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The Effect of Digital Transformation on Bank Financial Performance with Fee Based Income as an Intervening Variable in Commercial Banks Listed on the IDX in the 2020-2023 Period

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Keywords

digital transformation, financial performance, fee-based income, banking

Abstract

Digital transformation has become a significant trend across all industrial sectors, aiming not only to address contemporary challenges but also to improve companies' operational performance. This study investigates the effect of digital transformation and fee-based income on the financial performance of banks. Specifically, it examines whether digital transformation significantly enhances financial performance (measured by ROA) through the mediation of fee-based income. The study adopts the latest digital transformation metrics developed in China and focuses on banking sector companies listed on the Indonesia Stock Exchange (IDX) from 2020 to 2023. Secondary data were collected from financial and annual reports using purposive sampling, resulting in a final sample of 40 firms. The analysis was conducted using multiple linear regression with E-Views 12 software. The findings demonstrate that digital transformation and fee-based income both positively and significantly affect banks' financial performance, both jointly and individually. Furthermore, digital transformation is shown to have a significant positive impact on ROA through the mediation of fee-based income. Future research is recommended to include non-bank financial institutions as research subjects, incorporate additional variables, and assess financial performance over a longer period.

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INTRODUCTION

The banking sector wields significant influence in Indonesia due to its crucial role in impacting the national economy extensively. The advancement of the banking sector is evidenced by its financial performance reports released on the Indonesia Stock Exchange. The financial performance of banks serves as a key indication for public and investor evaluations of the efficacy of banking activities. The World Bank asserts that the advancing financial sector is expected to stimulate economic development, alleviate poverty, and diminish macroeconomic instability (Dangnga & Haeruddin, 2018). The banking industry bears a strategic obligation to enhance the nation's economy. The availability of bank finance will enhance individual productivity. During the Covid-19 outbreak, all activities, including those of general and sharia banks in Indonesia, must be adapted to a new paradigm. Each bank must formulate an innovative strategy and assess the planned tactics aimed at mitigating the risks now confronted by the institution, given the prevailing unpredictable economic and environmental conditions. This indicates that the banking sector encounters significant obstacles in enhancing its profitability. At that time, the duration of the Covid-19 pandemic was uncertain, prompting banks to reassess their policies (Tahliani, 2020).

Prior to Covid-19, banks had a financial crisis in 1997-1998 that significantly affected the banking sector in Indonesia. The depreciation of the rupiah during that period significantly affected the financial performance of banks. Following the 1997 monetary crisis, the financial performance of banks was once again disrupted by the worldwide pandemic that first emerged in Indonesia in 2020. During the Covid-19 outbreak in 2020, traditional commercial banks in Indonesia saw a deterioration in financial performance.

Figure 1 illustrates that in the first quarter of 2020, before to the onset of Covid-19 in Indonesia, banking ROA remained robust at 2.50%. Following the initial Covid-19 case on March 2, 2020, banks Return on Assets (ROA) exhibited a gradual fall during the second quarter of 2020, continuing into the fourth quarter. This may result from the upheaval in the financial industry. In 2021, banking ROA saw little fluctuations, remaining constant with a level below 2%. The widespread transmission of Covid-19 raised concerns over the financial performance of all industrial sectors within the nation's economy. The Covid-19 epidemic adversely affects Indonesia's economic development, resulting in diminished state income and global economic instability, necessitating exceptional actions in taxes and the banking sector (Onibala et al., 2021). The government has implemented various measures to mitigate the spread of Covid-19 in Indonesia, including the PSBB (large-scale social restrictions) policy, which adversely affects economic activities and diminishes the financial performance of numerous industrial sectors in the country. Conventional commercial banks in Indonesia successfully confronted problems and maintained financial stability, evidenced by a rise in ROA in 2023.

Digital transformation has emerged as a prevalent trend across all industrial sectors, aimed not only at addressing contemporary difficulties but also at enhancing the operating operations of companies. Digital transformation is a process wherein firms adjust to environmental changes by employing digital technology to create value creation (Chao et al., 2024). To address business requirements during Covid-19, banks must be equipped to implement extensive digital transformation to enhance customer retention through improved customer service, therefore bolstering the company's financial performance and ensuring the seamless operation of banking activities. Research by Chao

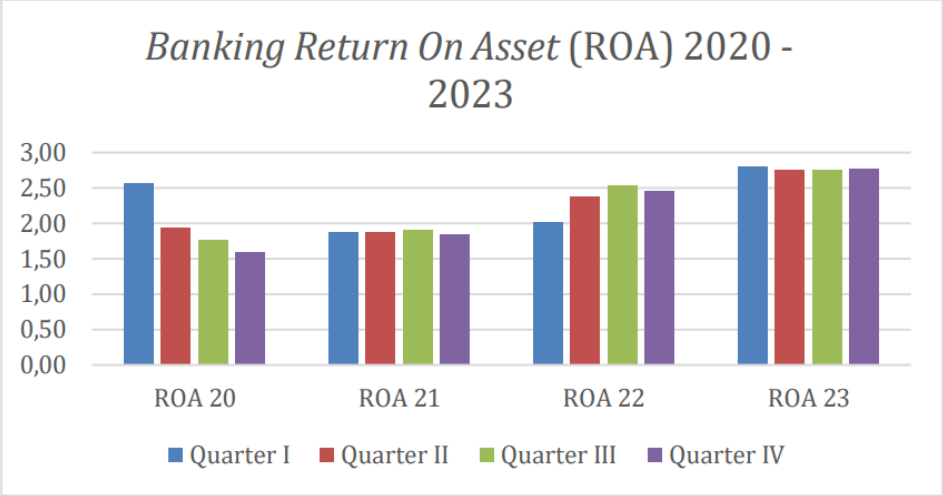

Figure 1. Banking Financial Performance 2020-2023

Source: author's result data, 2024

et al. (2024) indicates that the degree of digital transformation in rural commercial banks positively influences their profitability. Research (Y. Chen & Zhang, 2024) corroborates that digital transformation markedly enhances overall financial performance and stability, as demonstrated by heightened profitability, diminished operational expenses, and lowered financial risk. However, study (Sklenarz et al., 2024) indicates that digital transformation has no substantial impact on ROA. Research (Putra, 2022) indicated that digital transition significantly affects ROA and ROE with a negative coefficient, suggesting that organizations undergoing digital transformation will face a fall in performance.

The volatile Indonesian economy necessitates that banks consistently achieve optimal profitability by delivering superior financial services to the people. Consequently, banks must explore alternative methods to augment their revenue, one of which is generating fee-based income from mobile banking transfer operations, alongside interest income (Surachim et al., 2021). Despite its modest size, this revenue contributes to the overall total (Marsekal Maroni, 2020). The study results (Rachma & Wardana, 2023) indicate that the partial hypothesis test reveals a negative correlation between fee-based revenue and profitability (ROA) at Bank Muamalat Indonesia. This indicates that a rise in Fee Based Income correlates with a decline in return on assets (ROA). Nonetheless, according (Febrina et al., 2019) The hypothesis test findings indicate that the Fee Based Income variable does not significantly affect ROA, since the interest income component (credit), which is the primary portion of operating income, exceeds the value of Fee Based Income. Research indicates that fee-based revenue positively influences corporate profits, suggesting that a rise in fee-based income correlates with enhanced profitability (Rusdiansyah & Hayat, 2022).

This research is an adaptation of the study titled "How does digital transformation influence the profitability of rural commercial banks?". The research (Chao et al., 2024) examined the profitability of Chinese rural banks in relation to digital transformation, focusing on asset quality, operational efficiency, and heightened risk-taking. Findings indicate that the degree of digital transformation in Chinese rural commercial banks

positively influences their profitability. Digital transformation may enhance the profitability of rural commercial banks by enhancing asset quality, operational efficiency, and risk management capabilities. The research indicated that the effect of enhanced profitability due to digital transformation was more significant in rural commercial banks possessing more assets and smaller equity concentrations, as well as in state-owned rural commercial banks. The author distinguishes the research object by focusing on commercial bank sector companies listed on the Indonesia Stock Exchange from 2020 to 2023, incorporating an intervening variable, fee-based income, as contemporary assessments of bank performance encompass both interest and non-interest income.

LITERATURE REVIEW AND DEVELOPMENT OF A HYPOTHESIS

Signalling Theory

Signal Theory, established by Michael Spence in 1973, elucidates the methods to mitigate the information asymmetry frequently present among market participants. Signal Theory elucidates how market participants might transmit signals to communicate information to other entities (Bafera & Kleinert, 2023). Consequently, the recipient acquires assurance that the signal transmits trustworthy information (Spence, 2002). Signalling theory may elucidate the assessment of banking performance. A superior financial report indicates to external parties that the firm has performed effectively. External signals pertain to the company's disclosed information as shown in its yearly financial report (Sari et al., 2020). This signal serves as an indication of management's actions to satisfy the desires of owners and other stakeholders (Azra, 2023).

Resource-Based View Theory

The inception of resource-based theory was signified by the release of Wernerfelt's "Resource-based Theory of Firm" in 1984 (Wernerfelt, 1984). According to Wernerfelt (1984), the resource-based perspective theory posits that organizations may maintain a competitive advantage and enhance financial performance by owning, controlling, and effectively utilizing strategic assets. These strategic assets are resources owned and managed by the company, encompassing both intangible and tangible elements, including assets, individual competencies, technological knowledge, organizational processes, and information or characteristics related to the execution of company strategies aimed at enhancing efficiency and effectiveness. The Resource- Based View thesis posits that a company's enduring competitive advantage arises from the synergistic integration of resources and strategic skills. Organizations must develop, integrate, and adapt digital technology alongside a broader array of management competencies to get this advantage (Nandi et al., 2020). This encompasses the owner/manager's viewpoint on utilizing digital transformation to establish a competitive edge in the market.

Bank Financial Performance

The company's capacity to manage and arrange its resources might be seen as financial performance. Financial performance is a metric that enables the industry to evaluate its capacity to earn profits over a certain timeframe. Financial performance can reflect the efficacy of corporate management in asset use over a certain timeframe. Consequently, evaluating the company's financial performance is crucial to ascertain its true condition regarding success, management, and control, as well as its operational efficiency. The primary source of information on banks financial performance is the issuance of financial reports. Bank Indonesia Regulation Number 3/22/PBI/2001, enacted

by the Governor of Bank Indonesia on December 13, 2001, mandates that banks create and provide financial reports to enhance the transparency of their financial status. The financial reports include financial statements, consolidated financial reports, quarterly published financial reports, and monthly published financial reports (Marisya, 2021).

Digital Transformation

Digital transformation is the use of digital technology to a company's goods, processes, organizations, business models, and strategy. Certain academics contend that digital transformation is a profound evolution rooted in digitalization, which fundamentally impacts the organization's basic operations and seeks to establish novel business models (Teng et al., 2022). The need for digital acceleration has grown significantly in recent years due to heightened public expectations for secure, efficient, and rapid financial services accessible from any location. In such circumstances, digital transformation is a strategy that banks must pursue to enhance competitiveness. Banks must modify their operational and managerial strategies to accommodate digital revolution. To enhance client experience, the shift from traditional banking to future-oriented banking compels banks to modify their business strategies, reorganize their distribution networks, and promote financial transactions via digital channels.

Fee-Based Income

Lapoliwa (2000) asserts that fee-based income constitutes bank revenue utilized to augment earnings and expand market share (Lapoliwa., 2000). As a result of heightened rivalry among banks, interest income is diminishing. Banks can create profits not just from core activities but also from transactions associated with numerous financial services. Despite the modest profits generated by these financial services, they instill trust due to their comparatively lower risk relative to credit (Kasmir, 2014). Alongside risk concerns, the substantial variety in income from these services enables banks to enhance their offerings.

Development of a Hypothesis

The Effect of Digital Transformation on Financial Performance

Digital solutions may enhance banks financial performance by enabling access to a broader market and fostering deeper interactions with technologically adept clients. This is substantiated by studies employing digital transformation. The degree of digital transformation in rural commercial banks in China was found to positively influence their financial performance (profitability) (Chao et al., 2024). Other studies (Y. Chen & Zhang, 2024) indicate that digital transformation positively influences a company's financial success. Research (Theiri & Hadoussa, 2024) indicates that digital transformation positively influences the financial performance of Tunisian banks, since investments in payment instruments, digital channels, and internet security enhance bank performance. The study's results allow for the formulation of the first hypothesis as follows:

H1: Digital transformation has a positive effect on bank financial performance.

The Effect of Digital Transformation on Fee Based Income

The use of information technology through a digitalization system may serve as a strength and advantage for banks in navigating the digital era. The advantages of fee-

based income derived via electronic channels, including ATMs, EDC, internet banking, SMS banking, and mobile banking, emphasize the significance of digital transformation, particularly in the realm of digital services. The popularity of mobile banking is rising, particularly in association with government-sponsored cashless programs. Research by (Alkahfi et al., 2024) indicates that mobile banking transactions and IT investment, as elements of banking digitalization, significantly enhance fee-based income. Research (Simbolon, 2023) indicates that the presence of Mobile Banking, Payment Gateway, and QRIS as products of digital transformation positively and significantly influences fee-based income. Consequently, the second hypothesis might be articulated as follows based on the study's findings:

H2: Digital transformation has a positive effect on fee-based income.

The Effect of Fee Based Income on Bank Financial Performance

Fee-based income comprises earnings from service fees and transaction commissions, which tend to be more stable and sustainable than revenue reliant on sales that may vary with market circumstances. The inclusion of this supplementary income stream enables banks to enhance profit margins, diminish reliance on main revenue, and bolster overall financial stability. Researchers Rusdiansyah and Hayat (2022) affirm that their findings indicate Fee-Based Income positively influences company earnings (Rusdiansyah & Hayat, 2022). Khotijah and Sugiono (2021) similarly asserted that Fee-Based Income significantly positively influences Income (Khotijah & Sugiono, 2021). Consequently, the third hypothesis might be articulated as follows based on the study's findings:

H3: Fee-based income has a positive effect on bank financial performance.

The effect of digital transformation has a positive effect on bank financial performance through fee-based income as an intervening variable

The resource-based perspective hypothesis posits that organizations may maintain a competitive advantage and enhance financial performance by owning, controlling, and effectively utilizing strategic assets. These strategic assets are resources owned and managed by the corporation, encompassing both intangible and tangible elements, including assets, individual competencies, technological expertise, organizational procedures, and information that enhance corporate success. This encompasses the owner/manager's viewpoint on leveraging digital transformation to establish a competitive edge in the marketplace. To enhance their operations and capitalize on commercial opportunities, it is crucial for all industrial sectors, particularly the banks in this research, to amalgamate managerial competencies with digital technological resources. Digital transformation is anticipated to enhance financial performance via fee-based revenue. Research (Yusuf & Rahma, 2024) Branchless banking, as a facet of digital transformation, positively impacts fee-based income at BRI.

Consequently, the third hypothesis might be articulated as follows based on the study's findings:

H4: Digital transformation has a positive effect on bank financial performance through fee-based income as an intervening variable.

Framework Figure

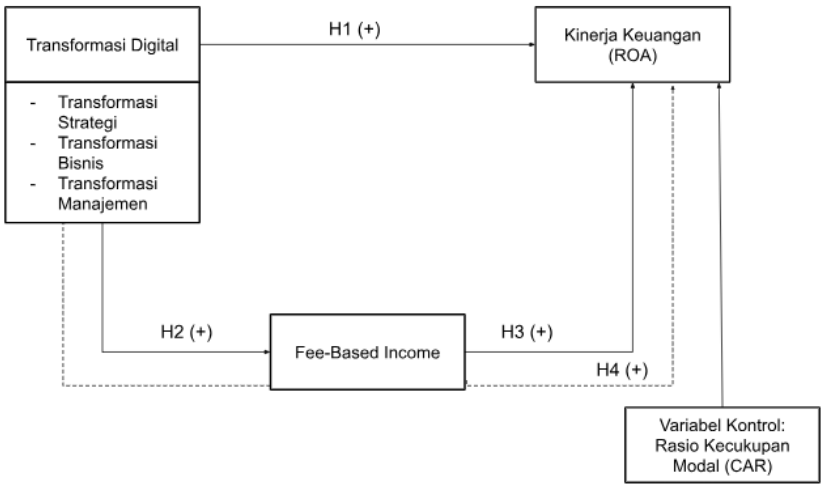

Figure 2. Framework

Source: Research modification (Chao et al., 2024) and (Yusuf & Rahma, 2024)

RESEARCH METHOD

Research Design

This research design uses a quantitative approach, and the type of causal research. Causality research is research that shows the possibility of cause and effect. This study explains the causal influence between the independent variable (digital transformation) on the dependent variable (bank financial performance) through the intervening variable (fee-based income) and sample data from the banking sector research listed on the Indonesian stock exchange in 2020-2023. Testing in this study was conducted based on secondary data. The data is then processed to obtain information and can be used as a framework for answering the predetermined hypothesis.

Population and Sample

This research examines banking businesses listed on the IDX from 2020 to 2023, with a total of 47 institutions. This study employed the purposive sampling approach. Banks that fulfill the subsequent criteria will be chosen as samples for the study, including:

1. Banking sector companies listed on the Indonesia Stock Exchange for the period 2020 - 2023
2. Conventional banking sector companies outside of Islamic banks and BPDs listed on the IDX from 2020 to 2023
3. Conventional commercial banks that do not publish complete financial reports and annual reports during 2020 - 2023
4. Conventional commercial banks that do not have complete data as needed by the author during the period 2020 - 2023

Variables Operationalization

Table 1. Variables Operationalization

Variabel	*Measurement*	Scale
Dependent Variable		
Bank Financial Performance	$ROA = \frac{Net\ Income}{Total\ Assets}$ (Ross et.al, 2019)	Ratio
Independent Variable		
Digital Transformation	• Strategy Transformation – Digital Technology Keyword Frequency (Number of occurrences of keywords about digital technology in the annual report (natural logarithm)). Keywords were extracted from Chinese study (Chen et al., 2024) because to the commonalities in the examined industries, specifically banking and the renewal of processed information. • Business Transformation – Digital Network (Measured by scoring 1 or 0 based on whether the bank has launched mobile banking and micro banking in the year.) – Digital Products (Measured by scoring 1 or 0 if the bank has launched internet money management/wealth management, internet credit, and e-commerce.) – Digital R&D (Number of patents related to digital technology (natural logarithm) • Management Transformation: – Digital architecture (Measured by scoring 1 or 0 on whether the bank has made internal organizational changes and whether it has established a fintech subsidiary) – Digital talent (Percentage of directors with an IT background on the board and percentage of executives with an IT background on the executive team) – Digital Cooperation (Measured by scoring 1 or 0 on whether the bank has entered into investment partnerships with external technology companies)	Nominal, Ratio
Intervening Variable		
Fee Based Income	$Fee\ Based\ Income = \frac{Fee\ Based\ Income}{Total\ Pendapatan\ Operasional}\ x\ 100$ (Dahlan, 2005)	Ratio
Control Variable		
Capital Adequacy Ratio	$CAR = \frac{Modal}{ATMR}\ x\ 100$ Based on: Bank Indonesia circular letter No.9/24/DPbS 2007	Ratio

Source: Data processed by researchers, 2025

Index Calculation for Digital Transformation: In this study, various types of data have different units and dimensions, it is necessary to carry out dimensionless processing. Therefore, (Xie & Wang, 2023) to facilitate and adopt the following transformation formula:

$$x^{*}_{i,j,k,2020} = \frac{X_{i,j,k,t} - X_{j,k\ 2020^{l}}}{X_{j,k\ 2020^{h}} - X_{j,k\ 2020^{l}}} \quad (1)$$

$x_{i,j,k,t}$ shows the value of the indicator k of bank i in dimension j at period t, and $x^{*}_{i,j,k,t}$ shows the corresponding value after dimensionless processing. In the calculation of the indicator in each year, the lower limit $X_{j,k_t^{l}}$ and Upper limit $X_{j,k\ 2020^{h}}$ is a fixed value in 2020. Lower limit $X_{j,k\ 2020^{l}}$ shows the minimum value of the actual indicator k in dimension j in 2020, and the upper limit $X_{j,k\ 2020^{h}}$ shows the maximum value of the actual k indicators in dimension j in 2020 (Xie & Wang, 2023).

$$I_{i,t} = \sum_{J=1}^{3} W_j Z_{i,j,t} = \sum_{J=1}^{3} W_j \sum_{k=1}^{n} m_{j,k}\, x^{*}_{i,j,k,t} \quad (2)$$

$li_{,t}$ shows the combined index of digital transformation of bank i in period t. Meanwhile, wj Displays the weights of the three dimensions: strategic transformation, business transformation, and management transformation within the composite index. The composite index is derived from the summation of the digital transformation subindices, calculated as a weighted sum of these subindices. $x^{*}i,j,k,t$ shows the value of the indicator k of bank i in dimension j at period t, and $mj_{,k}$ shows the weight of indicator k in dimension j. The sub-indexes of strategy transformation, business transformation, and management transformation can be obtained by the weighted sum of the indicators in each dimension. (Xie & Wang, 2023) The weight of the indicators in this study uses the (Xie & Wang, 2023) research weighting.

Data Analysis

In this study, linear regression analysis was used to determine the influence of several independent variables on the dependent variable. Statistical analysis and hypothesis testing in this study will use the Eviews 12 program. The regression model used in this study is as follows:

Equation 1 (Digital Transformation on Fee Based Income)

1. $FIBit = \alpha + \beta 1\, TDit + \varepsilon$

Equation 2 (Digital Transformation and Fee Based Income on Financial Performance)

2. $ROAit = \alpha + \beta 1\, TDit + \beta 2 FBIit + \beta 3 CARit + \varepsilon$

Path Analysis is an extension of multiple linear regression analysis employed to estimate the causal relationships among variables that have been previously established based on theoretical frameworks (Ghozali, 2018). This study used a route analysis model to identify the direct and indirect effects of mediating factors, which is transformed into a structural equation model. The regression equation is expressed as follows:

Direct effect:

1. $FIBit = \alpha + \beta 1\, TDit + \varepsilon$
2. $ROAit = \alpha + \beta 1\, TDit + \beta 2 FBIit + \beta 3 CARit + \varepsilon$

Indirect effect:
$ROAit = \alpha + \beta 1\_TDit * \beta 2\_FBIit + \varepsilon$

Description:
ROAit = Bank Financial Performance (profitability)
α = Constant
β1, β2, β3 = Regression Coefficient
TDit = Digital transformation of banks i in time t
FBIit = Fee based income of banks i in time t CARit
CARit = Capital Adequacy Ratio of banks i in time t
ε = Error Estimation
i = Cross Section identifiers
t = Time series identifier

The selection of models in processing panel data requires statistical testing to consider the selection of the right regression model. This needs to be done in order to obtain more precise and efficient estimates. According to (Gujarati & Porter, 2010), there are three tests that can be performed to select panel data estimation techniques, namely the Chow Test, the Hausman Test and the Lagrange Multiplier (LM) Test.

The classical assumption test is carried out to determine the feasibility of the data to be processed in this study, in order to eliminate any bias values from the data obtained, so that if the data used in this study has passed the classical assumption test, it can be feasible to carry out the estimation process. The classical assumption test has four tests that are carried out to determine the feasibility of the processed data. The classical assumption tests used in this study are: normality test, multicollinearity test, heteroscedasticity test, and autocorrelation test (Ghozali, 2018).

RESULTS AND DISCUSSION

This research focuses on banking businesses listed on the IDX from 2020 to 2023. The research population comprises all Conventional Commercial Banks listed on the IDX. During the study phase, several banks were chosen from the population utilizing the purposive sample approach. Consequently, the sample selection procedures in this investigation may be delineated as follows.

Descriptive Statistics

Descriptive statistical analysis is an analysis that can be used to facilitate understanding of research in interpreting processed raw data. This analysis is carried out by displaying the frequency distribution of data and several basic statistical measures, such as mean, median, minimum, maximum, standard deviation of each variable represented by ROA, Digital Transformation, FBI, and CAR in banking companies listed on the IDX during the period 2020-2023. The results of this descriptive statistical analysis were obtained through data processing using Eviews 12 and can be described in table 3.

Table 2. Sample Observation Criteria

No	Kriteria Sampel	Jumlah
1	Banking sector companies listed on the Indonesia Stock Exchange for the period 2020 - 2023	47
2	Conventional banking sector companies outside of Islamic banks and regional development banks listed on the IDX from 2020 to 2023	(7)
3	Conventional commercial banks that did not publish complete financial reports and annual reports during 2020 - 2023	0
4	Conventional commercial banks that do not have complete data as required by the author during the period 2020 - 2023	0
	Total Sampel	40
	Observation Total (40 x 4 Years)	160
	Outliers	(45)
	Research Observation Total	115

Source: Author's Result Data, 2025

Table 3. Descriptive Statistics Results

	ROA	TRANSFORMASIDIGITAL	FBI	CAR
Mean	0.007759	1.262798	0.067368	0.366968
Median	0.005900	1.284800	0.052370	0.264200
Maximum	0.025600	1.909300	0.187070	2.838800
Minimum	-0.010400	0.670600	0.003780	0.069400
Std. Dev.	0.007232	0.275827	0.055512	0.340508
Skewness	0.467345	-0.029713	0.653170	4.267169
Kurtosis	3.089589	2.394971	2.135807	27.61794
Observations	115	115	115	115

Source: Data processed by researchers with Eviews 12, 2025

Table 4. Chow Test Results Equation 1

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	3.717536	(28,85)	0.0000
Cross-section Chi-square	91.951379	28	0.0000

Source: Data processed by researchers with Eviews 12, 2025

Table 5. Chow Test Results Equation 2

Redundant Fixed Effects Tests
Equation: Untitled
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	2.218586	(28,83)	0.0029
Cross-section Chi-square	64.253174	28	0.0001

Source: Data processed by researchers with Eviews 12, 2025

Panel Data Model Testing

Determining the right model to use in the research needs to be done before proceeding to panel data regression. Panel data models consist of Common Effect Model, Fixed Effect Model, and Random Effect Model. There are three types of tests that can be done to choose the panel data model estimation technique, namely the Chow Test, the Hausman Test, and the Lagrange Multiplier (LM) Test. The results of testing the panel data of the regression equation 1 in this study using the Chow test using the Eviews 12 application can be seen in table 4.

From Table 4 can be seen that the Cross-section Chi-square probability value is 0.0000, which is smaller than the significance level of 0.05. Therefore, the regression results in this study use the Fixed Effect Model. This study will be continued with the Hausman Test.

The results of testing the panel data of the regression equation 2 in this study using the Chow test using the Eviews 12 application can be seen in table 5. From Table 5 can be seen that the Cross-section Chi-square probability value is 0.0001, which is smaller than the significance level of 0.05. Therefore, the regression results in this study use the Fixed Effect Model. This study will be continued with the Hausman Test.

The results of testing on panel data of the regression equation 1 in this study using the Hausman test using the Eviews 12 application can be seen in table 6. From Table 6 can be seen that the probability value of the random Cross-section is 0.2340, which is greater than the significance level of 0.05. Therefore, the regression results in this study use the Random Effect Model. This study will be continued with the Lagrange Multiplier Test.

The results of testing on panel data of the regression equation 2 in this study using the Hausman test using the Eviews 12 application can be seen in table 8. From Table 8 can be seen that the Cross-section probability value is 0.0000, which means it is smaller than the Cross-section significance level of 0.05. Therefore, the most appropriate panel data regression model in this study is Random Effect. It can be concluded that in this study, the Random Effect Model is more optimal.

Table 6. Hausman Test Results Equation 1

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	1.416309	1	0.2340

Table 7. Hausman Test Results Equation 1

Correlated Random Effects - Hausman Test
Equation: Untitled
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	7.281007	3	0.0635

Source: Data processed by researchers with Eviews 12, 2025

Table 8. Lagrange Multiplier Tests Result Equation 1

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	25.61859 (0.0000)	1.278994 (0.2581)	26.89758 (0.0000)

Source: Data processed by researchers with Eviews 12, 2025

Table 9. Lagrange Multiplier Tests Result Equation 2

Lagrange Multiplier Tests for Random Effects
Null hypotheses: No effects
Alternative hypotheses: Two-sided (Breusch-Pagan) and one-sided (all others) alternatives

	Test Hypothesis		
	Cross-section	Time	Both
Breusch-Pagan	5.681248 (0.0171)	2.292921 (0.1300)	7.974169 (0.0047)

Source: Data processed by researchers with Eviews 12, 2025

From Table 9 can be seen that the Cross-section probability value is 0.0000, which means it is smaller than the Cross-section significance level of 0.05. Therefore, the most appropriate panel data regression model in this study is Random Effect. It can be concluded that in this study, the Random Effect Model is more optimal.

The results of testing on panel data of the regression equation 2 in this study using the lagrange test using the Eviews 12 application can be seen in table 9.

From Table 9 can be seen that the Cross-section probability value is 0.0171, which means it is smaller than the Cross-section significance level of 0.05. Therefore, the most appropriate panel data regression model in this study is Random Effect. It can be concluded that in the context of this study, the Random Effect Model is more optimal.

Classical Assumption Test

The classical assumption tests in this study include: Normality test, Multicollinearity test, Autocorrelation test, and Heteroscedasticity test. The results of the normality test on the residual data in equation model 1 are distributed with a probability value of 0.051439> 0.05, so it can be concluded that the residual data in equation 1 is normally distributed. Then the results of the normality test on equation model 2 with a probability value of 0.223287> 0.05, so it can be concluded that the residual data in equation 2 is normally distributed.

The results of the multicollinearity test show that all independent variables in the equation model 1 and equation 2 have coefficients less than 0.8. This indicates that each independent variable in this study is free from multicollinearity problems.

The results of the heteroscedasticity test in equation 1 show that the probability coefficient

for digital transformation has a value of 0.1991, where this value is greater than the significance level of 0.05, so it can be concluded that this study does not experience heteroscedasticity problems. The results of the heteroscedasticity test in equation 2 show that the probability coefficient for each independent variable, namely digital transformation, FBI, and CAR, has a value greater than 0.05, so it can be concluded that this study does not experience heteroscedasticity problems.

Based on the results of the autocorrelation test in equations 1 and 2 in this study, they are not affected by the autocorrelation problem, so the linear regression analysis process can be continued.

Hypothesis Test

The regression model used for both equations 1 is a random effect model. The results of the hypothesis testing presented have met the criteria for normality, multicollinearity, heteroscedasticity, and autocorrelation tests. With the following results

The regression findings in equation I of Table 10 indicate that the digital transformation variable has a probability value of 0.0000, which is less than the significance level of 0.05, and a regression coefficient of 0.079953. This indicates that digital transformation substantially enhances fee-based income. Hypothesis 2 (H2), which posits that digital transformation positively influences fee-based income, is accepted.

H2: Digital transformation has a positive effect on fee-based income.

The regression model used for both equations 2 is a random effect model. The results of the hypothesis testing presented have met the criteria for normality, multicollinearity, heteroscedasticity, and autocorrelation tests.

The regression findings in equation II of table 5 indicate that the digital transformation variable has a probability value of 0.0420, which is less than the significance level of 0.05, and a regression coefficient of 0.007013. This indicates that digital transformation substantially enhances financial performance (ROA). Hypothesis 1 (H1), which posits that digital transformation positively influences financial performance (ROA), is accepted.

H1: Digital transformation has a positive effect on bank financial performance.

The regression findings in equation II of table 5 indicate that the fee-based revenue variable has a probability value of 0.0068, which is less than the significance level of 0.05, and a regression coefficient of 0.026322. This indicates that fee-based income has a substantial beneficial impact on financial performance (ROA). Hypothesis 3 (H3), which posits that fee-based income positively influences bank financial performance, is accepted.

H3: Fee-based income has a positive effect on bank financial performance

Coefficient of Determination

According to Table 10, the coefficient of determination, or *R*-squared, is 0.165773, equivalent to 16.57%. This indicates that 16.57% of the variability in value is affected by the digital transformation variable. This indicates that the independent variables in this study can affect up to 16.57% of the dependent variable, Fee Based Income (FBI). Conversely, the

remaining 83.43% is affected by factors outside the scope of this study.

According to Table 11, the value of the coefficient of determination, or adjusted *R*2, is 0.118622, equivalent to 11.86%. Thus, 11.86% of the variability in value is affected by the factors of digital transformation, fee-based income, and CAR. The independent variables in this study can impact up to 11.86% of the dependent variable, ROA. Conversely, the remaining 88.14% is affected by factors outside the scope of this study.

Path Analysis

The path coefficient is a standardized regression coefficient that is used to find the most appropriate path from an independent variable to a dependent variable.

Table 12 presents the results of the direct path coefficient test, revealing a coefficient value of 0.114616 for the direct influence of the digital transformation variable on ROA, indicating a positive direct relationship between the variables. The coefficient for the direct impact of the digital transformation variable on fee-based income is 0.079953, signifying a positive influence. The coefficient for the direct impact of the fee-based income variable on ROA is 0.000303, indicating a positive direct influence.

Table 10. Hypothesis Test Results for Equation 1

$FBIit = -0.033443 + 0.079953\,TDit + \varepsilon$

Variabel	*Expected Sign*	*Coefficient*	*t-Statistic*	*Prob*
C		-0.033443	-1.819697	0.0715
TD	+	0.079953	5.403119	0.0000
R-squared			0.165773	
Adj. R-squared			0.158391	
F-statistic			22.45479	
Prob(F-Statistic)			0.000006	

Source: Data processed by researchers with Eviews 12, 2025

Table 11. Hypothesis Test Results for Equation 2

$ROAit = -0.003998 + 0.007013\,TDit + 0.026322\,FBIit + 0.003151\,CARit + \varepsilon$

Variabel	*Expected Sign*	*Coefficient*	*t-Statistic*	*Prob*
C		-0.003998	-0.990061	0.3243
TD	+	0.007013	2.057169	0.0420
FBI	+	0.026322	2.760319	0.0068
CAR		0.003151	1.454164	0.1487
R-squared			0.141816	
Adj. R-squared			0.118622	
F-statistic			6.114312	
Prob(F-Statistic)			0.000690	

Source: Data processed by researchers with Eviews 12, 2025

Table 12. Direct Effect Path Results

Model	Path Coefficient (Total Direct Effect)
Regression Model I (Digital Transformation on Fee Based Income)	
Digital Transformation → Fee Based Income	0.079953
Regression Model II (Digital Transformation and Fee Based Income on ROA)	
Digital Transformation → ROA	0,114616
Fee Based Income → ROA	0,000303

(Source: Data processed by researchers with Eviews 12, 2025)

Table 13. Indirect Effect Path Coefficient Results

Regression Model	Path Coefficient (indirect effect)	Total
Digital Transformation → Fee Based Income → ROA	(0.079953) x (0,000303)	0,000024

(Source: Data processed by researchers, 2025)

Table 13 presents the results of the path coefficient test, indicating that the impact of digital transformation on ROA, mediated by fee-based income, is 0.000024. This indicates that the study yields a beneficial outcome.

Sobel Test (Fee Based Income Mediation Test)

The Sobel test was employed in this investigation because to the mediation model's simplicity and lack of complexity. The Sobel test was conducted using the Interactive Mediation Tests website and the following results were obtained:

The results of the analysis using the Sobel test show that digital transformation has a positive and significant influence via fee-based income, as seen by the t-count value of 2.45810845, which exceeds the t-table value of 1.981566757, and a p-value of 0.0139671, which is less than 0.05. The enhancement in digital transformation value substantially positively influences bank financial performance (ROA) via fee-based income. Hypothesis 4 (H4), which posits that Digital Transformation positively influences bank financial performance via fee-based income as an intervening variable, is accepted.

H4: Digital transformation has a positive effect on bank financial performance through fee-based income as an intervening variable.

Table 14. Sobel Test

Model	Coefficient & Std. Error	Test statistic	Std.error	P-value
Transformasi digital - FBI	(a) 0.079953	2.45810845	0,00085616	0,0139671
FBI – ROA	(b) 0.026322			
Transformasi digital - FBI	(Sa) 0.014797			
FBI – ROA	(Sb) 0.009536			

Source: Data processed by researchers with quantpsy, 2025

Discussion of Hypothesis Results

The Impact of Digital Transformation on Bank financial performance

The effect of digital transformation on financial performance (ROA) shows significant positive results, which means that the implementation of digital transformation can increase banking net income. Rapid technological developments encourage the banking sector in Indonesia to carry out digital transformation, especially in business through digital services that create digital banking. Digital transformation is defined as a process that aims to improve business performance by changing business activities through information technology, communication, and connectivity. Digital technology is the main factor that accelerates transformation and improves company performance, which then produces benefits in the form of better business performance. This transformation also strengthens the organization's ability to utilize resources optimally and develop new digital products and services. In accordance with the Resource-Based View Theory, sustainable competitive advantage is obtained through synergistic integration between resources and strategic capabilities. Organizations must adapt digital technology with managerial skills to achieve this advantage, as well as utilize digital transformation to adapt to the environment, save costs, and build flexibility, such as eliminating space and time barriers.

The Impact of Digital Transformation on Fee Based Income

The impact of digital transformation on fee-based income shows significant positive results. This indicates that the implementation of digital transformation can have an impact on increasing fee-based income. Digital transformation allows banks to offer digital services such as non-cash transactions, online payments, and digital investments. This can increase fee-based income through service fees, transaction commissions, and income from new products such as digital wealth management. With banking using information technology in the form of a digitalization system, this can be a strength and advantage for banks in facing the digital era. Especially due to the impact of Covid-19, customers are increasingly switching to digital services such as transactions on mobile banking that customers carry out periodically can increase the potential fee-based income that banks can obtain. There are several factors that can explain this relationship, one of which is the existence of administration fees and transfer fees charged to customers when making transactions through digital services provided by the bank. This is in line with the efficiency theory where according to Liesch & Knight, shows that technological developments have reduced constraints in companies and this theory also states that companies with high market share can use economies of scale and scope to reduce their costs, so that companies can be more profitable. Indirectly, this theory states that digital transformation with the adoption of sophisticated technology can improve operational efficiency and expand the customer base.

The Impact of Fee Based Income on Bank Financial Performance

The effect of fee-based income on financial performance (ROA) shows significant positive results. This indicates that fee-based income can have an impact on increasing

net income. Fee-based income is obtained through banking transaction fees such as transfers to other banks, collections, safe deposit boxes, credit cards and monthly savings user administration fees, ATM card users (Mandiri cash terminals), mobile banking application users and so on. Fee-based income can be a source of company profit because the source of income is not only interest income but also comes from other facilities provided by the bank. In relation to signaling theory, the bank's financial performance functions as a positive signal to the market and other stakeholders regarding the condition and potential of the company. The results of this study can show that fee-based income makes a positive contribution to financial performance, this is a signal that management is able to produce and disclose quality profit information so that this can strengthen and provide a positive signal to the market. Signaling Theory states that companies will use certain signals such as fee-based income and financial performance to communicate important information about their quality and potential to the market. In this context, the results of the study show that fee-based income indicates company growth but also affects market perception of company performance. In addition, good financial performance also supports positive signals by providing reliable and transparent financial information, which in turn strengthens market confidence and increases the assessment of the company.

The Influence of Digital Transformation on Bank Financial Performance through Fee-Based Income as an Intervening Variable

The effect of digital transformation on financial performance through fee-based income as an intervening variable shows significant positive results, which means that companies that implement digital transformation well can improve bank financial performance through fee-based income. Digital transformation allows banks to offer additional services that are efficient and convenient for customers, such as payments, money transfers, and investment management, which generate transaction fees and service fees. These services increase fee-based income which helps improve bank profitability. In addition, digital transformation also includes automation of internal processes, which reduces operational costs and increases efficiency, allowing banks to focus on developing services that focus on fee-based income. The Resource-Based View (RBV) theory explains that digital technology is a strategic asset that strengthens banks' capabilities in creating new services that generate fee-based income. The Signaling Theory perspective also supports this finding, by showing that banks that focus on fee-based income provide signals of income stability and the ability to generate sustainable income, which can improve market perception and attract investors.

CONCLUSIONS, LIMITATIONS, AND SUGGESTIONS

Conclusions

Based on the results of the analysis of the research that has been conducted in the previous chapter, the following conclusions can be obtained from the research results:

1. The digital transformation variable has a significant positive effect on banking financial performance (ROA) for the period 2020-2023. This shows that the higher the value of

digital transformation in a bank, the better the bank's financial performance (ROA).

2. The digital transformation variable has a significant positive effect on fee-based income for the period 2020-2023. This shows that the higher the value of digital transformation in a banking company, the better the bank's financial performance (ROA).
3. The fee-based income variable has a significant positive effect on banking financial performance (ROA) for the period 2020-2023. This shows that the higher the fee-based income obtained by banks, the better the bank's performance (ROA).
4. The digital transformation variable has a significant positive effect on banking financial performance (ROA) mediated by fee-based income for the period 2020-2023. This finding indicates that bank financial performance can increase through fee-based income due to the digital transformation carried out by banks.

Managerial Implications

The results of the analysis of the effect of digital transformation on bank financial performance mediated by fee-based income in banking companies listed on the Indonesia Stock Exchange for the 2020-2023 period show that digital transformation has a significant positive effect on financial performance, especially through fee-based income. Digital transformation helps companies optimize their business and increase revenue by expanding customer reach through digital technology, which creates new services such as digital payments, online investment, and digital loans. This stable fee-based income contributes directly to increasing bank profitability, reducing dependence on interest income which is vulnerable to interest rate fluctuations. To maintain profitability, management needs to ensure that employees have the right skills, encourage innovation in business models, and develop a strong infrastructure. Partnerships with fintech and the use of data analytics can also open up new opportunities for non-interest income. This study shows that by expanding digital services and offering fee-based products that are relevant to customer needs, banks can improve financial performance even in uncertain economic conditions, such as the impact of the COVID-19 pandemic.

Limitations

Based on the research results, this study has several limitations as follows:

1. The independent variable of digital transformation in this study uses 3 dimensions, namely Strategy Transformation, Business Transformation, and Management Transformation. However, in calculating the strategy transformation, this study took keywords from other studies originating from China so that there was a lack of relevance to the conditions in Indonesia.
2. This study only tested limited research objects, namely Conventional Commercial Banks listed on the Indonesia Stock Exchange in 2020-2023.
3. This study only uses financial performance measurements with the current year's Return on Asset (ROA) ratio.

Suggestions for Future Research

For further researchers, it is recommended to involve research objects in various types of financial institutions, such as Islamic banks and non-bank financial industries, especially MSMEs. In further research, it is expected to add other independent variables which are factors that influence bank financial performance that are still related to digitalization, such as digital technology investment, asset quality, and others. Further researchers can use financial performance variables with ROA ratios of t + 1 or t + 2 in order to help investors regarding the long-term performance of banks that are undergoing digital transformation.

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