

Fintech and Non-Performing Loans: Evidence from Oman's Banking Sector

Jokha Nasser Al Kindi¹, Aisha Majeed Al Balushi², Karima Sayari³

Managerial and Financial Sciences Department, Al Zahra College for Women, Muscat – Oman

DOI: <https://doi.org/10.47772/IJRISS.2026.10100046>

Received: 29 December 2025; Accepted: 06 January 2026; Published: 20 January 2026

ABSTRACT

The emergence of financial technology (FinTech) has significantly transformed the financial sector, reshaping traditional banking operations and risk management practices. The objective of the study is to investigate the impact of Fintech adoption on the operational efficiency and non-performing loan (NPL) percentages of the Omani banking industry. Drawing on secondary data from annual reports from 2015 to 2024, the study aims to provide insights on the role of FinTech in enhancing credit risk management in the banking sector. The study's regression results indicate a negative, but statistically insignificant, relationship between Fintech adoption and NPLs, with transactional income showing a weak effect on both gross and net NPLs. The model demonstrates strong explanatory power for gross NPLs ($R^2 = 0.9766$, $p = 0.0023$), while the net NPL model shows lower statistical significance ($R^2 = 0.8217$, $p = 0.1152$). These findings suggest that although FinTech contributes to operational efficiency and credit risk assessment, its direct impact on reducing NPLs remains limited in the Omani context. The research contributes to the literature on the fintech revolution in the banking sector by providing policymakers and other stakeholders with useful insights to strengthen operational performance and risk management frameworks in the Omani banking sector.

Keywords: financial technology (FinTech), non-performing loan (NPL), Credit Risk Management, Banking Sector.

INTRODUCTION

FinTech has evolved into a transformative force in the banking industry, significantly impacting traditional financial services through technology. This technology encompasses a range of advanced technologies, such as blockchain, artificial intelligence, and big data analytics, that contribute to increased operational efficiency (Ozili, 2022; Wang et al., 2023). Conversely, non-performing loans are a major concern for banks, given their impact on their lending capacity. This issue has a substantial impact on financial and economic stability (Safitri & Oktavia, 2022; Yang, 2017). Recent studies indicate that the use of FinTech helps reduce NPLs by improving credit risk assessment, thereby facilitating the detection of default risks at early stages (Albi et al., 2025; Zeb et al., 2024). This contributes to enhancing financial stability and reducing NPLs, particularly in a fast-changing environment such as that of Oman Vision 2040. This study examines the opportunities available to reduce non-performing loan ratios and enhance efficiency through the adoption of financial technology by the selected bank. Although there are digital advancements in the Omani banking sector, research remains limited. This study aims to assess how fintech can reduce non-performing loans and improve the bank's financial performance.

LITERATURE REVIEW

Theoretical Literature

The theoretical literature explores several key hypotheses regarding the impact of FinTech on the banking sector. First, the financial intermediation hypothesis, proposed by Allen and Santomero (1997), focuses on how FinTech

can be used to enhance intermediation in the banking sector through artificial intelligence and big data analytics, as a result improving banks' ability to assess loans and mitigate risks. Second, the Technology Acceptance Model (TAM), developed by Davis (1996), explains how technology is accepted in the financial sector based on its ease of use and usefulness to users. Finally, the theory of information asymmetry, originally proposed by Akerlof (1970), provides a foundational framework for understanding inefficiencies arising from unequal information between lenders and borrowers; however, in the context of modern financial systems, FinTech innovations—through AI-driven analytics and real-time data processing—have significantly mitigated these asymmetries by enhancing transparency and credit assessment, as highlighted in recent studies by Thorsten Beck (2020) and Xavier Vives (2019), thereby reducing default risk while promoting more efficient and inclusive financial intermediation.

While the above reviewed theories provides a strong foundation for understanding the role of fintech in banking sector, the main focus is more on efficiency and adoption perspective, with limited emphasis on credit performance particularly non-performing loans. This suggests a need to extend these theoretical frameworks to better capture the relationship between technological advancements and loan performance.

Concept of Fintech and Non-Performing Loans

FinTech is an innovative approach to providing financial services using technology to make them faster and more efficient (Ozili, 2022). This contributes to improving the traditional banking system and developing new financial products (Serkbayeva et al., 2024). Transaction income (FinTech Index) is an alternative metric for measuring the impact of this technology. It includes income generated from fees charged on everyday transaction activities such as payments, money transfers, and the use of cards and electronic channels. Thus, FinTech improves the performance of the banking system by increasing efficiency and innovation, by reducing the risks associated with loans (Wang et al., 2023).

However, despite these promising benefits, the role of fintech on credit risk indicators such as non-performing loans remains inconclusive, as efficiency gains do not necessarily translate into improved loan quality.

Non-Performing Loans are defined as loans that have become due for a period exceeding 90 days or are likely to default (Vatansever & Hepsen, 2015). Bank size, which refers to the total amount of outstanding loans, investments, and facilities extended to other parties prior to any deduction for provisions made (Mamatzakis & Tsionas, 2018). Total Customer Deposits reflect a bank's ability to provide necessary funding. At the same time, loan loss provisions show the size of the reserves a bank sets aside to mitigate the risks associated with non-performing loans (Chen et al., 2018). Finally, equity is a key measure of a bank's stability and its ability to withstand financial risks. To apply these concepts in an empirical context, the study focuses on the selected bank, one of the leading commercial banks in the Sultanate of Oman in terms of assets, as a case study to explore the relation between financial technology and non-performing loans.

Empirical Studies

The empirical literature on FinTech and non-performing loans can be broadly categorized into three main streams. In addition to the theoretical background, several empirical studies have examined the impact of non-performing loans on financial performance (Ally et al., 2025; Zeb et al., 2024; Li et al., 2025). The study by Atisu et al. (2024) examines the effect of non-performing loans (NPLs) on the financial performance of commercial banks in Ghana. The results showed that an increase in non-performing loans in Ghanaian banks was associated with unexpectedly higher profits. In contrast, an increase in the loan-to-deposit ratio led to a decrease in financial performance. Similarly, the study by Bhattarai (2016) found that the non-performing loan ratio (NPLR) had a negative and statistically significant effect on overall bank profitability, while it showed a positive association with shareholders' return. The study concluded that NPLR significantly influences the profitability of Nepalese commercial banks.

While the study of Chukwu et al. (2024) analyzed eight Nigerian commercial banks between 2017 and 2022 to examine the impact of non-performing loans (NPLs) on financial stability and performance. The analysis results

indicated that, in the long term, NPLs were statistically negatively related to financial performance, implying that an increase in NPLs tends to reduce performance.

These conflicting results indicate that the relationship between non-performing loans and financial performance is complex and context-dependent, varying across countries, banking systems, and economic conditions.

Moreover, the research of Sewanyina, et al. (2025) aims to review how FinTech contributes to the management of NPLs in the banking sector. The study focuses on FinTech tools, particularly AI-enhanced credit assessment, as innovative solutions that help reduce NPLs by improving the accuracy of lending decisions. The results show that FinTech has real potential to reduce default risk and improve loan quality, although many less developed areas still face challenges in adopting these technologies.

Nevertheless, the majority of existing studies focus on one of the two main areas : non-performing loans determinants or the role of FinTech in banking efficiency, with limited integration of both aspects in a single analytical framework. In addition, previous research has highlighted the importance of banking efficiency and structural characteristics in explaining variations in non-performing loans (Afroj et al., 2024; Shrestha & Khadka, 2024). Furthermore, most of the studies have been conducted in developed or large developing countries, and there is less research investigating this relationship in economies like Oman. This gap is particularly important given that smaller and emerging economies may exhibit different from those of developed banking systems (ISAKOV, 2024; Baharuddin et al., 2025).

Research Gap and Hypothesis Development

Recent empirical studies provide mixed evidence on the relationship between fintech and non-performing loans. While several studies suggests that fintech development can contribute to reducing credit risk through improved data analytics and monitoring (Qin & Jing, 2025; Chai & Sun, 2024; Wang et al., 2023), other research indicates that this effect is not always consistent or immediate. In particular, the impact of fintech may remain limited or highly context-dependent, varying with economic conditions, regulatory frameworks, and levels of technological maturity, especially in emerging economies where digital adoption is still evolving (Sadok & El Maknouzi, 2025). These mixed findings highlight that the relationship between FinTech and NPLs is not uniform but rather influenced by country-specific factors such as institutional quality, financial system development, and technological readiness. Accordingly, examining this relationship within the Omani banking sector provides valuable insights into how fintech adoption operates in smaller, emerging financial systems.

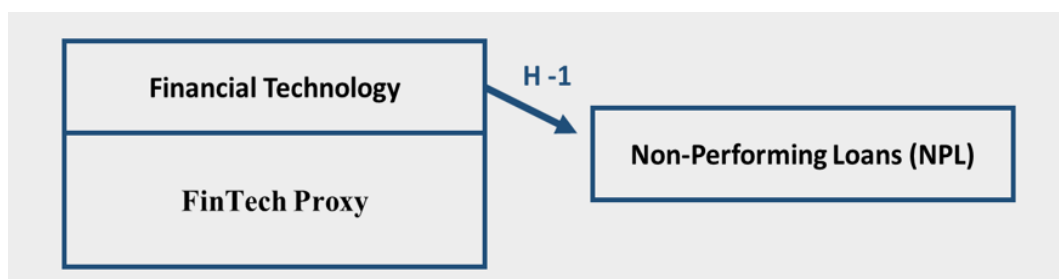
Based on the theoretical and empirical review of previous studies, a clear gap emerges in the literature regarding the effect of FinTech adoption on non-performing loans within the Omani banking context. Moreover, further research are needed as the findings of previous studies are incomplete. The study proposes the following hypothesis to examine the relationship between fintech and non-performing loans.

H1: There is a significant impact of Fintech on non-performing loans in the selected bank

Conceptual Framework

This study proposes a model to analyze the impact of financial technology on non-performing loans. Increased adoption of financial technology may contribute to reducing the ratio of non-performing loans.

Figure 1. Conceptual Framework



METHODOLOGY

Research Design

The study adopted a quantitative analysis method using data from the selected bank's annual reports for the period from 2015 to 2024. It analyzed the impact of FinTech adoption on non-performing loan ratios using Stata 17 software.

Data Collection Method and Sources

The data were collected from the selected bank's annual reports for the period from 2015 to 2024, including data on total loans, non-performing loans, and FinTech indicators. The data were manually presented in tables for statistical analysis.

The proxy variable for Fintech adoption used in the paper is transactional income. This proxy reflects the level of digital financial activity within the bank, including payments, transfers, and electronic services. The complex aspect of Fintech adoption, however, may not be well captured. Other measures, such as blockchain technology, AI based credit scoring, and digital loan applications, could provide a more comprehensive assessment of Fintech development. When analyzing the findings, the limitations of utilizing a single proxy are recognized and carefully considered when interpreting the result.

Descriptive Statistics

This was used to examine general financial indicators and explain changes in NPL ratios and the level of fintech adoption during the study period (2015-2024).

Regression Analysis

Regression analysis was used to examine the relationship among variables and determine the impact of fintech adoption on NPL at the selected bank, considering the influence while accounting for the influence of economic variables. The linear regression model to test the impacts is given in equations (1) and (2) below

Justification for the Selection of the Two Regression Models:

- The GNPL variable was used because it accurately represents the total volume of non-performing loans before any provisions, enabling a comprehensive assessment of the bank's overall non-performing loan status.
- The NNPL variable was used because it represents the level of non-performing loans after provisions, thus giving a more accurate and realistic indication of the actual loan quality.
- The use of both variables together were justified because combining them provides a comprehensive assessment of non-performing loans from two perspectives: gross non-performing loans (GNPL) and net non-performing loans (NNPL), making the model more accurate.

$$GNPL_t = \beta_0 + \beta_1 TI_t + \beta_2 Banksizet + \beta_3 Deposites_t + \beta_4 LLP_t + \beta_5 Equity_t + \varepsilon_t$$

Where: GNPL = Gross Non-Performing Loans ratio, B0 = The intercept of the model, TI = Transactional Income, Bank Size = Bank Size in year t, Deposits = Total customer deposits, LLP = Loan Loss Provisions, Equity = Total shareholders' equity, E = The error term capturing all unobserved factors affecting GNPL

$$NNPL_t = \beta_0 + \beta_1 TI_t + \beta_2 Banksizet + \beta_3 Deposites_t + \beta_4 LLP_t + \beta_5 Equity_t + \varepsilon_t$$

Where: NNPL = Net Non-Performing Loans ratio, B0 = The intercept of the model, TI = Transactional Income, Bank Size = Bank Size in year t, Deposits = Total customer deposits, LLP = Loan Loss Provisions, Equity = Total shareholders' equity, E = The error term capturing all unobserved factors affecting NNPL

RESULT AND DISCUSSION

Descriptive Statistics

Descriptive statistical analysis is a research methodology used to simplify information and transform data into meaningful insights through the measurement of fundamental statistics such as the mean, standard deviation, and maximum and minimum values in the dataset. This helps in structure data in a well-organized, interpretable format. Many studies have used this approach to analyze financial factors.

Table 1. Descriptive Statistics of Study Variables

Variable	Obs	Mean	Std. dev.	Min	Max
Gross NPL Ratio	10	0.0336	0.004174646	0.0275	0.0386
Net NPL Ratio	10	0.0069	0.002169175	0.0014	0.0089
Transactional Income (FinTech Proxy)	10	49,673	35,266.75	0	86,903
Bank Size (Total Gross Exposure)	10	14,180,984	4,221,847.37	7,627,922	18,513,537
Total Customers Deposits	10	8,376,040	831,619.91	7,363,448	9,777,068
Loans Loss Provision(LLP)	10	456,821	161,055.51	297,707	722,646
Equity	10	1,968,923	324,232.52	1,396,959	2,444,833

The descriptive statistics provide insights into the overall trends observed in bank performance across the study period, revealing significant variation across key performance indicators. On the one hand, the lowest values indicate periods of improvement in certain metrics, such as non-performing loans (0.0275 gross and 0.0014 net) and loan loss provisions (297,707), reflecting improved asset quality and demonstrating a negative relationship: lower risk levels correspond to better asset quality. The lowest transactional income (0) also indicates inconsistent adoption of digital financial services in some years, reflecting another negative relationship between weak digital activity and overall expansion.

On the other hand, the highest values reflect periods of banking expansion, where non-performing loans peaked (0.0386 gross and 0.0089 net), and digital transaction income reached 86,903, indicating broader fintech adoption. This demonstrates a positive relationship: increases in digital income accompanied by increases in lending and credit risk. Total assets, customer deposits, and equity also reached record levels (18,513,537, 9,777,068, and 2,444,833, respectively), emphasizing enhanced balance sheets and strong capital, further indicating a positive relationship among key financial indicators during expansion periods.

Overall, the data varies in a normal distribution, which is common for changes in the banking sector. This is also evident in that the data follows economic cycles and the growth of fintech over time, which is appropriate for advanced statistical analysis.

Table 2. Correlation Matrix

(obs=10)

	GrossNPLRatio	NetNPLRatio	TransactionalIncomeFinTechPr	BankSizeTotalGrossExposure	TotalCustomersDeposits	LoansLossProvisionLLP	Equity
GrossNPLRatio	1.0000						
NetNPLRatio	0.3214	1.0000					
TransactionalIncomeFinTechPr	0.8880	0.4414	1.0000				
BankSizeTotalGrossExposure	0.8550	0.5279	0.9853	1.0000			
TotalCustomersDeposits	0.9031	0.2629	0.8955	0.8886	1.0000		
LoansLossProvisionLLP	0.9285	0.0579	0.7538	0.7000	0.9045	1.0000	
Equity	0.9099	0.4754	0.8999	0.8917	0.9279	0.8567	1.0000

The correlation matrix shows that the major banking factors are interconnected, with most factors closely correlated with each other throughout the entire period under review. All the factor correlations are positive, showing that as the value of any factor increases, the other factors also tend to increase during the same period.

There is a notable positive correlation between gross NPL and digital income (0.888), bank size (0.855), and customer deposits (0.903). This indicates that during periods of growth in the banking sector, there is a high probability of high credit risks in the system. There is a high positive correlation between loan loss provisions and non-performing loans (0.928), which is a positive aspect in the banking sector, as this shows that banks are using sound banking practices. The positive correlation between equity (0.909) and non-performing loans is quite significant, as banks use this to add to their capital base in anticipation of risks in the system. The moderate positive correlation of net non-performing loans (0.321 and 0.441) is because, when provisions from loans in the banking system, this provides a more accurate reflection of the risks in the system.

The results of this analysis indicate that there is a highly integrated system in which growth in the banking sector is associated with high risks, a phenomenon observed in the global banking sector as well.

Table 3. Regression Analysis Result (Gross NP Gross NPL Model)

Source	SS	df	MS	Number of obs	=	10
Model	.000153172	5	.000030634	F(5, 4)	=	33.32
Residual	3.6771e-06	4	9.1928e-07	Prob > F	=	0.0023
				R-squared	=	0.9766
				Adj R-squared	=	0.9473
Total	.000156849	9	.000017428	Root MSE	=	.00096

GrossNPLRatio	Coefficient	Std. err.	t	P> t	[95% conf. interval]
TransactionalIncomeFinTechPr	-5.16e-08	7.10e-08	-0.73	0.507	-2.49e-07 1.46e-07
BankSizeTotalGrossExposure	1.21e-09	6.77e-10	1.79	0.148	-6.67e-10 3.09e-09
TotalCustomersDeposits	-4.30e-09	1.87e-09	-2.31	0.082	-9.48e-09 8.76e-10
LoansLossProvisionLLP	3.06e-08	7.69e-09	3.97	0.017	9.20e-09 5.19e-08
Equity	-6.84e-11	3.18e-09	-0.02	0.984	-8.91e-09 8.77e-09
_cons	.0412043	.0096785	4.26	0.013	.0143324 .0680763

The model explained much of the change in non-performing loans, with an R² of 0.9766, accounting for 97.66%. The results are highly statistically significant, as indicated by F = 33.32 and p = 0.0023. Among all the variables,

Loan loss provisions (LLP) were significant at $P= 0.017$, indicating a direct relationship: higher provisions with higher gross non-performing loans. Other variables, such as deposits, bank size, and transactional income, did not show statistically significant effects, although their coefficients indicated positive relationships with gross NPLs. Additionally, the relationship between transactional income and gross non-performing loans appears negative and not statistically significant, suggesting that higher digital income may slightly reduce NPLs, though this effect is very weak.

Table 4. Regression Analysis Result (Net NPL)

Net NPL Model

Source	SS	df	MS	Number of obs	=	10
Model	.000034513	5	6.9026e-06	F(5, 4)	=	3.69
Residual	7.4912e-06	4	1.8728e-06	Prob > F	=	0.1152
				R-squared	=	0.8217
				Adj R-squared	=	0.5987
Total	.000042004	9	4.6671e-06	Root MSE	=	.00137

NetNPLRatio	Coefficient	Std. err.	t	P> t	[95% conf. interval]
TransactionalIncomeFinTechPr	-1.51e-07	1.01e-07	-1.49	0.210	-4.33e-07 1.30e-07
BankSizeTotalGrossExposure	1.60e-09	9.66e-10	1.66	0.172	-1.08e-09 4.29e-09
TotalCustomersDeposits	-3.92e-09	2.66e-09	-1.47	0.215	-1.13e-08 3.47e-09
LoansLossProvisionLLP	-1.31e-09	1.10e-08	-0.12	0.911	-3.18e-08 2.92e-08
Equity	9.26e-09	4.54e-09	2.04	0.111	-3.36e-09 2.19e-08
_cons	.0069592	.0138143	0.50	0.641	-.0313955 .0453139

This model showed high explanatory power, with an R^2 of 82.17% (0.8217). However, the model was not statistically significant ($Prob > F = 0.1152$). None of the independent variables, including loan loss provisions, customer deposits, and bank size, showed statistically significant effects. However, the coefficients indicated that the relationships between these variables and net non-performing loans were positive but not statistically significant, suggesting that other non-financial factors, such as write-off and collection policies and collateral quality, influence net non-performing loans. For the net NPL model, transactional income showed a negative relationship with net NPLs, indicating a weak impact of fintech on reducing net non-performing loans.

Comparison with Previous Studies

The weak and statistically insignificant relationship between FinTech adoption and NPLs in Oman may be explained by several factors. First, the relatively early stage of digital transformation in the Omani banking sector may limit the immediate impact of FinTech on credit risk management. Second, cultural and behavioral factors, including customer trust and adoption rates of digital financial services, may influence the effectiveness of FinTech tools. Third, the fintech proxy used constrains the full integration of advanced technologies such as AI-based credit scoring systems.

These findings are consistent with studies conducted in emerging economies such as Ghana, Nigeria, and Nepal, where the impact of FinTech on financial performance and risk indicators remains gradual and context-specific.

The results of this study are partially consistent with the findings of Wang et al. (2023), who found that investments in FinTech, particularly in technical personnel, are negatively associated with high-risk loans and NPL ratios. However, in this study, the negative relationship between transactional income and NPL was weak and not statistically significant in both the gross and net NPL models, indicating a limited impact of fintech adoption on reducing NPLs at the selected bank. This is also supported by Abdullah (2024), which showed that an increase in non-performing loans (NPLs) and loan loss provisions accelerates credit risk, causing banks to be more cautious in lending, which in turn reduces the amount of lending.

CONCLUSION AND RECOMMENDATIONS

This study finds that while FinTech adoption shows a negative relationship with non-performing loans, the effect remains weak and statistically insignificant in the Omani banking context. These findings suggest that the benefits of FinTech in credit risk management require a longer time horizon and broader implementation across multiple digital dimensions.

From a policy perspective, regulators should encourage deeper FinTech integration by promoting digital lending frameworks, AI-based credit risk assessment, and enhanced data-sharing mechanisms. Banks should invest in advanced analytics and digital infrastructure to strengthen credit evaluation processes. Furthermore, expanding financial inclusion through digital platforms could improve borrower quality and reduce default risk over time.

REFERENCES

1. Abdullah, W., Rahmati, S., Mohammad, A., Al-Hajj, N., & Khalaf, B. A. (2024). Does Non-performing Loans Affect Bank Lending Behavior?. In *The AI Revolution: Driving Business Innovation and Research: Volume 2* (pp. 919-933). Cham: Springer Nature Switzerland.
2. Afroj, F., Dutta, C. B., & Farjana, F. (2024). Interrelationship between bank efficiency and non-performing loans: evidence from Bangladesh. *Journal of Banking and Financial Technology*, 8(1), 29-44.
3. Akerlof, G. A. (1970). A market for "lemons": Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics*, 84(3), 488–500. <https://doi.org/10.2307/1879431>
4. Albi, R. U., Komalasari, A., & Syaipudin, U. (2025). The Influence of Earnings Quality, Banking Technology, Operational Efficiency, and Non-Performing Loans (NPL) on Firm Value. *Jurnal Economic Resource*, 8(1), 315-321.
5. Allen, F. & Anthony M. Santomero. (1997). A theory of financial intermediation. *Journal of Banking & Finance*, 21(11–12), 1461–1485. [https://doi.org/10.1016/S0378-4266\(97\)00032-0](https://doi.org/10.1016/S0378-4266(97)00032-0)
6. Ally, O. J., Kulindwa, Y. J., & Mataba, L. (2025). Financial technology and credit risk management: the case of non-performing loans in Tanzanian banks. *Cogent Economics & Finance*, 13(1), 2459188.
7. Atisu, J. C., Mensah, N., Alipoe, S. A., & Rahman, S. A. (2024). The Effect Of Non-Performing Loans On The Financial Performance Of Commercial Banks In Ghana. *IOSR Journal of Economics and Finance*, 15(5), 42-48.
8. Baharuddin, C., Liutfi, A., Ar, D. P., Rizal, M., & Sasmita, H. (2025). Non Performing Loan Resolution Strategies and Impact on Financial Performance. *Golden Ratio of Mapping Idea and Literature Format*, 5(2), 106-114.
9. Bhattarai, Y. R. (2016). Effect of non-performing loan on the profitability of commercial banks in Nepal. *Prestige International Journal of Management and Research*, 10(2), 1-9.
10. Beck, T. (2020). FinTech and financial inclusion: Opportunities and pitfalls. *Asian Development Bank Institute Working Paper Series*, 1165. <https://doi.org/10.2139/ssrn.3383615>
11. Chai, Y., & Sun, S. (2024). Can the development of fintech mitigate non-performing loan risk? *Finance Research Letters*, 67(Part B), 105889. <https://doi.org/10.1016/j.frl.2024.105889>
12. Chen, F. W., Feng, Y., & Wang, W. (2018). Impacts of financial inclusion on non-performing loans of commercial banks: Evidence from China. *Sustainability*, 10(9), 3084.
13. Chukwu, G. N., Muritala, T. A., Akande, J. O., & Adekunle, A. O. (2024). Impact of Non-Performing loan on bank performance in Nigeria. *Journal of Law and Sustainable Development*, 12(6), e3796-e3796.
14. Davis, F. D., & Venkatesh, V. (1996). A critical assessment of potential measurement biases in the technology acceptance model: Three experiments. *International Journal of Human-Computer Studies*, 45(1), 19–45. <https://doi.org/10.1006/ijhc.1996.0040>
15. ISAKOV, O. (2024). Factors affecting non-performing loans: Empirical evidence from commercial banks in Uzbekistan. *Journal of Economics and Financial Analysis*, 8(2), 1-21.
16. Li, X., Yang, J., & Zhang, X. (2025). Fintech and the NPL Provisioning Coverage Ratio: Facilitating or Inhibiting. *Asia Pacific Economic and Management Review*, 2(4).
17. Mamatzakis, E., & Tsionas, M. (2018). Decomposing global bank productivity growth: the role of non-performing loans, equity and technology (No. 18-41).

18. Ozili, P. K. (2022). Bank non-performing loans in the fintech era. *International Journal of Financial Innovation in Banking*, 3(2), 95-112.
19. Qin, Z., & Jing, Z. (2025). Fintech adoption and credit risk mitigation: Evidence from Chinese commercial banks. *Sustainability*, 17(22), 10294. <https://doi.org/10.3390/su172210294>
20. Sadok, H., & El Hadi El Maknouzi, M. (2025). Evaluation of the fintech era on the performance of Moroccan banks: analysis through non-performing loans. *F1000Research*, 13, 1365.
21. Safitri, M., & Oktavia, V. (2022). The role of interest rates on the effect of non-performing loans and capital adequacy ratios on banking profitability (case study on conventional commercial banks listed on the Indonesia stock exchange 2016-2020). *Jurnal Cakrawala Ilmiah*, 1(7), 1785-1796.
22. Serkbayeva, Z., Zhumabayeva, M., Kassenova, G., Karimbayeva, G., Faizulayev, A., & Kulumbetova, D. (2024). Examining the impact of fintech and other factors on banking practices: QISMUT+ 3 countries. *Cogent Business & Management*, 11(1), 2385069.
23. Sewanyina, M., Nyambane, D., Manyange, M., & Ongesa, T. (2025). Managing non-performing loans in the banking sector: Determinants, impacts, and innovative solutions: A systematic literature review. *F1000Research*, 14, 486.
24. Shrestha, P. M., & Khadka, K. K. (2024). Impact of non-performing loan on profitability of Nepalese commercial banks. *Researcher CAB: A Journal for Research and Development*, 3(1), 62-75.
25. Vatansever, M., & Hepsen, A. (2015). Determining impacts on non-performing loan ratio in Turkey. *Journal of Applied Finance and Banking*, 5(1), 1.
26. Vives, X. (2019). Digital disruption in banking. *Annual Review of Financial Economics*, 11, 243–272. <https://doi.org/10.1146/annurev-financial-100719-120854>
27. Wang, H., Mao, K., Wu, W., & Luo, H. (2023). Fintech inputs, non-performing loans risk reduction and bank performance improvement. *International Review of Financial Analysis*, 90, 102849
28. Yang, C. C. (2017). Reduction of non-performing loans in the banking industry: an application of data envelopment analysis. *Journal of Business Economics and Management*, 18(5), 833-851.
29. Zeb, A., Ashraf, A., Israr, S., & Meghwar, D. R. (2024). Financial Technology's Impact On The Non-Performing Loans Held by Commercial Banks In Pakistan. *Kashf Journal of Multidisciplinary Research*, 1(12), 1-10.