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Leveraging intellectual capital and MSME credit to drive rural bank performance: Insights from Jambi Province, Indonesia

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ABSTRACT

This study explores the impact of Intellectual Capital and MSME (Micro, Small, and Medium Enterprises) credit on the performance of rural banks in Jambi Province, Indonesia, with a focus on their role in promoting business growth. Using panel data regression analysis, the study applies three models—Pooled Least Squares (PLS), Common Effect Model (CEM), and Random Effect Model (REM)—to analyze data from rural banks. The results show that both Intellectual Capital and MSME credit significantly affect bank performance, both individually and together. Intellectual Capital contributes by enhancing employee skills and professionalism, while MSME credit supports business development. The study is limited to rural banks in Jambi, which may affect the generalizability of the findings, and the use of cross-sectional data limits causal conclusions. Future research should expand the geographic scope and use longitudinal data to observe long-term trends. The findings suggest that investing in human capital and managing MSME credit strategically can strengthen rural bank performance. This research contributes new insights into how Intellectual Capital and MSME credit influence rural banking, offering practical implications for bank managers and policymakers aiming to improve financial inclusion and regional economic growth.

1. Introduction

Banks, as financial institutions, play a fundamental role in the economy by collecting deposits from the public and redistributing them to third parties, thereby providing payment liquidity services. This core function of banks as aggregators and distributors of public funds is critical for supporting national development, promoting equitable growth, and enhancing economic stability, all of which contribute to an improved standard of living (Levine, 2014; WBG, 2021). The Indonesian banking sector is, therefore, vital for enabling economic indicators to improve and thrive, as the economy cannot grow sustainably without the support of financial institutions (Beck et al., 2000).

This is particularly true for rural banks, which must actively capture market share to remain competitive against both bank and non-bank financial institutions. In the face of rapid global economic shifts and technological advancements, rural banks must innovate continually to stay relevant. Developing strong, healthy, and competitive institutions capable of serving the community, especially Micro, Small, and Medium Enterprises (MSMEs), is essential for their survival. However, the challenges faced by rural banks are mounting, with intensifying competition from commercial banks and government programs like the People's Business Credit (KUR), which offers low-interest loans to MSMEs through commercial banks. This policy has increased the difficulty for rural banks to grow, as commercial banks are mandated to allocate at least 20% of their total credit to MSMEs, effectively pushing them into this market space.

Besides competition, the large number of rural banks in Indonesia, 1,441 as of 2022, has created an overcrowded market, particularly in the micro-lending sector. To survive in this environment, rural banks need to strengthen their professional capabilities, especially by developing Intellectual Capital. Stewart (1997) defines Intellectual Capital as intellectual resources that are formalized, captured,

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and used to create higher-value assets. It includes knowledge-based assets such as stakeholder relationships and human resources, which can provide strong competitive advantages (Rong et al., 2025). Intellectual Capital has been recognized as a key driver of organizational competitiveness in the 21st century (Edvinsson and Malone, 1997), and it may serve as a foundation for stabilizing rural banks in the face of their current decline.

OJK data show that the number of rural banks has steadily decreased from 2018 to 2022. This trend emphasizes the urgent need for rural banks to enhance their competitiveness and adopt strategic measures to remain viable within the financial system. Table 1 reports the annual number of rural banks in Indonesia and their growth rates, revealing a consistent decline that raises concerns about the sector's long-term sustainability.

Table 1: Development of the number of rural banks (growth of total rural banks)

Indicator	2018	2019	2020	2021	2022
Number of rural banks	1.597	1.545	1.506	1.468	1.441
Progress (%)	-	-3.26	-2.52	-2.52	-1.84

The data in Table 1 highlight a consistent national decline in the number of rural banks, with a downward trend in their total count from 2018 to 2022. In 2018, there were 1,597 rural banks, which dropped to 1,545 in 2019, reflecting a decrease of 3.26%. This decline continued into subsequent years: 1,506 banks in 2020 (a 2.52% decrease), 1,468 in 2021 (another 2.52% decrease), and finally 1,441 in 2022 (a 1.84% decrease). This pattern indicates a persistent contraction in the rural banking sector, marked by closures and bankruptcies that raise significant concerns about the sustainability of rural banks. Despite these institutions' role in supporting MSMEs, their numbers continue to dwindle, sparking questions about the underlying challenges these banks face. In contrast, rural banks in Jambi Province present an intriguing anomaly. Although only 18 rural banks are spread across various cities and regencies in Jambi, several key performance indicators—such as Total Assets and Third-Party Funds—show a positive trajectory, countering the national decline in rural bank numbers. This suggests that while the national rural banking sector faces systemic challenges, rural banks in Jambi are achieving performance gains, pointing to potentially unique factors in this region that warrant closer examination.

The indicators in Table 2 provide a detailed overview of the performance achievements of rural banks in Jambi Province, highlighting a phenomenon that may offer insights for improving the resilience and sustainability of rural banks nationally.

Table 2: Rural bank performance achievement indicators in Jambi province (billion IDR)

Indicator	2018	2019	2020	2021	2022
Total assets	909	1047	1091	1197	1261
Progress (%)	-	15.18	4.20	9.72	5.35
Third party funds	654	766	788	875	894
Progress (%)	-	17.13	2.87	11.04	2.17

The data in Table 2 reveal a steady growth in total assets for rural banks in Jambi Province from 2018 to 2022, indicating a resilient performance despite external challenges. In 2018, total assets stood at Rp. 909 billion, which rose to Rp. 1,047 billion in 2019, a significant 15.18% increase. This growth trajectory continued into 2020, with total assets reaching Rp. 1,091 billion, an additional 4.20% rise, even amidst the economic uncertainties of the COVID-19 pandemic. The upward trend persisted in 2021, with assets totaling Rp. 1,197 billion, marking a 9.72% increase, and in 2022, assets further expanded to Rp. 1,261 billion, reflecting a 5.35% rise.

This asset growth aligns with an increase in third-party funds (DPK), which also showed steady growth over this period. In 2018, DPK totaled Rp. 654 billion, which rose by 17.13% to Rp. 766 billion in 2019. This upward trend continued in 2020, with DPK reaching Rp. 788 billion, a 2.87% increase, followed by another rise to Rp. 875 billion in 2021 (11.04%) and Rp. 894 billion in 2022, marking an additional 2.17% increase.

This pattern is particularly noteworthy as it presents a contrasting phenomenon: while the number of rural banks nationally continues to decline, rural banks in Jambi Province show robust growth in key performance indicators like total assets and DPK. This discrepancy raises compelling questions about the unique conditions or strategies in Jambi Province that may be driving these positive outcomes.

This study explores the factors that affect rural bank performance in Jambi, with a focus on Intellectual Capital and MSME credit. It aims to analyze how these elements support business sustainability and strengthen competitive advantage. By examining their influence, the research provides insights into the role of knowledge resources and lending practices in shaping rural banks' long-term growth and resilience.

2. Literature review

2.1. Rural bank business

Generally, businesses produce goods and services for profit. For banks, profit orientation is essential for sustaining operations, making profitability a key factor in their long-term viability. Similarly, rural banks must operate effectively and efficiently to

achieve their primary goal of maximizing profits. To support business growth, rural banks need strategic policies encompassing their vision, mission, governance, risk management, competitive positioning based on assets or geographic location, and lending strategies tailored to micro, small, and medium enterprises (MSMEs). These strategies align with the guidelines specified in the Financial Services Authority's Circular Letter No. 52/SEOJK.03/2016 on the Business Plans of Rural Banks.

The effectiveness of rural bank operations is frequently assessed through the CAMEL framework, which evaluates Capital, Assets, Management, Earnings, and Liquidity. This analysis is crucial for gauging efficiency, where efficiency can generally be understood as the ratio or comparison of input to output, representing the bank's capability to convert resources into profitable outcomes. Assessing a bank's health involves evaluating financial statement conditions based on standards set by regulatory authorities (Wali et al., 2023). For rural banks in Indonesia, these standards are defined in Financial Services Authority Regulation No. 3/POJK.03/2022 on the Health Level of Rural Banks and Sharia Financing Banks, ensuring that rural banks maintain financial stability and meet regulatory benchmarks.

Given the intensified competition within the banking sector, effective strategies and rigorous health assessments are even more critical. Recent studies highlight that rural banks' success increasingly depends on adapting to dynamic regulatory environments and technological advances, which are integral to sustaining competitiveness in a rapidly evolving market (WBG, 2022). This suggests that strategic adaptation and regulatory compliance are indispensable for the long-term sustainability of rural banks.

2.2. Intellectual capital

Intellectual capital (IC) is a crucial intangible asset in the modern era of information and knowledge-driven economies. Stewart (1997) defined Intellectual Capital as the sum of a company's intangible assets that enable it to compete effectively in the market, encompassing intellectual material, knowledge, experience, and intellectual property that contribute to value creation. Nahapiet and Ghoshal (1998) expanded on this by describing IC as the knowledge and capabilities possessed by a social collectivity—such as an organization or intellectual community—that can be leveraged to create value through collective expertise. Intellectual Capital thus represents a strategic resource, with the potential to enhance a company's market position and operational effectiveness.

Intellectual Capital can be conceptualized as the combined intangible assets of a company, including intellectual property, human resources, and infrastructure that together enable the organization to function and innovate (Martins and Lopes, 2024). This view aligns with the notion that Intellectual Capital encompasses a spectrum of intangible assets that drive a company's competitive edge. According to Stewart (1997), IC can be divided into three core components: Human Capital, Structural Capital, and Customer Capital. Human Capital refers to the skills, knowledge, and competencies of employees, while Structural Capital represents the systems, processes, databases, and intellectual property that support the company's operations. Customer Capital, meanwhile, reflects the value derived from customer relationships and loyalty.

Pulic (2000) introduced the Value-Added Intellectual Coefficient (VAICTM) model, which quantifies the value-creation capacity of IC by examining three types of added value: Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Capital Employed Efficiency (CEE). The VAICTM model has since become widely used to measure a firm's intellectual capital performance and its ability to generate value.

Recent studies affirm that IC contributes significantly to organizational success, particularly in knowledge-intensive industries. Bontis (1998) posited that intellectual capital provides a competitive advantage that is sustainable over the long term. Likewise, Youndt et al. (2004) asserted that organizations with well-managed intellectual resources are better equipped to respond to market changes and achieve superior financial performance. The importance of IC is underscored by its role in driving innovation, fostering relationships with stakeholders, and enhancing overall business resilience in rapidly changing environments (Subramaniam and Youndt, 2005).

2.3. Micro, small, and medium enterprise (MSME) loans

One of the primary challenges faced by rural banks in extending credit to MSME customers is the government's People's Business Credit (Kredit Usaha Rakyat, or KUR) program, which channels low-interest loans through commercial banks. The KUR program, launched by the Indonesian government, aims to enhance community income levels by increasing financial accessibility for MSMEs through a credit guarantee scheme. This initiative supports MSME growth by providing low-interest loans, aligning with the broader goals of economic empowerment and sectoral development under financial sector reform policies and Law No. 20/2008 on MSMEs, which mandates that the government and local governments are obliged to create a business climate by stipulating regulations and legislation covering aspects of funding, facilities, infrastructure, etc.

However, the competitive advantage provided by the KUR program poses significant challenges for rural banks. With KUR loans offered at a low interest rate of 6% per year, rural banks find it difficult to compete, as their loans typically have interest rates ranging from 15% to 18% per year. This disparity

puts rural banks at a disadvantage, as potential MSME borrowers may prefer the lower-cost KUR loans provided by commercial banks. The policy, while beneficial for MSMEs, inadvertently limits the ability of rural banks to serve this sector effectively, thus impacting their profitability and market share.

The sustainability of rural banks is further challenged by their reliance on MSME loans, a core segment of their lending portfolios. Recent studies highlight that the KUR scheme, while successful in improving financial inclusion, has intensified competition, making it difficult for rural banks to sustain their loan portfolios without additional government support or differentiation strategies. This situation calls for policy adjustments that would enable rural banks to better support MSME financing without being overshadowed by commercial banks under the KUR scheme. Furthermore, there is a growing need for rural banks to innovate and adopt more flexible credit products tailored to the unique needs of MSMEs in rural areas.

Fig. 1 presents the conceptual framework guiding the study. It illustrates the hypothesized relationships among the independent variables—Intellectual Capital and MSME Credit—and the dependent variable—Rural Bank Business Performance.

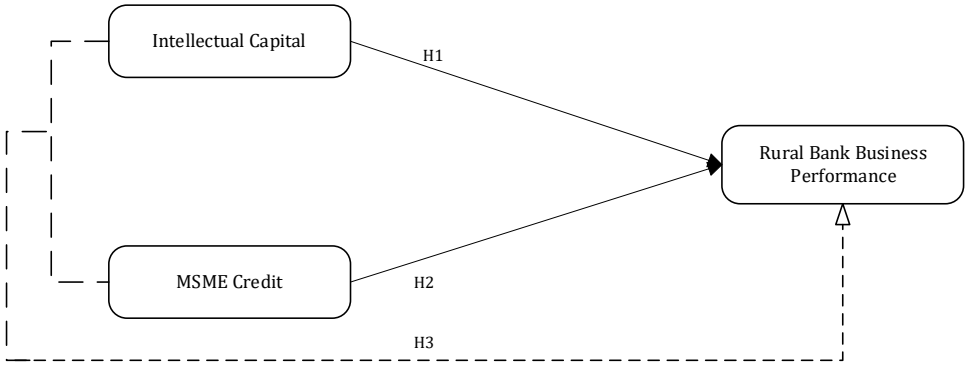

Fig. 1: Research model

Based on the conceptual framework presented in Fig. 1, the following hypotheses are proposed:

H1: Intellectual Capital factor affects the BPR business in Jambi Province.
H2: UMKM Credit factor effects on BPR business in Jambi Province.
H3: Intellectual Capital and UMKM Credit factors affect the BPR business in Jambi Province.

3. Research methods

The research methodology in this study involves systematic procedures designed to collect and analyze data effectively. A sound methodology is essential as it guides data collection and analytical processes, ensuring the validity and reliability of results (Creswell and Creswell, 2018). The primary data consists of annual financial reports from rural banks in Jambi Province for the period 2013 to 2022. These reports were sourced from authoritative institutions such as Bank Indonesia (BI), the Financial Services Authority (OJK), the Central Statistics Agency (BPS), and directly from the banks themselves. This comprehensive approach ensures a solid and consistent empirical foundation for evaluating rural bank performance (Sekaran and Bougie, 2016).

To analyze the data, the study employs panel data regression techniques, which are particularly well-suited to capturing both cross-sectional and time-series variations. The models used include the Pooled Least Squares (PLS), Common Effect Model (CEM), and Random Effect Model (REM). These methods enable a nuanced understanding of the relationships among variables by accounting for heterogeneity across banks and over time (Gujarati and Porter, 2009; Baltagi, 2013).

The study uses exclusively quantitative data, primarily extracted from OJK's publicly available datasets—including balance sheets, income statements, and key financial ratios. Only active rural banks with complete and consistent records within the specified period and region were included. All data were accessed from OJK's official portal (www.ojk.go.id), ensuring standardization and comparability across institutions.

This study measures Intellectual Capital using a proxy-based approach, specifically the Value Added Intellectual Coefficient (VAIC™) method developed by Pulic (2000). VAIC™ decomposes Intellectual Capital into three components: Human Capital Efficiency (HCE), Structural Capital Efficiency (SCE), and Capital Employed Efficiency (CEE). These indicators are calculated based on financial data and reflect how efficiently a bank utilizes its intellectual resources to create value. This approach, widely used in the literature (Chen et al., 2005; Ulum et al., 2014), provides a reliable and replicable way to assess the impact of intangible assets on bank performance using observable financial proxies.

4. Results and discussion

To ensure the reliability of the regression results, several diagnostic tests were conducted to assess the

robustness of the model and the validity of key statistical assumptions.

First, a multicollinearity test was performed using the Variance Inflation Factor (VIF). All independent variables reported VIF values below 5, indicating the absence of serious multicollinearity concerns and ensuring that the predictors in the model are not highly correlated.

Second, the normality of residuals was assessed using the Jarque-Bera test and visual inspection of the residual distribution through a histogram and normal probability plot. The results suggest that the residuals are approximately normally distributed, satisfying the normality assumption required for inference.

Third, heteroscedasticity was examined using the Breusch-Pagan and White tests. The test outcomes did not indicate significant heteroscedasticity, suggesting that the variance of residuals remains constant across observations.

Additionally, to enhance the robustness of the findings, the model estimates were compared across multiple panel data estimation methods, including the Pooled Least Squares (PLS), Fixed Effects Model (FEM), and Random Effects Model (REM). The Hausman test was applied to determine the most appropriate model. The test favored the REM specification, which accounts for unobserved heterogeneity and yields consistent estimates under the assumption of no correlation between individual effects and explanatory variables.

These diagnostic results collectively affirm the robustness and statistical validity of the estimated model, strengthening the reliability of the conclusions drawn from this study.

The results and discussion of this study, which examines the impact of Intellectual Capital and MSME credit on the business operations of rural banks in Jambi Province, are structured in two main stages. First, the research results encompass statistical analysis, model specification testing, and model selection, which are integral for validating the robustness of the model and confirming the research hypotheses. Statistical rigor in these initial steps ensures that the conclusions drawn are reliable and reflective of actual trends within the data (Wooldridge, 2010).

Second, the analysis includes a comprehensive discussion of the research model, conducted quantitatively in alignment with the data collected for each rural bank. Quantitative methods are particularly useful in banking research as they provide objective insights and help to establish causal relationships. For analyzing the results, this study uses panel data processed through the E-views-10 software application, which is well-regarded for handling complex panel data analysis efficiently (Asteriou and Hall, 2015). Utilizing panel data allows for a deeper examination of both cross-sectional and longitudinal variations, offering insights into temporal trends while accounting for individual bank characteristics (Hsiao, 2007).

To provide an overview of the data prior to model estimation, Table 3 presents descriptive statistics for the key variables used in this study. These include the dependent variable (Return on Assets) and the independent variables (components of Intellectual Capital and MSME Credit). Table 3 outlines their definitions, measurement methods, means, standard deviations, and data sources.

Table 3: Descriptive statistics and variable definitions

Variable	Definition	Measurement/proxy	Mean	SD	Data source
ROA (Return on assets)	Indicator of rural bank business performance	Net income/total assets	1.82	0.65	Financial statements (OJK)
HCE	Human capital efficiency	Value added/human capital	5.34	2.12	Calculated from financial statements
SCE	Structural capital efficiency	Structural capital/value added	0.47	0.13	Calculated from financial statements
CEE	Capital employed efficiency	Value added/capital employed	0.11	0.04	Calculated from financial statements
MSME credit	Share of loans directed to the MSME sector	Total MSME loans/total loans (%)	56.72	10.89	Rural bank loan reports (OJK)

Value added (VA) is computed as operating profit + employee costs + depreciation; Structural capital = VA – HC

Table 3 summarizes the key variables used in the study, including their definitions, measurement methods, average values, standard deviations, and data sources. The variables reflect the financial performance and intellectual capital components of rural banks. Through this approach, the study aims to provide a nuanced understanding of how Intellectual Capital and MSME credit influence the business performance of rural banks in a specific regional context. The findings from this analysis are anticipated to contribute to the broader literature on rural banking and financial inclusion, particularly in emerging markets.

To analyze the impact of Intellectual Capital and MSME credit on rural bank business performance in Jambi Province, this study employs statistical panel data regression. Panel data regression is widely used for its ability to capture both cross-sectional and time-series variations, thus providing a robust approach to understanding financial performance over time (Baltagi, 2013; Hsiao, 2007). This analysis specifically utilizes three regression models: The Common Effect Model (CEM), the Fixed Effect Model (FEM), and the Random Effect Model (REM). By integrating Intellectual Capital (IC) and MSME Credit as independent variables, the study aims to predict and quantify their effect on rural bank business performance in Jambi Province, covering data from 18 rural banks over a period of 10 years (2013–2022).

Following standard procedures in panel data analysis, three tests were employed to determine the most suitable model: The Chow Test, the Hausman Test, and the Lagrange Multiplier Test. These tests are crucial in selecting between fixed and random effects and ensuring that the model aligns with the data characteristics (Gujarati and Porter, 2009). Based on these tests, the Random Effect Model (REM) was identified as the best fit for this study. REM is particularly suitable when variations across entities (rural banks) are assumed to be random and uncorrelated with the independent variables, allowing for generalizable insights across the sample (Wooldridge, 2010).

In this regression model, the rural bank business performance (dependent variable, Y) is analyzed in relation to two independent variables: Intellectual Capital (X1) and MSME Credit (X2). Intellectual Capital has been shown to contribute to enhanced financial performance through improved organizational efficiency and innovation (Chen et al., 2005; Youndt et al., 2004). Meanwhile, MSME Credit is a critical factor, as it aligns with the banks' mission to support local economic growth by extending credit to smaller enterprises, which is often linked to increased bank profitability and community impact (Beck et al., 2005; Berger and Udell, 2006).

This methodological approach enables the study to examine whether Intellectual Capital and MSME Credit have significant, positive impacts on rural bank performance, offering valuable insights into the strategic factors that drive financial success in this sector.

4.1. Hypothesis testing

4.1.1. T-test

The t-test is employed to evaluate the significance of each independent variable's impact on the dependent variable, specifically by comparing the calculated t-statistic (t-count) for each independent variable's coefficient with the critical t-table value. This test helps determine whether the independent variables—Intellectual Capital and MSME Credit—have a statistically significant effect on the dependent variable, which in this case is rural bank business performance in Jambi Province. According to standard statistical procedures, if the t-count exceeds the t-table value or if the p-value is less than 0.05, the null hypothesis (indicating no effect) is rejected. This signifies that the independent variable has a significant influence on the dependent variable (Hair et al., 2010).

In conducting this analysis, the study uses the E-views 10 software application to facilitate the panel data processing and hypothesis testing. E-views is particularly suitable for handling complex econometric analyses involving time-series and cross-sectional data, which enhances the reliability and precision of the results. The t-test outcomes obtained through E-views offer a rigorous basis for evaluating the relationships between the variables, as the software provides exact p-values, allowing researchers to make informed decisions based on probability thresholds.

The significance of these results is underscored by the practical implication that, if Intellectual Capital and MSME Credit show significant t-test results, these variables can be considered key drivers of rural bank performance. Intellectual Capital, for example, has been linked to enhanced financial performance through increased efficiency and innovation, as established in previous studies (Chen et al., 2005; Youndt et al., 2004). Similarly, MSME Credit is a critical component in rural bank lending portfolios, often associated with improved financial outcomes and community impact, which are essential for sustaining bank profitability in local economies (Beck et al., 2005; Berger and Udell, 2006). The application of these t-test results thus allows for evidence-based decisions about the strategic factors influencing rural bank success in a regional context. Table 4 reports the individual significance of each independent variable—Intellectual Capital (X1) and MSME Credit (X2)—on the dependent variable (Return on Assets). Significance is evaluated using p-values derived from panel regression.

Table 4: T-test results

Variable	Coefficient	SE	t-statistic	Probability
C	0.8438373	0.1256243	6.717149	0.0000
X1	0.146412	0.067633	2.164806	0.0326
X2	1.169059	0.034673	33.71641	0.0000

Table 4 illustrates that both Intellectual Capital (X1) and MSME Credit (X2) significantly influence rural bank business performance in Jambi Province. This impact is evident in the Intellectual Capital variable, which shows a significance value of 0.0326 (0.0326 < 0.05), indicating that Intellectual Capital has a meaningful effect on the rural bank business. Intellectual Capital's contribution aligns with the findings of Chen et al. (2005), who argued that intangible assets such as knowledge and expertise positively influence firm performance by enhancing efficiency and innovation. The role of Intellectual Capital in improving bank performance highlights its value as a strategic resource in a competitive financial environment (Youndt et al., 2004).

Similarly, the MSME Credit variable demonstrates a highly significant effect on rural bank business performance, with a p-value of 0.0000 (0.0000 < 0.05). This result underscores the importance of MSME Credit in supporting rural bank profitability, consistent with Berger and Udell's (2006) findings, which indicated that credit to smaller enterprises fosters local economic growth and strengthens the financial foundation of rural banking institutions.

MSME Credit allows rural banks to expand their customer base and community impact, reinforcing their role in financial inclusion (Beck et al., 2005).

In summary, these findings validate the hypothesis that both Intellectual Capital and MSME Credit play significant roles in rural bank performance, underscoring the strategic importance of these factors in enhancing financial outcomes in Jambi Province.

4.1.2. F-test

The F-test is utilized to evaluate whether the independent variables, collectively, have a significant effect on the dependent variable. This test is essential in determining the overall explanatory power of the model, assessing if Intellectual Capital and MSME Credit jointly impact rural bank business performance in Jambi Province. The test criterion states that if the F-count value exceeds the F-table value or if the p-value (ρ) is less than 0.05, the null hypothesis (indicating no effect) is rejected. This outcome would imply that the independent variables as a group significantly influence the dependent variable (Hair et al., 2010). Conducting the F-test is critical for validating the model's adequacy, as it indicates whether the chosen independent variables meaningfully explain variations in rural bank business performance. This collective assessment is especially valuable in multivariate regression contexts, where understanding the combined effect of variables like Intellectual Capital and MSME Credit provides insights into their cumulative influence on financial performance (Wooldridge, 2010).

The results from the panel data processing, performed using the F-test in E-views 10, demonstrate whether the model has statistically significant explanatory power. This testing approach aligns with best practices in econometric analysis, offering a robust statistical foundation for examining the overall relationship between independent and dependent variables (Asteriou and Hall, 2015).

Table 5 displays the F-statistic and related indicators used to test the joint significance of the independent variables. A p-value below 0.05 indicates the model significantly explains the variation in rural bank performance.

Table 5: F test results

Test	R-squared	Adjusted R-squared	SE of regression	F-statistic	Prob (F-statistic)
Results	0.976805	0.973960	4699669	343.3760	0.000000

In Table 5, the F-test results demonstrate that the probability (Prob) value of the F-statistic is 0.000000, which is considerably lower than the significance level (α) of 0.05 or 5% (0.000000 < 0.05). This outcome indicates that the null hypothesis (H0) is rejected, while the alternative hypothesis (H1) is accepted. Thus, it can be concluded that the independent variables—Intellectual Capital (X1) and MSME Credit (X2)—have a statistically significant combined effect on the rural bank business performance in Jambi Province over the period 2013–2022.

The significance of this finding underscores the combined influence of Intellectual Capital and MSME Credit on enhancing the performance and sustainability of rural banks. Intellectual Capital, encompassing knowledge, skills, and innovative capabilities, plays a critical role in creating value and competitive advantage for financial institutions (Chen et al., 2005; Youndt et al., 2004). Similarly, MSME Credit is crucial for supporting local economies and ensuring financial inclusion, which, in turn, strengthens rural banks' customer base and profitability (Berger and Udell, 2006; Beck et al., 2005). The strong Prob (F-statistic) outcome suggests that these variables are vital contributors to rural bank performance, aligning with existing literature that highlights their importance in financial stability and growth.

This result provides robust evidence that both Intellectual Capital and MSME Credit are not only individually impactful but also collectively essential for driving rural bank success in regional economies like Jambi Province, where financial resources and intellectual assets directly support community-based banking activities.

4.1.3. R-squared test

The results of the R^2 (coefficient of determination) model testing reveal a value of 0.976805 in the panel data regression model. This high R^2 value indicates that 97.68% of the variation in the rural bank business performance in Jambi Province can be explained by the independent variables—Intellectual Capital and MSME Credit—at a highly significant level (less than 1%). The remaining 2.32% is attributed to other variables not included in the model, suggesting a minimal impact from external factors.

This high level of explanatory power underscores the substantial influence of Intellectual Capital and MSME Credit on rural bank development. A model with an R^2 close to 1, as seen here, implies that the selected independent variables are highly predictive of the dependent variable, signifying their importance in shaping rural bank outcomes (Hair et al., 2010).

The findings are consistent with previous research that highlights the critical role of Intellectual Capital—through enhanced knowledge, skills, and innovation—in driving financial performance and organizational resilience in banking institutions (Chen et al., 2005; Youndt et al., 2004). Similarly, MSME Credit, by supporting local businesses, not only contributes to financial inclusion but also strengthens the operational foundations of rural banks, as evidenced in various

studies on MSME financing and rural banking (Berger and Udell, 2006; Beck et al., 2005).

Overall, the R^2 value provides robust evidence of the model's effectiveness, affirming that Intellectual Capital and MSME Credit are pivotal factors in the growth and sustainability of rural banks in Jambi Province. This high explanatory power reinforces the importance of strategic investments in these areas for long-term rural bank success.

4.2. Discussion

The results of this study provide strong empirical support for the role of both Intellectual Capital and MSME Credit in driving the business performance of rural banks in Jambi Province. Rather than merely confirming statistical significance, these findings offer valuable insights into how intangible assets and targeted lending practices can be strategically leveraged to enhance financial sustainability.

Intellectual Capital, comprising human resources, structural assets, and relational networks, emerges as a critical enabler of operational efficiency and innovation. This is especially relevant in the banking sector, where knowledge-based capabilities can differentiate institutions in competitive and highly regulated markets (Bontis, 1998; Youndt et al., 2004). However, the practical impact of Intellectual Capital is not uniform across contexts. In Indonesia's rural banking sector, structural constraints such as limited budgets and regulatory burdens may restrict the full realization of these intangible assets (Kamath, 2007). This suggests that while Intellectual Capital offers substantial potential, its effectiveness depends on the institutional environment and the capacity to invest in human and organizational development.

Similarly, MSME Credit plays a pivotal role in sustaining rural banks' relevance and profitability. By targeting underserved segments, rural banks not only fulfill their developmental mission but also expand their client base and revenue sources. Nonetheless, the findings also highlight the vulnerability of this model to external competition—particularly from commercial banks offering government-subsidized KUR loans at substantially lower interest rates. This disparity creates a structural disadvantage for rural banks, which must balance social objectives with financial viability (Berger and Udell, 2006; Beck et al., 2005).

The implications are twofold. First, rural banks must innovate by tailoring credit products to specific MSME niches or by providing complementary services that differentiate them from larger competitors. Second, the findings underscore the need for regulatory adjustments that level the playing field—such as granting rural banks access to subsidized credit programs or incentives for digital transformation.

The study also suggests that enhancing Intellectual Capital—particularly through specialized training in MSME financing and risk assessment—could enable rural banks to optimize their lending practices and build competitive capabilities. However, these strategies require long-term investment and may not yield immediate financial returns, posing a challenge for institutions with limited resources (Edvinsson and Malone, 1997).

Importantly, this research contributes to the existing literature by jointly examining the influence of Intellectual Capital and MSME Credit in the rural banking context. Prior studies have typically addressed these variables in isolation or within conventional banking environments. By focusing on rural banks in an emerging market, this study provides a nuanced understanding of how internal capabilities and external credit strategies interact to shape institutional resilience.

From a policy perspective, the findings advocate for a more inclusive design of financial support programs that take into account the unique position of rural banks. Encouraging collaboration between rural and commercial banks, offering regulatory flexibility, or supporting shared infrastructure development could significantly strengthen the role of rural banks in advancing financial inclusion.

Socially, the study highlights the broader developmental impact of MSME financing. Facilitating access to credit for micro and small enterprises can catalyze local economic growth, job creation, and poverty reduction—especially in underserved rural areas. Moreover, the emphasis on Intellectual Capital points to the importance of workforce development in improving service quality, community engagement, and institutional trust.

In sum, this study offers practical and policy-relevant insights into how rural banks can navigate structural challenges by leveraging their intellectual and lending assets. Strengthening these dimensions can position rural banks not only as financial intermediaries but also as catalysts of inclusive economic development in Indonesia.

5. Conclusion

This study provides actionable insights into how Intellectual Capital and MSME Credit contribute to the business performance of rural banks in Jambi Province, Indonesia. The findings demonstrate that both variables significantly influence rural bank sustainability, particularly in the context of competition from commercial banks and the structural challenges of serving underserved communities.

The empirical results confirm that effective management of Intellectual Capital—especially human and structural capital—enables rural banks to innovate and enhance service quality. Meanwhile, the strategic allocation of MSME Credit plays a critical role in financial inclusion and local economic development. By leveraging these assets, rural banks can improve profitability while maintaining their developmental mission.

This research extends the literature by integrating both Intellectual Capital and MSME Credit into a single analytical model within the rural

banking sector—an area that remains underexplored in the context of emerging economies.

5.1. Policy recommendations

Given the study's findings, several recommendations are proposed for policymakers and rural bank practitioners:

1. Support for capacity building: Rural banks should invest in developing staff capabilities through targeted training in MSME lending, risk assessment, and digital banking tools to enhance their intellectual capital.
2. Incentivize innovation: Government policies should encourage rural banks to create differentiated credit products and adopt technologies that address the unique needs of MSMEs in rural areas.
3. Reform of the KUR program: Policymakers should consider restructuring the KUR (People's Business Credit) scheme to allow rural banks more equitable participation. This may involve interest rate subsidies or risk-sharing mechanisms to make lending to MSMEs more viable for smaller institutions.
4. Promote collaborative models: Regulatory frameworks should support partnerships between rural and commercial banks to facilitate knowledge transfer, credit channeling, and resource sharing.
5. Expand access to low-cost funds: To maintain competitiveness, rural banks would benefit from improved access to affordable capital—potentially through government-backed funding or blended finance structures.

These recommendations aim to reinforce the strategic role of rural banks in promoting inclusive financial systems and accelerating rural economic development.

5.2. Research limitations

This study offers valuable insights but is subject to several limitations. It focuses solely on rural banks in Jambi Province, limiting the generalizability of its findings to regions with different economic, regulatory, and competitive contexts. The exclusive use of secondary financial data provides a quantitative perspective but may overlook qualitative factors such as customer satisfaction, employee motivation, and community impact. Additionally, while the ten-year timeframe allows for trend analysis, a broader temporal scope might capture more comprehensive effects of Intellectual Capital and MSME credit across varying economic cycles.

Lastly, the panel data approach does not fully control for external influences like regulatory shifts or macroeconomic changes that may affect bank performance.

5.3. Suggestions for future research

Future research should broaden its scope to include rural banks from various regions in Indonesia, enabling comparative analysis across different local economies and uncovering region-specific challenges and opportunities. Integrating qualitative methods, such as interviews or case studies, could enrich the understanding of how Intellectual Capital shapes organizational culture, customer loyalty, and community engagement. Further studies might also explore the role of digital innovation in enhancing rural bank performance, particularly in underserved areas with limited infrastructure. Additionally, examining macroeconomic factors—such as inflation, interest rates, and policy shifts—could provide a deeper view of the external forces affecting bank sustainability. Such an expanded approach would yield a more holistic understanding of rural banking dynamics and inform more effective strategies to strengthen their role in promoting financial inclusion and regional development.

List of abbreviations

BI	Bank Indonesia
BPR	Bank Perkreditan Rakyat
BPRS	Bank Pembiayaan Rakyat Syariah
BPS	Badan Pusat Statistik
CEE	Capital employed efficiency
CEM	Common effect model
DPK	Dana Pihak Ketiga
FEM	Fixed effects model
HC	Human capital
HCE	Human capital efficiency
IC	Intellectual capital
KUR	Kredit Usaha Rakyat
MSME	Micro, small, and medium enterprises
MSMEs	Micro, small, and medium enterprises
OJK	Otoritas Jasa Keuangan
PLS	Pooled least squares
POJK	Peraturan Otoritas Jasa Keuangan
REM	Random effect model
ROA	Return on assets
SCE	Structural capital efficiency
SD	Standard deviation
SE	Standard error
SEOJK	Surat Edaran Otoritas Jasa Keuangan
VA	Value added
VAIC™	Value-added intellectual coefficient
VIF	Variance inflation factor

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Compliance with ethical standards

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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