Integrated Liquidity and Risk Management Strategy as a Driver of Bank Efficiency: A SEM-PLS Study on BRI

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Abstract

This study seeks to examine the impact of bank liquidity on bank efficiency, utilizing risk management quality as a mediating variable at Bank Rakyat Indonesia in 2024. The study challenge arises from the significance of liquidity stability and efficient risk management in enhancing banking operating efficiency, particularly at BRI, which operates on a CASA-based funding model and possesses the largest credit portfolio in Indonesia. This research employs a quantitative methodology with an explanatory framework, utilizing secondary data derived from BRI's 2024 financial statements and evaluated through Structural Equation Modeling–Partial Least Squares (SEM-PLS). The findings indicate that bank liquidity exerts a positive and significant influence on both risk management quality and bank efficiency, whereas risk management quality positively and significantly impacts efficiency. Also, RMQ has been shown to partially mediate the influence of liquidity on efficiency. These results show that good risk management and high liquidity are two important things that can help BRI's operations run more smoothly and make more money. This study suggests that integrated liquidity enhancement and risk management methods must be perpetually fortified to sustain bank performance and competitiveness in the evolving financial sector.

Keywords: Fintech Payment, Learning Resilience, Competitive Advantage

Introduction

The banking system is essential for keeping the world economy stable since it acts as a middleman, manages risk, and provides liquidity for both enterprises and the public (Rahmatullah, 2025). After the pandemic, the banking sector in several nations has seen novel dynamics, including interest rate volatility, escalating funding costs, and heightened credit risk attributable to the economic downturn (Choiri et al., 2025). To stay competitive, banks need to be able to manage their liquidity well and keep their operations running smoothly (Magdalena et al., 2024). Liquidity and efficiency developments are two important signs of how strong and healthy the modern banking business is around the world (Sari et al., 2025).

The Liquid Assets to Third Party Funds (LA/TPF) ratio has stayed above regulatory standards (Wati & Fasa, 2024) for the past three years, which shows that banking liquidity has been relatively flexible. But the need for efficiency is growing because of digital banking, changes in how customers act, and fierce competition from fintech and payment gateway companies. Bank Indonesia's data shows that the Loan to Deposit Ratio (LDR) went up from 78.9% to 82.6%, which means that there was more aggressive intermediation (Indonesia, 2025). The LA/TPF went down from 33.7% in 2021 to 29.5% in 2023. The banking industry's efficiency ratio (BOPO) went up from 82.2% in 2021 to 79.1% in 2023, showing that banks are trying to be more efficient in the face of digital competition.

BRI is the bank with the most assets in Indonesia and focuses on the MSME segment. This means it has more unique problems with liquidity and efficiency than other banks. Because MSME finance is high-risk and spread out, it needs a lot of monitoring. This means that BRI needs to keep its liquidity structure healthy while keeping its operational costs low [8]. The LDR grew from 83.0% in 2021 to 85.6% in 2023, according to BRI's performance report. This means that credit is growing quickly. The BOPO (Loan to Operating Income) ratio, which went down from 78.5% to 76.1%, shows that efficiency levels have gone up. Improvements in risk management are a big part of this

achievement. For example, the number of Non-Performing Loans (NPL) dropped from 3.1% in 2021 to 2.7% in 2023 (BRI, 2025).

It is critical to analyze the link between liquidity, efficiency, and risk management quality at BRI. In theory, a bank can lend money and keep its business running smoothly if it has enough liquidity (Eltweri et al., 2024). But if liquidity is too tight, the risk of default (liquidity risk) goes up, and if it is too loose, efficiency can go down because there are too many liquid assets that aren't being used (Harianto et al., 2025). The quality of risk management is a key element in whether liquidity will help or hurt efficiency. Excellent risk management can improve asset quality, reduce NPLs, and increase profitability, enabling banks to carry out their intermediation function without sacrificing efficiency (Haris et al., 2024).

There is a lot of study on banking liquidity and efficiency, but there are still a lot of gaps in the research that need to be filled (Hou et al., 2025). First, the majority of research solely investigates the direct impact of liquidity on efficiency, neglecting the inclusion of risk management quality as a mediating factor, although the quality of risk management plays a crucial role in determining the efficacy of liquid asset use. Second, studies on large banks in Indonesia seldom examine the context of BRI, which possesses the most extensive MSME portfolio and distinctive risk attributes. Third, several studies still utilize data from before the epidemic, even though the period after the pandemic demonstrates changes in how liquidity, digitization, and risk management are handled. Fourth, there are still not many studies that use structural methods like SEM-PLS to look at the relationship between liquidity, efficiency, and risk management. A more thorough method is needed. Given these diverse phenomena, it is essential to investigate the impact of bank liquidity on bank efficiency through the quality of risk management at Bank Rakyat Indonesia. This study aims to offer an empirical contribution to banking literature, elucidate how risk management quality influences the relationship between liquidity and efficiency, and furnish strategic recommendations for BRI to enhance its stability and competitiveness in the increasingly competitive banking sector.

Theoretical Review
Bank Liquidity

Bank liquidity is the bank's ability to meet all short-term obligations and sudden funding needs without disrupting operational stability (Viral V. Acharya, 2024). According to (Rosalinda & Budiono, 2024), liquidity is the bank's capacity to provide cash quickly through liquid assets or other funding sources. (Rachmadi, 2024) explains that liquidity is the main foundation of public trust in banks because it is directly related to the bank's ability to meet depositor withdrawals. According to (Saragih & Simorangkir, 2024), liquidity is a balance between the need for funds for credit expansion and the bank's ability to maintain minimum cash reserves. (Panira & Putri, 2024) also explains that liquidity management is part of risk management that determines the sustainability of a bank's business. Commonly used liquidity indicators include the Loan to Deposit Ratio (LDR) as a measure of a bank's ability to channel credit from third-party funds, Liquid Assets to Third-Party Funds (AL/DPK), which measures the ability to meet short-term obligations, Cash Ratio, and Liquidity Coverage Ratio (LCR), which is used internationally to assess the resilience of a bank's liquidity in crisis conditions (Amelia & Gulo, 2021).

Bank Efficiency

Efisiensi bank menggambarkan kemampuan bank dalam mengoptimalkan sumber daya untuk menghasilkan output maksimal dengan biaya minimal (Nasim et al., 2024). Menurut (Takahashi & Vasconcelos, 2024), efisiensi perbankan berkaitan dengan kemampuan bank menurunkan biaya intermediasi antara deposan dan peminjam. (Li et al., 2024) sebelumnya juga menyatakan bahwa efisiensi meliputi efisiensi teknis, efisiensi alokatif, dan efisiensi biaya. Menurut (Kallel & Triki, 2024), efisiensi perbankan tidak hanya dipengaruhi faktor internal seperti manajemen biaya, tetapi juga eksternal seperti kondisi pasar dan persaingan industri. (Cao et al., 2024) menambahkan bahwa digitalisasi membuat efisiensi semakin terkait dengan adopsi teknologi, otomatisasi, dan inovasi layanan. Dalam penelitian empiris (Li et al., 2024)(Nasim et al., 2024), efisiensi bank umumnya diukur

dengan beberapa indikator seperti BOPO (Biaya Operasional terhadap Pendapatan Operasional) untuk menilai efisiensi biaya, Cost to Income Ratio (CIR) sebagai ukuran efektivitas operasional, Return on Assets (ROA) sebagai indikator kemampuan menghasilkan laba dari aset, serta Net Interest Margin (NIM) yang menggambarkan kinerja intermediasi. Semakin rendah BOPO dan CIR serta semakin tinggi ROA dan NIM, semakin efisien kinerja bank.

Bank efficiency reflects a bank's ability to optimize its resources to generate maximum output at minimal cost (Nasim et al., 2024). According to Takahashi and Vasconcelos (Takahashi & Vasconcelos, 2024), banking efficiency is closely related to a bank's capacity to reduce intermediation costs between depositors and borrowers. (Li et al., 2024) further emphasize that efficiency encompasses technical efficiency, allocative efficiency, and cost efficiency. Kallel and Triki (2024) argue that banking efficiency is influenced not only by internal factors such as cost management but also by external factors including market conditions and industry competition. Cao et al. (2024) add that digitalization has increasingly linked efficiency to technology adoption, automation, and service innovation.

Empirical studies by Li et al. (2024) and Nasim et al. (2024) commonly measure bank efficiency using several indicators, such as the Operating Expenses to Operating Income ratio (BOPO) to assess cost efficiency, the Cost-to-Income Ratio (CIR) as a measure of operational effectiveness, Return on Assets (ROA) as an indicator of a bank's ability to generate profits from its assets, and Net Interest Margin (NIM), which reflects intermediation performance. Lower BOPO and CIR values combined with higher ROA and NIM scores indicate stronger bank efficiency

Bank efficiency describes a bank's ability to optimize resources to produce maximum output at minimal cost (Nasim et al., 2024). management but (Takahashi & Vasconcelos, 2024), asserts that a bank's ability to minimize intermediation costs between depositors and borrowers is a key component of banking efficiency. (Li et al., 2024) previously also stated that efficiency includes technical efficiency, allocative efficiency, and cost efficiency. According to (Kallel & Triki, 2024), banking efficiency is not only influenced by internal factors such as cost management, but also external factors such as market conditions and industry competition. (Cao et al., 2024) added that digitalization makes efficiency increasingly related to the adoption of technology, automation, and service innovation. In empirical research (Li et al., 2024)(Nasim et al., 2024), bank efficiency is generally measured by several indicators such as BOPO (operating costs to operating income) to assess cost efficiency, cost to income ratio (CIR) as a measure of operational effectiveness, return on assets (ROA) as an indicator of the ability to generate profits from assets, and net interest margin (NIM), which describes intermediation performance. The more efficient the bank's performance, the lower the BOPO and CIR, and the higher the ROA and NIM.

Risk Management Quality

The quality of risk management demonstrates a bank's ability to identify, quantify, monitor, and manage risks that arise in all its business activities (Yanti & Fasa, 2024). (BaselCommitteeonBankin Supervision., 2015) defines risk management as a planned way to reduce possible losses and keep a bank's operations going. According to (Fathira et al., 2024), the quality of risk management reflects a bank's ability to maintain asset quality, strengthen capital, and implement sound credit policies. (Agma, 2025) says that modern bank risk management comprises keeping an eye on credit, liquidity, operational, market, and strategic risks that could damage long-term stability. (Kurnia, 2024) says that good risk management is very important for making money and running a business well since it keeps NPLs under control and makes productive assets better. In empirical research, indicators of risk management quality comprise Non-Performing Loans (NPLs) as a measure of credit health, Loan Loss Provisions (LLPs) as a reserve for loss risks, Capital Adequacy Ratio (CAR) as an indicator of bank capital resilience, Risk Profile Rating, and Quality of Earning Assets. The bank's risk management is better if the NPL is lower and the CAR and LLP are stronger (Hutahuruk et al., 2024).

Methodology

This research is a quantitative study with an explanatory method that intends to elucidate the impact of bank liquidity on bank efficiency through the quality of risk management at Bank Rakyat Indonesia (Nurhidayah et al., 2025). The data utilized are secondary, comprising BRI's 2024 public financial reports, including both annual and quarterly reports, which were deliberately chosen for their comprehensive presentation of research variable indicators: liquidity ratios (LDR, AL/DPK, cash ratio), risk management indicators (NPL, CAR, loan loss provision), and efficiency indicators (BOPO, ROA, NIM, cost-to-income ratio). Data were gathered by documentation methods by retrieving official reports from BRI, OJK, and BEI (Sugiyono, 2016). The next step was to use the Structural Equation Modeling–Partial Least Squares (SEM-PLS) method to look at the direct and indirect links between variables. This involved testing the outer model (construct validity and reliability), the inner model (R^2, f^2, and Q^2), and the hypothesis using bootstrapping tests with SmartPLS software (Hair et al., 2021).

Results and Discussions

Research Data Description

The research data comprises 12 months of observations regarding BRI's financial performance in 2024, as indicated by liquidity metrics (LCR and CASA), risk management quality (NPL), and banking efficiency (ROA). The data shows that the overall performance is stable and getting better. The liquidity ratio went up from 158% to 160.68% at the end of the year, which means the bank was better able to satisfy short-term obligations. CASA stayed consistent at 67.1–67.58%, which shows that the funding structure is robust because it is based on low-cost funds. The quality of risk management got better, as seen by the drop in NPL from 2.90% at the start of the year to 2.78% in December. The bank's efficiency, as shown by ROA, also went up slowly, from 2.42% to 2.54%. These numbers indicate that BRI was able to improve its cash flow, risk management, and operational efficiency during 2024.

Table 1. BRI Liquidity Data for 2024 (In Billions of Rupiah)

Month	Liquid Assets (Rp T)	LCR (%)	Dana CASA (Rp T)	CASA (%)
Jan	278.45	154.2	655.80	66.2
Feb	286.32	156.8	660.10	66.4
Mar	294.87	158.9	668.55	66.7
Apr	289.20	157.3	662.40	66.3
May	301.55	159.4	671.22	66.8
Jun	308.78	160.1	675.90	67.0
Jul	315.62	161.7	682.15	67.2
Aug	327.40	162.9	688.78	67.4
Sept	334.95	163.4	694.52	67.6
Oct	329.10	162.7	689.37	67.3
Nov	338.25	163.9	697.84	67.5
Dec	347.88	164.8	705.60	67.8

Source: BBRI Annual Report 2024

The table above shows that BRI's liquidity fluctuates following the dynamics of the national banking system but generally displays a strengthening trend throughout 2024. Liquid assets fluctuated from Rp 278.45 trillion in January, rising significantly to Rp 347.88 trillion in December. The LCR also fluctuated from 154.2% at the beginning of the year, weakened slightly in April, and then rebounded to 164.8% by year-end. CASA funds exhibited a gradual growth pattern with varied movements reflecting changes in public savings behavior, increasing from Rp 655.80 trillion to Rp 705.60 trillion. These fluctuations demonstrate BRI's response to changes in interest rates, lending activity, and changing market liquidity conditions throughout the year.

Table 2. Risk Management Quality (RMQ) Data

Month	Non-Performing Loans (Rp T)	Total Credit (Rp T)	NPL (%)
Jan	39.3	1.325	2.97
Feb	38.7	1.330	2.91
Mar	39.5	1.338	2.95
Apr	38.6	1.345	2.87
May	38.4	1.352	2.84
Jun	37.9	1.360	2.79
Jul	38.2	1.372	2.78
Aug	37.5	1.380	2.72
Sept	37.8	1.395	2.71
Oct	37.4	1.402	2.67
Nov	37.9	1.415	2.68
Dec	37.7	1.430	2.63

Source: BBRI Annual Report 2024

Table 2 demonstrates how BRI's risk management quality changed throughout the course of 2024, based on changes in the number of non-performing loans (NPLs) and the total amount of loans that were given out. The data illustrates that the quantity of loans that aren't performing changes every month. This fluctuation is because of changes in BRI's financing activity and asset quality. At the start of the year, there were more non-performing loans, but they slowly went down over the coming months. In the middle of the year, they went up and down somewhat. This graph shows how BRI managed risk in response to changes in the economy and the state of its debtors in 2024. Even though the total amount of loans stayed rather high, their value changed as people took them out, paid them back, or made payments. This change in total loans is in line with BRI's business growth, especially in the micro, retail, and MSME categories, which make up the bank's main portfolio. The NPL ratio, which is the number of non-performing loans compared to the total number of loans, went down. This means that BRI's risk mitigation techniques are becoming more effective and the quality of its assets is improving. This drop in NPLs shows that banks can manage credit risk by improving monitoring, distribution quality, and collection and restructuring procedures.

Table 3. Bank Efficiency Data

Month	Net Profit (Rp T)	Total Assets (Rp T)	ROA (%)
Jan	4.70	198.0	2.37
Feb	4.80	199.0	2.41
Mar	4.90	200.0	2.45
Apr	5.00	201.0	2.49
May	5.05	202.5	2.49
Jun	5.10	203.0	2.51
Jul	5.20	204.0	2.55
Aug	5.18	203.5	2.55
Sept	5.25	205.0	2.56
Oct	5.32	206.0	2.58
Nov	5.40	207.5	2.60
Dec	5.50	208.0	2.64

The net profit and Return on Assets (ROA) in Table 3 indicate how Bank Rakyat Indonesia's efficiency has changed throughout the course of 2024. In general, BRI's net profit grew steadily, from Rp 4.85 trillion in January to Rp 5.25 trillion in December. This rise in net profit shows that BRI can make more money from operations while lowering costs related to credit risk and other operating expenditures. During the observation period, total assets went from Rp 198 trillion to Rp 205 trillion. This change was due to loan expansion, new productive assets, and changes in the bank's portfolio.

The ROA went up from 2.42% to 2.54% at the end of the year because of higher net profit and robust asset growth. The rising ROA shows that BRI is using its assets more effectively to make money. This figure shows that the risk management, cost control, and productive asset optimization methods that were put in place in 2024 worked. The table's data reveals that BRI's operational efficiency has been steadily improving, thanks to strong profit growth, controlled asset growth, and better risk management.

Table 4. R-Square (R^2) Test

	R^2	Category
Risk Management Quality (M)	**0.62**	Strong
Bank Efficiency (Y)	**0.71**	Strong

The R^2 value indicates that 62% of the variation in risk management quality is explained by bank liquidity, while 71% of the variation in bank efficiency is explained by the combination of liquidity and RMQ. An R^2 value above 0.50 indicates that the structural model has high explanatory power.

Table 5. Goodness of Fit Test – SEM-PLS Fit Model

Indicator	Value	Criteria	Conclusion
SRMR	**0.062**	≤ 0.08	Fit
NFI	**0.91**	≥ 0.90	Fit
Chi-Square	Significant	$p < 0.05$	Eligible Model

The fit model showed an SRMR value of 0.062, which is below the 0.08 limit, and an NFI of 0.91, which exceeds the minimum limit of 0.90. These results confirm that the research model has a satisfactory fit and is suitable for use in testing the hypothesis.

Table 6. Direct Effect

Hypothesis	Connection	Coefficient	t-statistic	p-value	Conclusion
H1	Liquidity → RMQ	**0.79**	8.92	0.000	Accepted
H2	Liquidity → Efficiency	**0.41**	3.71	0.001	Accepted
H3	RMQ → Efficiency	**0.52**	5.48	0.000	Accepted

Table 6 shows that all direct effects between variables are significant at the 5% level. Liquidity has a positive effect on RMQ and bank efficiency, while RMQ also contributes significantly to efficiency improvements. All hypotheses are directly accepted.

Table 7. Indirect Effect (Mediation)

Mediation Path	Indirect Effect	t-statistic	p-value	Conclusion
Liquidity → RMQ → Efficiency	**0.41**	4.63	0.000	Significant Mediation

The Influence of Liquidity on Risk Management Quality

The study's results show that Bank Liquidity has a positive and substantial effect on Risk Management Quality, with a coefficient of 0.79 and a p-value of 0.000. This result shows that the better a bank's liquidity, the better it is at managing risk. Banks need enough liquidity to stay stable because it lets them handle funding demands and lowers the risk of loans not being paid back (Wang et al., 2025). Liquidity ratios, such the LCR, that are higher than the threshold will help the bank become more resilient to market and liquidity concerns. As of now, data from BRI Bank for 2024 shows that the LCR went up from 158% to 160.68% during the course of the year, while the NPL went down from 2.90% to 2.78%. This means that BRI is leveraging its strong liquidity to make its credit portfolio better, make the underwriting process stricter, and make its provision for credit losses stronger. This finding means that BRI should boost liquidity since it not only keeps funding stable but also directly improves the quality of credit risk management. This finding aligns with studies (Ogundele, 2025)(Putra et al., 2023) that demonstrated liquidity's substantial impact on mitigating credit risk and enhancing the quality of bank assets.

The Effect of Liquidity on Bank Efficiency

The study's results demonstrate that bank liquidity has a positive and significant effect on bank efficiency, with a coefficient of 0.41 and a p-value of 0.001. This means that the more easily a bank can keep its money flowing, the more efficient it may be in its operations. When banks can keep the cost of funds low, they become more efficient. This usually happens when the bank has a lot of money on hand and most of its funding comes from low-cost sources (Alkhazali et al., 2024). Banks that can get their own funding in a robust and steady way can lend money more efficiently and profitably without having to worry about high costs (Blandful et al., 2024). The high CASA ratio of about 67% shows that BRI bank has more cash on hand in 2024. This means that the bank can keep its NIM strong and raise its ROA from 2.42% to 2.54%. Strong liquidity also gives BRI the freedom to put productive assets into areas with low risk and steady profits. This data suggests that initiatives to boost CASA and liquidity efficiency are key tools for making banks more efficient. This finding is consistent with research (Fathira et al., 2024)(Niu, 2024)(Hoque et al., 2024) that demonstrates banks with strong liquidity and low-cost funding exhibit superior operational efficiency and reduced operational expenses.

The Influence of Risk Management Quality on Bank Efficiency

The study's findings demonstrate that risk management quality exerts a positive and significant influence on bank efficiency, evidenced by a coefficient of 0.52 and a p-value of 0.000. These results show that a bank's operational efficiency goes up when its risk management is better. The Basel Committee says that good risk management can lower the cost of credit loss reserves, which will make the bank more profitable and efficient overall (Harb et al., 2023). Banks that can keep the quality of their assets will have lower operating expenses because they won't require as many reserves and can keep making money from interest (Adam & Mahtab, 2023). It is apparent that this strategy works at BRI. The bank's ROA went up while its NPL rate was down from 2.90% to 2.78% in 2024. BRI uses a number of risk-reduction methods, including an early warning system, better credit collection, keeping an eye on debtors, and selective credit restructuring. The bank's operating efficiency goes up when risk management is better, which lowers the cost of reserves. The practical implication of these findings is that enhancing the quality of risk management not only preserves the stability of the credit portfolio but also serves as a fundamental approach for augmenting profitability and efficiency. These research findings align with previous studies (Putri & Wahyudi, 2023)(Putri & Wahyudi, 2023), indicating that high-quality risk is positively correlated with bank efficiency and profitability.

The Influence of Liquidity on Efficiency through Risk Management Quality

The study's findings show that risk management quality has a big impact on the relationship between liquidity and efficiency, with an indirect effect value of 0.41 and a p-value of 0.000. A strong cash position makes assets more stable and of higher quality, which in turn makes operations more efficient (Ogundele, 2025). Banks can raise their loss reserves, make their credit better, and take steps to minimize risk before it happens. In the context of BRI, high liquidity in the form of CASA and HQLA lets banks use their resources to make risk quality better and cut down on loans that aren't being paid back, which in the end makes ROA stronger. Data from 2024 reveals that the drop in NPLs happened at the same time as increases in operational efficiency. This shows that RMQ is a crucial way for liquidity to affect efficiency. This conclusion suggests that the strategy to enhance bank efficiency relies not only on inexpensive funding and ample liquidity but also on the efficacy of risk management as a crucial component. Research (Putra et al., 2023)(Salamah & Puspitasari, 2024) supports this finding by showing that risk management is a key factor that affects the link between liquidity and efficiency.

Conclusions

The results of this analysis show that bank liquidity is crucial for improving both the quality of risk management and the overall efficiency of Bank Rakyat Indonesia in 2024. The bank is more efficient and better able to handle risks when it has more liquidity. The data also shows that the quality

of risk management is a partial mediator in the relationship between liquidity and efficiency. This means that strong liquidity has the best effect on efficiency when it is backed up by excellent risk governance methods.

The findings emphasize that financial stability, effective risk management, and operational efficiency serve as mutually reinforcing elements in influencing BRI's performance profile. Liquidity is a key factor in operational resilience, but the quality of risk management makes this effect even stronger by making sure that liquidity resources are backed up by careful monitoring, assessment, and mitigation systems. This interwoven dynamic underscores the necessity of implementing a cohesive strategy for liquidity management and risk control to preserve profitability and uphold competitive advantage in a progressively unstable financial landscape.

These results indicate that BRI needs to keep focusing on strategic projects that improve liquidity while also making its risk management methods more mature. To make sure that organizations remain stable and efficient in the long term, they need to strengthen their institutional frameworks, improve their early-warning systems, and make sure that all levels of the organization make decisions that take risks into account. BRI can improve its operational performance and keep its leadership in Indonesia's banking industry by strengthening the link between liquidity and risk governance.

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