Ratio (ER), ranges from 0.19 to 1.43, with an average of 0.672 and a standard deviation of 0.230. This wide dispersion suggests differences in cost management strategies, with some firms operating efficiently while others experience relatively high operational costs that may suppress profitability.

Table 2. Descriptive Analysis Results

| Variable | Minimum | Maximum | Mean | Std. Deviation |
|--------------------------|---------|---------|-------|----------------|
| ROE | 0.04 | 0.21 | 0.099 | 0.041 |
| Digital Payment | 0.20 | 1.00 | 0.629 | 0.232 |
| Digital Customer Service | 0.20 | 1.00 | 0.666 | 0.234 |
| Expense Ratio | 0.19 | 1.43 | 0.672 | 0.230 |

Based on the descriptive statistics presented in Table 2, Digital Payment ranges from 0.20 to 1.00, with a mean of 0.629 and a standard deviation of 0.232, indicating a relatively high level of digital payment adoption despite variation across firms. Digital Customer Service also ranges from 0.20 to 1.00, with an average of 0.666 and a standard deviation of 0.234, suggesting generally strong implementation of digital service features with moderate dispersion. Operational Efficiency, measured by the Expense Ratio, ranges from 0.19 to 1.43, with a mean of 0.672 and a standard deviation of 0.230, reflecting differences in cost management practices, where operational expenses remain substantial relative to revenue. Profitability (ROE) ranges from 0.04 to 0.21, with a mean of 0.099 and a standard deviation of 0.041, indicating an average return on equity of approximately 9.9% and relatively stable profitability across firms. Overall, the study includes 55 valid observations, all of which were used in the subsequent analysis.

4.1.1. Classical Assumption Tests

A. Normality Test

The One-Sample Kolmogorov-Smirnov test on unstandardized residuals was employed to test for normality. For $N = 55$, the test yielded a Kolmogorov-Smirnov statistic of 0.093 with an asymptotic significance (2-tailed) of 0.200 (see table 3). Since this significance value surpasses 0.05, the residuals exhibit a normal distribution, satisfying the normality condition required for the regression analysis. The graphical analysis using the Normal P-P Plot further supports this result. The plotted residual points follow the diagonal line without extreme deviations or clear curvature patterns, indicating that the residual distribution approximates normality. This visual evidence aligns with the findings of the Kolmogorov-Smirnov test. Accordingly, the regression model meets the normality assumption and is deemed suitable for subsequent regression analysis.

Table 3. Normality Test Results (Kolmogorov-Smirnov)

| Test | N | Test Statistic | Asymp. Sig. (2-tailed) | Conclusion |
|--------------------|----|----------------|------------------------|----------------------|
| Kolmogorov-Smirnov | 55 | 0.093 | 0.200 | Normality Distribute |

B. Multicollinearity Test

Multicollinearity was examined using Tolerance and Variance Inflation Factor (VIF) values, with the criteria of Tolerance > 0.10 and VIF < 10. Prior to testing, data transformation was applied by using first difference on Return on Equity (DROE) and mean-centering on the independent variables to reduce potential linear dependency.

Table 4. Multicollinearity Test Results

| Variable | Tolerance | VIF |
|--------------------------|-----------|-------|
| Digital Payment | 0.153 | 6.517 |
| Digital Customer Service | 0.15 | 6.370 |
| Expense Ratio | 0.940 | 1.064 |

Dependent Variable = DROE (First Difference of ROE)

As seen in Table 4, the tolerance and VIF values indicate no multicollinearity issues for Expense Ratio (0.940 and 1.064, respectively). For Digital Payment and Digital Customer Service, tolerance values are 0.153 and 0.157, with corresponding VIFs of 6.517 and 6.370. While these VIF figures are moderately elevated, they remain under the conventional threshold of 10, and all tolerance values exceed 0.10. Thus, the transformed regression model is free from severe multicollinearity and is suitable for continued analysis.

C. Heteroscedasticity Test

To test for heteroscedasticity, the Glejser method was employed. This involved regressing the absolute residual values (ABS_RES) against the transformed independent variables: Expense Ratio, Digital Payment, and Digital Customer Service. This test was performed after applying first difference transformation to the dependent variable (DROE) and mean-centering to the independent variables to improve model stability.

Table 5. Glejser Test Results

| Variable | B | T | Sig. |
|--------------------------|--------|--------|-------|
| Constant | 0.019 | 6.976 | 0.000 |
| Expense Ratio | -0.018 | -0.826 | 0.413 |
| Digital Payment | 0.005 | 0.171 | 0.865 |
| Digital Customer Service | 0.008 | 0.248 | 0.805 |

Dependent Variable = ABS_RES

The testing criterion states that a regression model is free from heteroscedasticity if the significance value of each independent variable exceeds 0.05. The results as in table 5 show that Expense Ratio (0.413), Digital Payment (0.865), and Digital Customer Service (0.805) all have significance values greater than 0.05. Therefore, the independent variables show no significant influence on the absolute residual values. This finding confirms the absence of heteroscedasticity, meaning the homoscedasticity assumption is met. Accordingly, the transformed regression model is statistically valid and suitable for subsequent hypothesis testing.

D. Autocorrelation Test

Autocorrelation was examined using the Durbin-Watson (DW) statistic, which tests for correlation among residuals across sequential observations. The model uses 55 observations (n = 55) with three independent variables, namely Digital Payment, Digital Customer Service, and Expense Ratio.

Table 6. Autocorrelation Test Result

| Model | R | R Square | Adjusted R Square | Std. Error | Durbin-Watson |
|-------|-------|----------|-------------------|------------|---------------|
| 1 | 0.520 | 0.270 | 0.226 | 0.02551 | 2.535 |

Dependent Variable = D ROE

With a Durbin-Watson value of 2.535, the results fall within the acceptable range of dU to $4 - dU$, indicating an absence of autocorrelation (see Table 6). This confirms that neither positive nor negative autocorrelation is present in the regression model. Thus, the residual independence assumption holds, and the model is appropriate for further analytical procedures.

E. Regression Test

1) Model 1: Effect of Digital Payment and Digital Customer Service on ROE

The regression equation for Model 1 is:

$$ROE = 0.014 + 0.144DP - 0.008DCS \quad (4)$$

Table 7. Model 1 Result

| Variables | B | Std. Error | Beta | t | Sig. |
|--------------------------|--------|------------|--------|--------|-------|
| Constant | 0.014 | 0.011 | - | 1.304 | 0.198 |
| Digital Payment | 0.144 | 0.039 | 0.817 | 3.709 | 0.001 |
| Digital Customer Service | -0.008 | 0.038 | -0.047 | -0.212 | 0.833 |

R = 0.774
R² = 0.599
Adjusted R² = 0.584
F = 38.909
Sig. (F) = 0.000

With an F-statistic of 38.909 ($p = 0.000$), the regression model demonstrates statistical significance (see Table 7). The R² value of 0.599 indicates that Digital Payment and Digital Customer Service account for 59.9% of the variance in ROE. Digital Payment shows a positive and significant influence on ROE ($B = 0.144$; $p = 0.001$), suggesting that greater implementation of digital payment systems enhances profitability. The standardized beta (0.817) shows that Digital Payment is the dominant predictor in the model. In contrast, Digital Customer Service does not significantly affect ROE ($p = 0.833$), suggesting that digital service features do not directly contribute to short-term profitability.

2) Model 2: Effect of Digital Payment and Digital Customer Service on Expense Ratio

The regression equation for Model 2 is:

$$ER = 0.126 + 1.038DP - 0.162DCS \quad (5)$$

Table 8. Model 2 Result

| Variables | B | Std. Error | Beta | t | Sig. |
|--------------------------|--------|------------|--------|--------|-------|
| Constant | 0.126 | 0.042 | - | 2.987 | 0.004 |
| Digital Payment | 1.038 | 0.151 | 1.048 | 6.863 | 0.000 |
| Digital Customer Service | -0.162 | 0.150 | -0.165 | -1.082 | 0.284 |

R = 0.899
R² = 0.808
Adjusted R² = 0.800
F = 109.077
Sig. (F) = 0.000

The F-statistic of 109.077 with a significance level of 0.000 indicates that Digital Payment and Digital Customer Service jointly have a significant effect on Expense Ratio (see Table 8). The R² value of 0.808 shows that 80.8% of the variation in operational efficiency (Expense Ratio) is explained by the two independent variables, indicating strong explanatory power. Digital Payment has a positive and highly significant effect on Expense Ratio ($B = 1.038$; $p = 0.000$). This indicates that higher adoption of digital payment systems is associated with changes in operational cost structure. The standardized beta (1.048) shows that Digital Payment is the most dominant variable

in explaining variations in Expense Ratio. In contrast, Digital Customer Service does not significantly affect Expense Ratio ($p = 0.284$), suggesting that digital service features do not directly influence operational efficiency.

3) Model 3: Effect of Digital Payment and Digital Customer Service and Expense Ratio on ROE
 The regression equation for Model 3 is:

$$ROE = -0.005 - 0.015DP + 0.017DCS + 0.153ER \tag{6}$$

Table 9. Model 3 Result

| Variables | B | Std. Error | Beta | t | Sig. |
|--------------------------|--------|------------|--------|--------|-------|
| Constant | -0.005 | 0.010 | - | -0.546 | 0.588 |
| Digital Payment | -0.015 | 0.043 | -0.085 | -0.346 | 0.731 |
| Digital Customer Service | 0.017 | 0.032 | 0.096 | 0.529 | 0.599 |
| Expense Ratio | 0.153 | 0.029 | 0.861 | 5.313 | 0.000 |

R = 0.861
 R² = 0.742
 Adjusted R² = 0.727
 F = 48.931
 Sig. (F) = 0.000

An F-statistic of 48.931 with a p-value of 0.000 confirms the statistical significance of the model (see Table 9). The R² of 0.742 indicates that 74.2% of the variability in ROE is explained by Digital Payment, Digital Customer Service, and Expense Ratio. After including Expense Ratio in the model, Digital Payment becomes statistically insignificant ($p = 0.731$), indicating that its direct effect on ROE disappears. Similarly, Digital Customer Service remains insignificant ($p = 0.599$).

In contrast, Expense Ratio has a positive and highly significant effect on ROE ($B = 0.153$; $p = 0.000$). The standardized beta coefficient (0.861) indicates that Expense Ratio is the most dominant variable in explaining ROE. The disappearance of the direct effect of Digital Payment after including Expense Ratio suggests the presence of full mediation. This implies that the influence of digital payment adoption on profitability operates entirely through operational efficiency. Therefore, Expense Ratio functions as a mediating variable in the relationship between digital adoption and profitability.

4.1.2. Mediation Analysis

To assess whether operational efficiency (Expense Ratio) mediates the relationship between digital adoption and profitability, mediation analysis was performed using PROCESS Macro Model 4 with 5,000 bootstrap samples at a 95% confidence interval. The findings as seen in Table 10 reveal a significant effect of Digital Payment on Expense Ratio ($\beta = 1.0384$, $p < 0.001$), as well as a significant effect of Expense Ratio on ROE ($\beta = 0.1531$, $p < 0.001$). However, after including Expense Ratio in the model, the direct effect of Digital Payment on ROE becomes insignificant ($\beta = -0.0150$, $p = 0.731$). Furthermore, the bootstrapping results show that the indirect effect is significant, as the confidence interval does not include zero (BootLLCI = 0.0803; BootULCI = 0.2436). These findings confirm the presence of full mediation, indicating that Digital Payment influences profitability entirely through operational efficiency mechanisms.

In contrast, Digital Customer Service does not significantly affect Expense Ratio ($p = 0.284$) nor ROE directly ($p = 0.599$). The bootstrapped indirect effect is also not significant, as the confidence interval crosses zero (BootLLCI = -0.0778; BootULCI = 0.0148). Therefore, operational efficiency does not mediate the relationship between Digital Customer Service and profitability. Overall, the findings suggest that digital initiatives focused on financial transaction systems contribute to firm profitability only when they effectively restructure internal cost efficiency, whereas customer-oriented digital services do not produce measurable financial effects through operational mechanisms.

Table 10. Mediation Results

| Relationship | Effect | Std. Error | t | P-value | BootLLCI | BootULCI | Result |
|--|---------|------------|---------|---------|----------|----------|-----------------|
| Digital Payment → Expense Ratio | 1.0384 | 0.1513 | 6.863 | 0.000 | 0.7348 | 1.3420 | Significant |
| Digital Customer Service → Expense Ratio | -0.1622 | 0.1500 | -1.0815 | 0.2844 | -0.4632 | 0.1388 | Not Significant |
| Expense Ratio → ROE | 0.1531 | 0.0288 | 5.313 | 0.000 | 0.0952 | 0.2109 | Significant |
| Digital Payment → ROE | -0.0150 | 0.0434 | -0.346 | 0.731 | -0.1021 | 0.0721 | Not Significant |
| Indirect Effect (X ₁ →M→Y) | 0.1589 | 0.0414 | — | — | 0.0803 | 0.2436 | Full Mediation |
| Digital Customer Service → ROE | 0.0167 | 0.0315 | 0.529 | 0.599 | -0.0466 | 0.0799 | Not Significant |
| Indirect Effect (X ₂ →M→Y) | -0.0248 | 0.0236 | — | — | -0.0778 | 0.0148 | No Mediation |

4.2. Discussion

The findings of this study provide a comprehensive understanding of the factors influencing the profitability of general insurance companies in Indonesia. Digital adoption in Indonesian general insurance companies does not directly improve profitability. Its impact depends on whether digital initiatives enhance operational efficiency, particularly through cost reduction, process automation, and improved financial monitoring systems. This aligns with prior studies that emphasize efficiency as the primary mechanism through which digital transformation affects financial performance Calderon (2025) and Hou et al. (2021) which affirm that digital transformation fundamentally operates through cost efficiency mechanisms, such as transaction cost reduction, process automation, and improvements in financial monitoring systems.

Digital Payment is proven to have a significant positive influence on ROE when operational efficiency has not yet been taken into account. This indicates that digital payment systems are capable of improving premium collection processes, transaction transparency, and cash flow management. However, when the Expense Ratio is incorporated into the model, this direct influence becomes insignificant, while the indirect influence remains significant. This condition confirms the existence of full mediation, whereby the influence of Digital Payment on profitability is entirely channeled through operational efficiency. In other words, Digital Payment does not directly improve profitability, but first reduces operational costs, which subsequently impacts ROE improvement. This mechanism is also supported by Agarwal et al. (2024); Jardak & Ben Hamad (2022); and Lana et al. (2025) which demonstrate that the financial benefits of digitalization often emerge after considering cost structures and the time lag resulting from initial technology investment.

From a theoretical perspective, these findings support Signal Theory and Agency Theory. The adoption of a structured digital payment system provides signals of modernization and operational transparency to stakeholders, thereby increasing confidence in the company (Chen et al., 2021). Furthermore, increased automation and transaction traceability are capable of reducing information asymmetry and monitoring costs, which are primary issues in Agency Theory. Therefore, when the Expense Ratio is incorporated into the model, the direct influence of Digital Payment on ROE disappears because all of its economic benefits have already been reflected in improvements in internal cost efficiency.

Conversely, Digital Customer Service does not demonstrate a significant influence on profitability, either directly or indirectly. This indicates that customer-oriented digital platforms have more influence on non-financial aspects, such as service quality, satisfaction, and customer loyalty, rather than short-term financial performance. This finding is consistent with the cost characteristics of digital services, which tend to have high fixed costs and still depend on a hybrid service model between digital and human elements. Consequently, without measurable cost efficiency

improvements, Digital Customer Service initiatives have not yet been capable of delivering a direct impact on profitability (Bankuoru Egala et al., 2021; S. H. Kim & Yang, 2025).

Operational efficiency emerges as the strongest determinant of ROE. Notably, the positive and significant relationship between Expense Ratio and ROE requires more careful interpretation. Theoretically, a high Expense Ratio reflects large operational costs and potential inefficiency. However, in the context of general insurance companies in Indonesia during the 2020–2024 period, an increasing Expense Ratio may also reflect expansion activities, premium growth, digital investment, and strengthening of underwriting capacity. Under these conditions, increased operational costs are in fact associated with increased business scale and revenue. Therefore, this positive relationship more accurately reflects growth-efficiency dynamics rather than mere cost inefficiency, whereby operational expenditures aligned with expansion and digital transformation can contribute positively to profitability.

Digital payment is proven to have a significant influence on ROE through the expense ratio with a full mediation pattern. The use of digital payment systems is capable of significantly reducing transaction costs (Calderon, 2025), while simultaneously improving the speed and accuracy of operational processes that impact company efficiency (Lulaj, 2025). This efficiency is reflected in a reduction in the expense ratio, which serves as the primary channel for improving profitability, particularly ROE (Rumyantseva & Tarutko, 2022). Furthermore, the benefits of digital payment on financial performance generally do not occur instantly, but rather require time to materialize alongside operational adaptation and increased customer usage (Ortikov et al., 2024). Thus, the influence of digital payment on ROE occurs entirely through improvements in operational cost efficiency (Arilesere et al., 2021).

However, in contrast to digital payment, digital customer service does not have a significant influence on ROE. Investment in digital services requires large upfront costs, such as system development and technology integration (Jardak & Ben Hamad, 2022), which in the short term may in fact suppress the company's financial performance (Lana et al., 2025). On the other hand, the primary benefits of digital customer service are more related to improvements in customer experience and loyalty (K. H. Kim et al., 2021; Stadlmann et al., 2023), which are not directly reflected in profitability indicators such as ROE (S. H. Kim & Yang, 2025). This condition results in the absence of a significant direct relationship between digital customer service and company financial performance.

Consistent with this, digital customer service also has no influence on ROE through the expense ratio, such that no mediation mechanism occurs. This indicates that the implementation of digital services has not yet been capable of creating significant operational cost efficiency, and in some cases actually increases the operational burden due to technology costs and investment amortization (S. H. Kim & Yang, 2025). Furthermore, the influence of digital services on financial performance depends more on other factors such as customer engagement and marketing strategy, which are not yet strong enough to directly reduce the expense ratio (Chauhan et al., 2022). Therefore, the expense ratio does not serve as a mediating variable in the relationship between digital customer service and ROE (Youssef et al., 2018).

Overall, the findings of this study affirm that digital transformation only delivers an impact on financial performance when accompanied by improvements in operational efficiency. Digitalization focused on customer-side innovation without concurrent improvements in internal processes tends not to produce significant financial implications. These findings simultaneously demonstrate a fundamental difference between internal process-based digitalization (Digital Payment & Collection System) and customer-based digitalization (Digital Customer Service), whereby only internal digitalization is proven capable of improving profitability through cost efficiency mechanisms.

The mediation results indicating that the direct influence of Digital Payment on ROE becomes insignificant after incorporating the Expense Ratio suggest that this relationship is entirely mediated by operational efficiency. From the perspective of Agency Theory, the implementation of Digital Payment plays a role in reducing agency costs through improvements in transparency, reduction of information asymmetry, and efficiency in internal control mechanisms. Transaction digitalization promotes automation and process standardization, thereby contributing to a reduction in operational costs reflected in the Expense Ratio. Thus, the influence of Digital Payment on profitability does not occur directly, but rather through improvements in cost efficiency as an intervening variable.

Furthermore, within the Signaling Theory framework, the adoption of Digital Payment reflects a strategic signal regarding the company's commitment to innovation and performance improvement. However, this signal does not carry meaningful economic consequences unless it is followed by measurable improvements in operational performance. In this regard, the Expense Ratio functions as an indicator that captures the effectiveness of technology implementation in reducing costs. Therefore, when the Expense Ratio is incorporated into the model, the direct influence of Digital Payment on ROE becomes insignificant because all of its influence has already been internalized through improvements in operational efficiency.

Overall, these findings affirm that the full mediation pattern reflects the role of Digital Payment as an indirect determinant of profitability. The contribution of technology to financial performance will only be realized if it is capable of substantially driving operational efficiency. Thus, the success of digital transformation is not solely determined by the level of technology adoption, but by its ability to produce structural improvements in the company's operational costs.

5. CONCLUSION

This study investigates the effect of Digital Payment and Digital Customer Service on profitability, with operational efficiency (Expense Ratio) as a mediating variable in Indonesian general insurance companies. This study affirms that digital transformation does not directly improve profitability, but rather depends on its ability to drive operational efficiency. Digital Payment is proven to only deliver an impact on ROE when it is capable of reducing operational costs through improvements in internal processes, while Digital Customer Service has not yet demonstrated meaningful financial contribution in the short term.

The practical implications of these findings indicate that general insurance companies need to prioritize digitalization oriented toward internal processes, particularly those capable of improving cost efficiency, such as payment systems and transaction management. A focus on optimizing the Expense Ratio becomes key to ensuring that digital investment can be translated into improved financial performance. Conversely, the development of customer-based digital services should be positioned as a long-term strategy supporting service quality and loyalty, rather than as a primary driver of profitability in the short term. In contrast, Digital Customer Service does not demonstrate a significant impact on profitability, either directly or indirectly. This suggests that customer-oriented digital initiatives may provide strategic benefits, such as improved service quality and customer satisfaction, but do not immediately translate into measurable financial outcomes.

This study contributes to the literature by providing empirical evidence on the mediating role of operational efficiency in the relationship between InsurTech adoption and profitability. It distinguishes between process-oriented and customer-oriented digitalization, demonstrating that only internal process digitalization significantly improves profitability through efficiency mechanisms. For practitioners, general insurance companies should prioritize digital investments in internal process efficiency, particularly payment automation and transaction management, as profitability gains are realized only when digitalization produces measurable reductions in the Expense Ratio. Customer-facing digital services should be positioned as a long-term strategic investment rather than a short-term profitability driver. For policymakers, regulatory frameworks and digital transformation incentive programs should encourage insurers to align technology adoption with operational efficiency targets, ensuring that InsurTech investment translates into improved industry-wide financial performance.

This study is limited to general insurance companies listed on the Indonesia Stock Exchange and covers a relatively short observation period, which may affect the generalizability of the findings. Future studies are encouraged to incorporate additional mediating variables, such as underwriting performance, premium growth, or claim efficiency, and to extend the analysis across different sectors or countries to enhance generalizability.

Conflict of Interest Statement

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

W.L.: Conceptualization, investigation, and writing the original draft.

K.K.: Methodology, supervision, validation, and writing, review, and editing.

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Informed consent was not required.

Ethical Approval

This article does not contain any studies with human participants or animals performed by the authors.

Data Availability

The data that support the findings of this study are available from the corresponding author [W.L.] upon reasonable request.

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