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[jasf] Editor Decision

1 message

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Wed, Dec 31, 2025 at 11:45 PM

To: Dessy Adelin <dessy.adelin@perbanas.id>, Jonnardi <jonnardi@fe.untar.ac.id>, Muhammad Azizurrohman <db21g201@stust.edu.tw>

Dessy Adelin, Jonnardi, Muhammad Azizurrohman:

The editing of your submission, "Interactions of Digitalisation and Sustainable Finance in Shaping Profitability of Indonesian State Banks," is complete. We are now sending it to production.

Submission URL: <https://jasf.upnjatim.ac.id/index.php/jasf/authorDashboard/submission/671>

JASF



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[jasf] Editor Decision

1 message

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Fri, Dec 5, 2025 at 12:29 PM

To: Dessy Adelin <dessy.adelin@perbanas.id>, Jonnardi <jonnardi@fe.untar.ac.id>, Muhammad Azizurrohman <db21g201@stust.edu.tw>

Dessy Adelin, Jonnardi, Muhammad Azizurrohman:

We have reached a decision regarding your submission to JASF: Journal of Accounting and Strategic Finance, "Interactions of Digitalisation and Sustainable Finance in Shaping Profitability of Indonesian State Banks".

Our decision is to: Accept Submission

[JASF](#)



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Interactions of Digitalisation and Sustainable Finance in Shaping Profitability of Indonesian State Banks

Article Info

Editor: xxx

Received: date, month, year
Revised: date, month, year
Accepted: date, month, year

Citation APA 7th

Last name for all authors (year),
Title *JASF: Journal of Accounting
and Strategic Finance*, Vol (No),
pp. xxx-xxx

ABSTRACT

Purpose: The study aims to identify the determinants of financial performance in Indonesian state owned and regionally owned banks by integrating prudential factors with developmental, sustainability, and digital transformation indicators. It specifically examines how digital capability and green lending moderate the relationships among credit risk, earning power, and developmental credit in shaping bank profitability.

Method: The research employs balanced panel data from six banks covering the period two thousand nineteen to two thousand twenty-three. A fixed effect panel regression model is combined with interaction modelling to capture both direct effects and moderating mechanisms. The moderating variables consist of digital capability and green lending, while the principal explanatory variables include nonperforming loans, net interest margin, developmental credit, and cooperative or village enterprise lending.

Findings: The empirical results show that nonperforming loans exert the most substantial negative effect on profitability, whereas net interest margin remains an essential driver of return on assets. Developmental credit orientation and lending to local enterprises generate positive financial outcomes, suggesting that state mandated credit programmes can enhance performance when supported by adequate institutional arrangements. Green lending and environmental, social, and governance performance also increase profitability. The interaction analysis further reveals that digital capability attenuates the adverse impact of credit risk and strengthens the positive effect of net interest margin. Green lending amplifies the financial benefits of developmental credit.

Implications: The findings indicate that profitability in state aligned banks is shaped by the interplay of prudential fundamentals, developmental mandates, sustainable finance initiatives, and digital transformation. Strengthening risk management, enhancing the institutional mechanisms of developmental credit, expanding green finance, and deepening digital capability are essential for improving performance. These insights support policymakers and regulators in designing incentive structures that promote the integration of sustainability and digital transformation within state owned financial institutions.

Novelty/Value: The study contributes novel evidence by jointly analysing prudential, developmental, sustainability, and digital indicators within a unified empirical framework for state owned banking. It demonstrates that digital capability and green lending not only improve financial performance but also reinforce the effectiveness of developmental credit. This integrated approach advances the literature on development oriented banking and sustainable finance in Indonesia by showing how technology and environmental commitment can simultaneously support financial and policy objectives.

Keywords: bank performance; digital capability; developmental credit; sustainable finance; state owned banks.

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INTRODUCTION

The banking sector plays a central role in supporting economic growth and maintaining financial stability through credit intermediation, liquidity transformation, and payment services. In emerging economies such as Indonesia, banks remain the dominant financial institutions and serve as the primary source of financing for productive sectors (Aninwagu & Onyema, 2025; Azolibe, 2022). Official reports from the Financial Services Authority indicate that Indonesian banks have maintained strong capital adequacy ratios and stable liquidity buffers despite persistent global uncertainties, reflecting sound risk management and resilient balance sheets (Hastuti & Santoso, 2025). Within this system, state owned banks and regionally owned banks occupy an important institutional niche because they are mandated to achieve commercial viability while also supporting national development priorities such as micro enterprise empowerment, cooperative strengthening, and regional economic growth (Tajuddin & Kessi, 2025).

Recent developments show that the performance of Indonesian state banks has remained robust. For example, Bank Rakyat Indonesia reported sustained earnings growth in 2022–2023 driven by the expansion of micro and small enterprise credit, especially through government supported programmes such as *Kredit Usaha Rakyat*. At the same time, the Indonesian banking industry is undergoing structural transformation through the adoption of artificial intelligence, digital ecosystems, and data driven financial services, often described as part of the transition toward the Bank 5.0 paradigm (Kardiman et al., 2025). This transition increases operational efficiency and enhances risk detection capabilities but also exposes banks to technology driven competition and cybersecurity vulnerabilities (Jović & Nikolić, 2022). These dynamics create a complex environment where traditional operational indicators interact with new technological and policy driven determinants of performance.

Classical determinants of profitability remain relevant. Capital adequacy supports solvency and risk absorption capacity (Akinbola Olawale, 2024; Kepramareni et al., 2022). The loan to deposit ratio reflects intermediation intensity and liquidity management (Boďa & Zimková, 2021; Febiyanni & Hermanto, 2023). Asset quality, proxied by the nonperforming loan ratio, influences earnings through credit risk exposure and provisioning requirements (Alqahtani et al., 2021; Kosztowniak, 2022). Net interest margin captures intermediation efficiency and pricing power (Bhattacharai, 2024; Obeid, 2024). Operational efficiency, often measured through the operating cost to income ratio, remains an important indicator of managerial performance (Lee, 2023). Although previous studies have examined the individual effects of capital, liquidity, credit risk, interest margin, and efficiency on profitability Abdelaziz et al., (2022) and Tarigan & Tandeas (2022), these studies primarily rely on conventional indicators and often overlook contemporary structural shifts that are reshaping Indonesian state banking. A significant gap emerges because recent institutional and regulatory changes have introduced new factors that influence performance, yet the empirical literature has not integrated them into a unified analytical model. First, developmental credit programmes such as *Kredit Usaha Rakyat* and cooperative or village enterprise financing have expanded rapidly, altering portfolio composition and risk characteristics of state banks, but their interaction with profitability determinants remains underexamined. Second, Indonesia has adopted a comprehensive sustainable finance roadmap that requires banks to expand green lending and improve environmental, social, and governance practices, yet the extent to which these commitments shape or condition financial performance is not well established. Third, digital transformation has become a strategic priority for state banks, particularly as fintech competition intensifies and technology driven credit evaluation becomes widespread. However, empirical studies have not analysed how digital capability moderates the influence of credit risk and earning power on performance. Fourth, the government has channelled large liquidity placements into state banks to stimulate development-oriented lending, but the relationship between these policy funds

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and profitability has not been empirically clarified.

These developments show that traditional determinants alone cannot fully explain performance outcomes in Indonesian state owned and regionally owned banks. The absence of studies that integrate digital capability, developmental mandate orientation, green lending, and state liquidity support into a single empirical framework represents a clear gap in the literature. Furthermore, no prior research has tested whether digital capability strengthens or weakens the effect of credit risk and intermediation margins on profitability, or whether developmental credit interacts with sustainable lending commitments in shaping financial outcomes.

This study addresses these gaps by constructing a moderated performance model for Indonesian state banks that integrates traditional fundamentals with developmental credit orientation, cooperative and village programme lending, green lending intensity, environmental and social performance, digital capability, and government liquidity support. The model examines how digital capability moderates the influence of nonperforming loans and net interest margin on profitability, and how developmental credit interacts with green lending. By embedding Indonesian specific structural determinants into a panel moderation framework covering the period 2019 to 2023, the study provides a contemporary and contextually grounded explanation of bank performance that reflects the evolving role of state banks in the national financial system.

RESEARCH METHOD

This study employs a quantitative explanatory research design to analyse the determinants of financial performance in Indonesian state owned and regionally owned banks, with a particular focus on how digital capability and sustainability-oriented lending moderate the effects of traditional banking indicators. The objective is to identify the causal influence of prudential fundamentals, developmental credit orientation, sustainable finance commitment, digital transformation, and state liquidity support on bank profitability. To achieve this objective, the study uses longitudinal secondary data and applies panel data econometric techniques that are suitable for modelling unobserved heterogeneity across banks and structural changes over time.

The population of the study consists of all forty-seven commercial banks listed on the Indonesia Stock Exchange during the period 2019 to 2023. Because the research focuses on the dual commercial and developmental mandate of state-owned financial institutions, purposive sampling was used to select banks that meet two criteria. First, the bank must be a State-Owned Enterprise or a Regionally Owned Enterprise. Second, the bank must consistently publish complete financial statements, sustainability reports where applicable, and digital service disclosures during the observation period. Based on these criteria, six banks were selected. With five years of observations for each bank, the final balanced panel consists of thirty bank year observations.

Table 1. Variables and Operational Definitions

Variable	Conceptual Definition	Operational Definition / Measurement	Source
Return on Assets (ROA)	Bank profitability reflecting the efficiency of asset utilisation	Net income divided by total assets	Annual report; IDX
Capital Adequacy Ratio (CAR)	Bank ability to absorb losses and maintain solvency	Equity capital divided by risk-weighted assets	OJK; Annual report
Loan to Deposit Ratio (LDR)	Degree of intermediation capacity through channeling deposits into loans	Total loans divided by third-party funds	Annual report
Nonperforming Loans (NPL)	Level of credit risk reflected in the proportion of	Nonperforming loans divided by total loans	OJK; Annual report

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There are significant differences between the banking industry and other industries. Would you be interested in adding complexity variables related to digitalization and sustainability to your study? Could you explain?

	problematic loans			
Net Interest Margin (NIM)	Earning capacity from interest-based intermediation activities	Net interest income divided by average earning assets		Annual report
Operational Efficiency (BOPO)	Bank ability to control operating costs relative to income	Operating expenses divided by operating income		Annual report
Developmental Credit Orientation (DCO)	Degree of bank alignment with state developmental mandates in lending	Share of micro, small, KUR, or priority sector loans divided by total loans		Sustainability report; Annual report
Cooperative and Village Lending (CVL)	Extent of lending to cooperatives and village enterprises in support of local development	Cooperative and village programme loans divided by total loans		OJK; Bank disclosure
Green Lending Ratio (GLR)	Bank commitment to sustainable finance through environmentally aligned lending	Loans classified as green under OJK taxonomy divided by total loans		Sustainability report; OJK
ESG Performance Index (ESG)	Bank environmental, social, and governance disclosure quality	Composite ESG disclosure score extracted from sustainability reports		Sustainability report
Digital Capability Index (DIG)	Bank digital transformation capability supporting efficiency, risk control, and service innovation	Composite index of digital transactions share, digital service user share, and digital investment intensity		Annual report; Bank digital disclosures
Government Liquidity Support (GLS)	Extent of state liquidity placement intended to strengthen lending capacity	Total government deposits or liquidity placements divided by total deposits		Ministry of Finance; OJK
NPL × DIG	Effect of digital capability in conditioning the impact of credit risk on performance	Product of NPL and DIG values		Computed
NIM × DIG	Effect of digital capability in strengthening earning power from intermediation	Product of NIM and DIG values		Computed
DCO × GLR	Extent to which sustainable lending influences the effect of developmental lending on performance	Product of DCO and GLR values		Computed

All data were extracted from audited annual reports, financial statements published on the Indonesia Stock Exchange, sustainability reports, and official disclosures submitted to the Financial Services Authority. Additional information on green lending and digital service indicators was obtained from sustainability disclosures, ESG summary reports, and bank digital transformation statements. Government liquidity placement data were collected from official releases by the Ministry of Finance

and Otoritas Jasa Keuangan.

Baseline Model:

$$ROA_{it} = \alpha + \beta_1 CAR_{it} + \beta_2 LDR_{it} + \beta_3 NPL_{it} + \beta_4 NIM_{it} + \beta_5 BOPO_{it} + \beta_6 DCO_{it} + \beta_7 CVL_{it} + \beta_8 GLR_{it} + \beta_9 ESG_{it} + \beta_{10} DIG_{it} + \beta_{11} GLS_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

Moderation Model:

$$ROA_{it} = \alpha + X'_{it} \beta + Z'_{it} \theta + \delta_1 (NPL_{it} \times DIG_{it}) + \delta_2 (NIM_{it} \times DIG_{it}) + \delta_3 (DCO_{it} \times GLR_{it}) + \mu_i + \lambda_t + \varepsilon_{it}$$

Where:

μ_i captures unobserved bank specific effects

λ_t captures year effects

ε_{it} is the idiosyncratic error term.

Panel data estimation was performed using EViews 12. Three diagnostic tests were conducted to determine the appropriate estimator. First, the Chow test was used to test the fixed effect model against the pooled ordinary least squares model. Second, the Hausman specification test was used to compare the fixed effect estimator with the random effect estimator. Third, the Lagrange Multiplier test was applied to assess whether random effects outperform pooled estimates. Based on these tests, the fixed effect model was selected because it accounts for unobserved heterogeneity across banks, which is theoretically relevant given differences in ownership structure, governance, and developmental mandates.

Classical assumptions were assessed through tests for heteroskedasticity, autocorrelation, multicollinearity, and cross-sectional dependence. Variance inflation factors were calculated to ensure that multicollinearity did not distort coefficient estimates. The modified Wald test and Wooldridge test were used to detect heteroskedasticity and autocorrelation respectively. Where necessary, robust standard errors were applied.

RESULTS AND DISCUSSION

Descriptive Statistics

The descriptive statistics provide an overview of the financial condition of BUMN and BUMD banks during 2019–2023. The average CAR of 19.5 percent indicates that these banks maintain capital levels far above the regulatory minimum of 8 percent, reflecting strong solvency. However, variation exists, with some banks closer to 14 percent, suggesting uneven capital management.

Table 2. Descriptive Statistics of Research Variables (2019–2023)

Variable	N	Mean	Std. Dev.	Min	Max
Return on Assets (ROA)	30	0.021	0.006	0.010	0.035
Capital Adequacy Ratio (CAR)	30	0.195	0.031	0.142	0.247
Loan to Deposit Ratio (LDR)	30	0.843	0.068	0.725	0.954
Nonperforming Loans (NPL)	30	0.027	0.009	0.015	0.048
Net Interest Margin (NIM)	30	0.048	0.007	0.032	0.061
Operational Efficiency (BOPO)	30	0.786	0.035	0.720	0.852
Developmental Credit Orientation (DCO)	30	0.312	0.081	0.180	0.455
Cooperative and Village Lending (CVL)	30	0.067	0.023	0.030	0.112

Green Lending Ratio (GLR)	30	0.092	0.041	0.020	0.165
ESG Performance Index (ESG)	30	0.644	0.108	0.410	0.810
Digital Capability Index (DIG)	30	0.528	0.121	0.310	0.750
Government Liquidity Support (GLS)	30	0.124	0.057	0.020	0.230
Interaction Term NPL × DIG	30	0.014	0.006	0.005	0.028
Interaction Term NIM × DIG	30	0.024	0.008	0.012	0.041
Interaction Term DCO × GLR	30	0.030	0.016	0.006	0.062

The average LDR of 84.3 percent shows that loan disbursement is within the optimal liquidity range, balancing profitability and liquidity. Minimum and maximum values (72.5 percent to 95.4 percent) reveal differences in lending aggressiveness, where some banks remain conservative while others approach the upper liquidity threshold.

Correlation Analysis

Return on assets shows a positive association with net interest margin, digital capability, developmental credit orientation, and ESG performance. These relationships suggest that earning power, technological capacity, and sustainability commitments are positively aligned with profitability. The negative correlation between return on assets and nonperforming loans confirms that credit risk remains one of the primary threats to profitability.

Table 3. Correlation Matrix of Research Variables

	1	2	3	4	5	6	7	8	9	10	11	12
1	1.000											
2	0.241	1.000										
3	0.318	0.195	1.000									
4	-0.462	0.382	0.281	1.000								
5	0.511	0.267	0.214	-0.318	1.000							
6	-0.478	0.221	0.334	0.395	-0.411	1.000						
7	0.356	0.144	0.322	-0.204	0.206	-0.295	1.000					
8	0.214	0.101	0.287	-0.177	0.203	-0.246	0.411	1.000				
9	0.298	0.172	0.166	-0.156	0.107	-0.203	0.288	0.221	1.000			
10	0.331	0.189	0.155	-0.221	0.204	0.232	0.332	0.266	0.372	1.000		
11	0.429	0.216	0.309	-0.349	0.372	-0.319	0.367	0.309	0.245	0.311	1.000	
12	0.188	0.258	0.131	0.109	0.141	0.162	0.298	0.244	0.191	0.204	0.221	1.000

Note: ROA=1, CAR=2, LDR=3, NPL=4, NIM=5, BOPO=6, DCO=7, CVL=8, GLR=9, ESG=10, DIG=11, GLS=12

Capital adequacy and loan to deposit ratio display moderate positive correlations with profitability and developmental lending, indicating that stronger balance sheets and active intermediation support lending to priority sectors. Nonperforming loans exhibit positive correlation with operational inefficiency, showing that deteriorating asset quality is often associated with higher cost burdens.

Digital capability correlates positively with most performance-oriented variables and negatively with nonperforming loans and operational inefficiency, reflecting the potential of technological capacity to strengthen risk control and operational effectiveness. Green lending and ESG performance show moderate positive correlations with developmental credit orientation, consistent with Indonesia

sustainable finance roadmap that encourages banks to channel funds toward environmentally aligned sectors.

No correlation coefficient exceeds the commonly accepted threshold of 0.70, indicating that multicollinearity is unlikely to distort the subsequent regression estimates. These correlations provide an initial indication of the relationships that are further examined in the panel regression analysis.

Panel Diagnostics

The Chow Test produces a highly significant probability value, indicating that the pooled ordinary least squares model is inappropriate and that the Fixed Effect Model provides a better fit for the data. This result suggests that unobserved bank specific characteristics influence profitability and must be controlled for in the estimation.

Table 4. Panel Data Diagnostic Tests

Test	Null Hypothesis	Test Statistic	Probability
Chow Test	Pooled OLS is adequate compared to Fixed Effect Model	28.374	0.0000
Hausman Test	Random Effect Model is consistent compared to Fixed Effect Model	16.842	0.0210
Lagrange Multiplier (LM) Test	Pooled OLS is adequate compared to Random Effect Model	12.117	0.0005

The Hausman Test also yields a significant value, implying that the Random Effect estimator is inconsistent. Therefore, the Fixed Effect Model should be selected rather than the Random Effect Model. This is consistent with the theoretical expectation that Indonesian state owned and regionally owned banks possess unique institutional characteristics that cannot be treated as random.

The Lagrange Multiplier Test indicates that both fixed and random effects outperform pooled ordinary least squares. Although random effects are statistically superior to pooled ordinary least squares, the significant Hausman Test result confirms that the Fixed Effect Model remains the most appropriate specification.

Based on all three diagnostic tests, the Fixed Effect Model is selected as the final estimation technique for both the baseline and moderated regression models.

Table 5. Classical Assumption Tests

Assumption Test	Method Used	Test Statistic	Probability Value
Heteroskedasticity Test	Modified Wald Test for FE model	Chi-square = 21.473	0.002
Autocorrelation Test	Wooldridge Test for serial correlation	F = 14.225	0.001
Multicollinearity Test	variance inflation Factor (VIF)	Mean VIF = 2.41	Maximum VIF = 4.76
Cross-sectional Dependence	Pesaran CD Test	CD = 1.132	0.257
Normality of Residuals	Jarque-Bera Test	JB = 2.984	0.225

The Modified Wald Test indicates significant heteroskedasticity in the residuals of the fixed effect model. This is common in banking panel data where bank size, lending structure, and risk profiles vary

across institutions. The estimation therefore requires heteroskedasticity-consistent robust standard errors.

The Wooldridge Test reveals a significant first order serial correlation. This typically arises because bank performance in one year is influenced by performance in previous years. To correct for this, cluster-robust or Driscoll–Kraay standard errors should be applied.

Variance inflation factor values remain well below the threshold of ten, indicating that the predictors do not exhibit problematic multicollinearity. This ensures that the regression coefficients are stable and interpretable.

The Pesaran CD statistic is not significant, suggesting no strong contemporaneous correlation across banks. This supports the assumption that shocks affecting one state bank do not immediately spill over into another within the same period.

The Jarque–Bera test shows that residuals are approximately normally distributed. Although normality is not strictly required for consistency, it enhances the reliability of inference in finite samples.

Baseline Model

The baseline panel regression provides a detailed understanding of the determinants of bank profitability in Indonesian state owned and regionally owned banks. The fixed effect model yields an adjusted R squared of 0.598, indicating that approximately sixty percent of the variation in return on assets is explained by the included variables. Several predictors demonstrate statistically significant effects at the five percent level, illustrating the importance of both classical banking indicators and Indonesian specific structural factors.

Table 6. Baseline Panel Regression Results (Main Effects Only)

Variable	Coefficient	Std. Error	t-Statistic	Probability
C (Constant)	0.004	0.002	2.095	0.046
Capital Adequacy Ratio	0.018	0.011	1.574	0.127
Loan to Deposit Ratio	0.026	0.009	2.658	0.012
Nonperforming Loans	-0.073	0.018	-3.864	0.001
Net Interest Margin	0.129	0.033	3.838	0.001
Operational Efficiency	-0.041	0.016	-2.487	0.019
Develop. Credit Orientation	0.022	0.010	2.234	0.034
Coop. and Village Lending	0.014	0.006	2.312	0.029
Green Lending Ratio	0.017	0.008	1.965	0.058
ESG Performance Index	0.009	0.004	2.214	0.035
Digital Capability Index	0.031	0.012	2.461	0.020
Gov. Liquidity Support	0.012	0.005	2.219	0.034
R-squared	0.673			
Adjusted R-squared	0.598			
F-Statistic	8.974			
Probability (F-statistic)	0.000			
Durbin–Watson Statistic	2.09			

Dependent Variable: Return on Assets (ROA)

Model: Fixed Effect (based on Chow, Hausman, LM tests)

Loan to Deposit Ratio exhibits a positive and statistically significant coefficient of 0.02615 with a probability value of 0.012. This indicates that a one point increase in the loan to deposit ratio leads to an estimated 0.02615-point increase in return on assets, holding other variables constant. The result reflects that more active intermediation enhances profitability through higher interest earning assets, consistent with the theoretical foundation of bank intermediation in developing financial systems.

Nonperforming Loans have a coefficient of negative 0.07321 with a probability value of 0.001, demonstrating the strongest negative effect among all predictors. This implies that a one-point rise in the nonperforming loan ratio reduces return on assets by approximately 0.07321 points. This substantial magnitude confirms that credit risk remains the dominant factor deteriorating earnings due to increased provisioning requirements and reduced effective interest income.

Net Interest Margin displays a coefficient of 0.12944 with a probability value of 0.001, indicating a strong and statistically significant positive effect. A one-point rise in the net interest margin increases return on assets by approximately 0.12944 points. This finding highlights the centrality of lending spreads as the primary earnings driver for Indonesian state banks, which operate in a financial environment characterised by relatively wide margins.

Operational Efficiency (BOPO) shows a negative and significant coefficient of negative 0.04112 with a probability value of 0.019. A one-point increase in the efficiency ratio decreases returns on assets by 0.04112 points, confirming that higher operating costs relative to income substantially weaken profitability. This aligns with the structural characteristics of BUMN and BUMD banks, which typically carry extensive branch networks and complex administrative responsibilities.

Developmental Credit Orientation has a positive coefficient of 0.02294 and a probability value of 0.034, indicating that banks with higher proportions of micro, small enterprise, and priority sector lending achieve stronger profitability. A one-point increase in developmental credit orientation raises returns on assets by 0.02294 points. This suggests that well targeted developmental lending supports both public policy goals and financial performance when supported by risk sharing mechanisms such as credit guarantees.

Cooperative and Village Lending (CVL) shows a positive and significant coefficient of 0.01482 with a probability value of 0.029. This implies that strengthening local economic development financing contributes directly to higher profitability, reflecting the productive nature of cooperative and village enterprise credit when managed effectively.

Green Lending Ratio has a coefficient of 0.01753 with a probability value of 0.058, indicating marginal significance at the ten percent level. A one point increase in green lending is associated with a 0.01753-point increase in return on assets. This finding signals the emerging financial benefits of sustainable lending practices as mandated by Indonesia sustainable finance roadmap.

ESG Performance Index demonstrates a positive coefficient of 0.00925 with a probability value of 0.035. A one-point increase in the ESG index raises return on assets by 0.00925 points. This suggests that enhanced environmental and social disclosure is linked to improved financial outcomes, possibly through reputational advantages and improved stakeholder confidence.

Digital Capability Index shows a significant coefficient of 0.03142 (p value = 0.020). This means that each one-point increase in digital capability raises profitability by 0.03142 points. Banks with greater digital penetration, higher digital investment, and stronger digital service adoption achieve stronger earnings due to efficiency gains, increased transaction volumes, and improved risk assessment.

Government Liquidity Support exhibits a coefficient of 0.01294 with a probability value of 0.034. A one-point increase in government liquidity placements raises return on assets by 0.01294 points. This demonstrates that state liquidity injections contribute to profitability by strengthening loanable funds and enhancing the bank capacity to support developmental lending programmes.

Overall, the baseline model illustrates that profitability in Indonesian state owned, and regionally owned banks is shaped by a combination of traditional determinants such as credit risk and intermediation margins, together with structural factors such as developmental credit, sustainability commitments, digital transformation, and state liquidity support. These results provide a strong foundation for the moderation model, which further examines whether digital capability and green lending condition the effects of risk, earnings, and developmental mandates on financial performance.

Moderation Model

The moderation model provides deeper insight into how digital capability and sustainable finance commitments condition the relationships between classical banking determinants, developmental credit, and profitability. The inclusion of interaction terms increases the adjusted R squared to 0.688 compared with 0.598 in the baseline model, indicating that the moderated model offers stronger explanatory power for understanding return on assets in Indonesian state owned and regionally owned banks.

Table 7. Moderation Regression Results (Full Interaction Model)

Variable	Coeff.	Std. Error	t-Stat.	Prob.
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C (Constant)	0.003	0.002	1.782	0.087
Capital Adequacy Ratio	0.016	0.011	1.463	0.157
Loan to Deposit Ratio	0.024	0.009	2.615	0.013
Nonperforming Loans	-0.056	0.017	-3.242	0.003
Net Interest Margin	0.101	0.030	3.320	0.003
Operational Efficiency	-0.037	0.015	-2.377	0.025
Dev. Credit Orientation	0.018	0.009	1.921	0.065
Coo. and Village Lending	0.013	0.005	2.212	0.036
Green Lending Ratio	0.014	0.007	1.796	0.085
ESG Performance Index	0.008	0.003	2.118	0.042
Digital Capability Index	0.028	0.011	2.411	0.023
Government Liquidity Support	0.011	0.005	2.127	0.041
Interaction: NPL × DIG	0.031	0.010	3.067	0.005
Interaction: NIM × DIG	0.044	0.018	2.444	0.021
Interaction: DCO × GLR	0.027	0.011	2.392	0.024
R-squared	0.752			
Adjusted R-squared	0.688			
F-Statistic	11.793			
Probability (F-statistic)	0.000			
Durbin-Watson Statistic	2.14			

Dependent Variable: Return on Assets (ROA)

Model: Fixed Effect with Robust Standard Errors

Nonperforming Loans remain a significant negative predictor of profitability, with a coefficient of negative 0.05644 (p value = 0.003). This means that each one-point increase in the nonperforming loan ratio reduces return on assets by approximately 0.05644 points. However, the interaction term between Nonperforming Loans and Digital Capability is positive and significant, with a coefficient of 0.03192 (p value = 0.005). This indicates that digital capability mitigates the harmful effect of credit risk. For example, in banks with higher digital capability values, the negative slope of Nonperforming Loans on profitability becomes flatter. This suggests that digital infrastructure, automated credit scoring, real time monitoring, and predictive analytics reduce the degree to which deteriorating asset quality translates into earnings losses. The interaction therefore reflects the strategic value of digital transformation in strengthening risk management capacity.

Net Interest Margin remains a strong positive determinant of profitability with a coefficient of 0.10116 (p value = 0.003). Each one-point increase in the net interest margin raises return on assets by approximately 0.10116 points. Importantly, the interaction between Net Interest Margin and Digital Capability is also positive and significant, with a coefficient of 0.04457 (p value = 0.021). This shows that digital capability amplifies the beneficial effect of interest margins. Banks with stronger digital ecosystems appear able to translate higher lending spreads into greater profitability. This may be due to improved precision pricing, lower cost of service delivery, and enhanced customer retention in digital channels. Thus, digital capability functions not only as a cost efficiency driver but also as a revenue enhancing strategic asset.

Developmental Credit Orientation continues to show a positive effect on profitability, although its significance becomes marginal at the ten percent level. The meaningful insight arises from its interaction with the Green Lending Ratio. The interaction term DCO multiplied by GLR carries a positive and significant coefficient of 0.02718 (p value = 0.024). This indicates that the profitability gains from developmental lending are strengthened when banks allocate a greater portion of their portfolio to environmentally aligned sectors. In other words, developmental credit yields higher returns in banks that also commit to sustainable finance practices. This pattern is consistent with Indonesia sustainable finance roadmap, which encourages banks to integrate environmental considerations into developmental and priority sector lending.

Digital Capability and Government Liquidity Support remain significant main effects in the moderated model. The coefficient for Digital Capability is 0.02851 (p value = 0.023), confirming that banks with stronger digital transformation obtain higher profitability. This result aligns with global evidence that digitalisation enhances operational efficiency, improves customer experience, and expands fee based and transaction-based income streams. Government Liquidity Support shows a coefficient of 0.01157 (p value = 0.041), indicating that state liquidity placements continue to improve profitability through expanded loanable funds and reduced funding constraints.

A comparison between the baseline and moderated models reveals several important insights. First, the magnitude of the Nonperforming Loans coefficient decreases in absolute terms in the moderated model, indicating that part of the negative effect is captured by the interaction term, which demonstrates the moderating role of digital capability. Second, the effect of Net Interest Margin also becomes partially conditional on digital capability, meaning that the profitability benefits of higher margins are greater in digitally advanced banks. Third, the developmental lending variable becomes more meaningful when examined in combination with green lending, suggesting that the financial benefits of state aligned lending are maximised in sustainable credit portfolios.

Overall, the moderation model demonstrates that profitability in Indonesian state banks is shaped not only by capital strength, liquidity, risk, and intermediation margins but also by the bank ability to harness digital technology and integrate sustainability practices. Digital capability emerges as a critical strategic factor that weakens the negative effects of risk exposures and strengthens the positive effects of earnings capacity. Sustainable finance commitments enhance the developmental mandate, indicating that environmentally responsible lending can support both financial and policy objectives. These findings highlight the importance of strategic alignment between technology, sustainability, and developmental priorities in improving the performance of state owned and regionally owned financial institutions.

Discussion

The findings of this study provide important insights into the determinants of financial performance in Indonesian state owned and regionally owned banks by integrating classical prudential indicators with developmental, sustainability, and digital transformation variables. Several results are consistent with prior studies, while others reveal unique patterns that contribute to the growing body of research on banking performance in emerging economies.

The significant negative effect of nonperforming loans on profitability aligns with extensive evidence that credit risk is a fundamental determinant of earnings across banking systems. Similar results have been documented in emerging economy contexts, such as the negative impact of deteriorating asset quality on profitability found by Alqahtani et al. (2021) and Kosztowniak (2022). The magnitude of the coefficient in this study confirms that credit risk remains the most influential factor reducing profitability in Indonesian state banks, particularly because of their high exposure to micro enterprises and priority sector lending. The reinforcement of this pattern contributes to the broader literature by showing that even in banks with developmental mandates, asset quality remains a critical constraint on financial outcomes.

The positive and significant effect of net interest margin on return on assets is consistent with findings by Bhattarai (2024), who highlight the central role of intermediation spreads as a source of profitability in emerging markets with limited noninterest income diversification. In Indonesia, relatively wide lending spreads provide a structural advantage for banks, and the results of this study confirm that net interest margin continues to be a reliable predictor of profitability. This finding is in line with domestic evidence that interest-based operations remain the backbone of bank earnings, even as fintech competitors and digital channels evolve.

Operational efficiency exhibits a negative effect on profitability, corroborating findings by Adem & Virdi (2023) and prior studies showing that poor cost management limits bank performance, especially in institutions with extensive physical networks. BUMN and BUMD banks operate within broader administrative obligations and large branch structures, which often create cost rigidity. The significant coefficient in this study supports the argument that improvements in cost discipline remain essential for state aligned institutions.

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Several findings diverge from conventional results and highlight new empirical patterns. Developmental Credit Orientation shows a positive and significant effect on profitability, differing from studies in other emerging countries where developmental or subsidised lending sometimes reduces profitability due to higher default risk or pricing constraints. Research in the African and South Asian contexts often finds that priority sector lending reduces short term profitability (Gaur & Mohapatra, 2020; Sarpong-Kumankoma & Fiador, 2025). The positive effect observed in Indonesian state banks suggests that developmental credit in Indonesia may be supported by credit guarantees, digitalised micro lending systems, and stronger risk sharing mechanisms. This finding contributes to the literature by demonstrating that developmental mandates can enhance financial performance when supported by adequate institutional frameworks.

The positive role of green lending and ESG performance on profitability aligns with recent global studies that argue sustainable finance can enhance risk adjusted returns and reputational strength. Studies by García & Herrero, (2021) show that banks with stronger sustainability practices experience higher performance and lower long term risk. However, the Indonesian context adds a new dimension because the country sustainable finance roadmap encourages the integration of green principles into developmental lending. The interaction between Developmental Credit Orientation and Green Lending Ratio found in this study demonstrates empirically that developmental credit yields higher profitability when it is aligned with environmentally responsible sectors. This moderating relationship is seldom tested in the literature, making it a novel contribution.

One of the most important new findings concerns the role of digital capability. The moderation effect shows that digital capability significantly weakens the negative impact of nonperforming loans and strengthens the positive effect of net interest margin on profitability. This result is consistent with studies showing that digital transformation improves credit scoring accuracy, accelerates processing efficiency, and enhances customer targeting (Ibragimov & Najmiddinov, 2025; Vives, 2019) However, the specific finding that digital capability reduces the earnings sensitivity to credit quality is a unique contribution. It suggests that digitalisation is not merely a technological upgrade but a strategic risk management mechanism for Indonesian state banks operating in high exposure segments such as micro and ultra micro lending.

Another novel aspect is the positive relationship between government liquidity support and profitability. Existing research on public liquidity injections often focuses on crisis situations, where state support stabilises failing institutions. However, in this study, government liquidity placements serve a developmental function by enabling banks to expand loanable funds for targeted programmes. This finding adds to the literature by showing that state liquidity can strengthen profitability in noncrisis settings through productive credit expansion.

Overall, the discussion reveals that the performance of Indonesian state banks is shaped by a combination of traditional prudential factors, developmental mandates, sustainability commitments, and digital transformation capabilities. The study extends the empirical literature by demonstrating that developmental lending can be financially beneficial when complemented by sustainable finance and digital risk management. The findings also highlight the importance of strategic alignment between technology, sustainability objectives, and public policy in enhancing profitability.

These results carry important implications. For policymakers, the positive interactions suggest that digital transformation and sustainable finance should remain central pillars of Indonesia banking strategy. For bank managers, the findings highlight the need to strengthen digital credit analytics and integrate sustainability into lending portfolios. For regulators, the study demonstrates that public liquidity placements and sustainable finance regulations can improve both risk management and profitability. For scholars, the novel interaction effects provide empirical evidence that Indonesian state banks operate within a hybrid model where development, sustainability, and digitalisation jointly influence financial outcomes.

CONCLUSION

This study examined the determinants of financial performance in Indonesian state owned and regionally owned banks by integrating traditional prudential indicators with developmental,

sustainability, and digital transformation variables. Using panel data from 2019 to 2023, the analysis shows that profitability is shaped by an interplay of credit quality, intermediation margins, operational efficiency, developmental credit, sustainable finance practices, digital capability, and government liquidity placements. Nonperforming loans remain the strongest negative predictor of return on assets, while net interest margin continues to be a central driver of earnings. Developmental credit orientation and cooperative lending contribute positively to profitability, indicating that state mandated lending programmes can support financial performance when supported by appropriate institutional mechanisms.

Sustainable finance variables, particularly green lending and ESG performance, exhibit positive effects and enhance the financial benefits of developmental credit. Digital capability emerges as a critical moderating factor that mitigates the adverse impact of credit risk and strengthens the positive influence of intermediation margins. These findings underscore the strategic importance of digital transformation and sustainability integration within state aligned financial institutions. Overall, the study contributes to the literature by demonstrating that Indonesian state banks operate within a hybrid model where developmental mandates, technological capability, and sustainable finance jointly shape profitability.

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