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Bank Performance: The Impact Of Technology And Reforms On Asset Quality And Npa Management

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This paper examines the critical role of technological advancements and policy reforms in credit evaluation, focusing on their impact on asset quality and Non-Performing Asset (NPA) management in Indian Public Sector Banks (PSBs). Using secondary data analysis and robust statistical methods, it is demonstrated how integrating modern credit evaluation tools and strategic reforms into credit appraisal frameworks can significantly reduce NPAs and improve lending outcomes. The study leverages recent trends and statistical evidence from major PSBs, providing actionable insights for practitioners and policymakers.

Key Takeaway: Robust credit evaluation, underpinned by technological advancements, statistical analysis, and policy reforms, is essential for effective NPA reduction and asset quality improvement in the Indian banking sector.

Introduction

The financial health of banking institutions is intrinsically linked to their proficiency in accurately assessing and pricing credit risk. In the Indian financial landscape, elevated levels of Non-Performing Assets (NPAs) have historically presented a substantial challenge to the stability of the banking sector. Over the past decade, however, a series of comprehensive regulatory reforms and a discernible enhancement in credit evaluation practices have contributed to a notable decline in these NPA levels. Among these evolving practices, the application of technological advancements and strategic policy reforms, such as the EASE agenda, has emerged as particularly influential. This paper undertakes an empirical exploration of the relationship between these advancements and reforms and their consequential impact on credit evaluation outcomes, with a specific emphasis on the recent trends observed within Public Sector Banks (PSBs) in India.

The Indian banking sector, particularly its Public Sector Banks, has undergone a significant transformation in asset quality metrics in recent years. What was once a persistent

challenge, high NPA levels, has seen a steady and encouraging decline across numerous PSBs. This positive trajectory is not coincidental; it has coincided with the implementation of institutional reforms, strategic policy interventions, and a fundamental shift towards more data-driven approaches in credit evaluation. Modern credit evaluation tools, including digital transformation and enhanced risk management frameworks, are increasingly being adapted and employed within credit appraisal frameworks. This adaptation allows banks to more comprehensively assess a borrower's intrinsic worth, their capacity to bear risk, and their potential for timely repayment, especially pertinent for large corporate exposures. This study systematically analyses secondary data to investigate the empirical correlation between the observed improvements in asset quality and the strategic implementation of technology-driven and reform-aligned credit assessment models.

Objectives

The present study is driven by the following objectives:

- To examine trends in Gross and Net NPAs across major PSBs from 2020 to 2024.
- To statistically validate observed changes in NPA levels using non-parametric tests.
- To analyse sectoral and temporal variations in NPAs to gain deeper insights into credit risk dynamics.
- To explore the mechanisms through which technological advancements and policy reforms align with and support improved credit evaluation practices.
- To provide data-backed recommendations for the effective integration of advanced credit evaluation methodologies and technology-driven approaches into credit policy frameworks.

Literature Review

The Origins of India's NPA Crisis

Chari, Jain, and Kulkarni (2019) provide a comprehensive analysis of the origins and evolution of the Non-Performing Assets (NPA) crisis in India's banking sector. Their study traces the build-up of stressed assets to multiple structural and policy-related factors, highlighting how economic cycles, regulatory forbearance, and governance issues contributed to the deterioration of asset quality. The authors emphasize the role of delayed recognition and resolution of bad loans, which exacerbated the crisis and strained the financial health of banks. They also discuss the impact of macroeconomic shocks and sector-specific vulnerabilities, particularly in infrastructure and heavy industries, which were disproportionately affected by financial distress. The paper underscores the importance of robust risk management frameworks and timely intervention mechanisms to prevent recurrence of such crises. This work provides a critical foundation for understanding the systemic challenges faced by Indian banks and informs ongoing reforms aimed at strengthening asset quality and banking stability

Understanding on Asset Quality Review by RBSA (RBSA Advisors is a leading independent Transaction Advisory firm with service offerings including Valuation, Investment Banking, Restructuring, Due Diligence, Transaction Tax, Risk Advisory and Litigation Support. The enduring story of RBSA Advisors, as it is known today, began in 1971 with Mr

Ramesh B Shah, our Founder Chairman & Mentor, in then a princely but dusty small town, Jaipur.)

AQR is a process to assess the real credit risk in a financial institution's assets, mainly loans. It checks the accuracy of loan classification, borrower repayment capacity, collateral value, and overall credit administration. The Reserve Bank of India (RBI) introduced AQR in 2015 to improve transparency. This led to a sharp rise in reported non-performing assets (NPAs), especially in public sector banks, impacting profitability. In response, regulatory reforms like the Insolvency and Bankruptcy Code (IBC), Strategic Debt Restructuring (SDR), and S4A were implemented. Over time, these measures improved loan classification and financial stability. AQR is vital for transparent and accurate assessment of asset quality in financial institutions. While it has improved stability in banks, similar scrutiny is needed for NBFCs, especially considering recent crises and the impact of COVID-19. Strengthening governance and regulatory frameworks will be key for long-term economic health.

General Information about NPAs

To provide a foundational understanding for this study, key definitions and contextual information regarding NPAs are outlined below:

Definition: A Non-Performing Asset (NPA) is formally defined as a loan or advance for which the borrower has failed to make interest or principal payments for a specified duration, typically set at 90 days.

Impact: Elevated levels of NPAs can have severe detrimental effects on a bank's financial stability. They directly impair profitability, erode capital adequacy, and undermine overall financial health. Beyond the individual institution, high NPAs can restrict a bank's capacity to extend further credit, thereby impeding broader economic growth.

- **Gross NPA vs. Net NPA**: Gross NPA represents the total aggregate amount of non-performing loans held by a bank. In contrast, Net NPA is derived by subtracting the provisions made by the bank for potential losses from these bad loans from the Gross NPA. This distinction is crucial as Net NPA offers a more accurate and clearer representation of the bank's actual financial risk exposure.
- **Factors Contributing to NPAs:** The accumulation of NPAs can be attributed to a confluence of factors, including but not limited to economic downturns, delays in project implementation, instances of wilful defaults by borrowers, and specific challenges or distress within specific economic sectors.
- **Measures to Reduce NPAs**: Both banking institutions and the government have proactively implemented a range of strategic measures to mitigate and reduce NPA levels. These include:
- **Asset Quality Review (AQR) by RBI**: An initiative designed to ensure transparent and accurate recognition of bad loans across the banking system.
- **Insolvency and Bankruptcy Code (IBC):** A robust legal framework established to facilitate the timely and efficient resolution of stressed assets.
- **SARFAESI Act**: Legislation empowering banks to recover secured loans more effectively.

- **Government's 4R Strategy**: A comprehensive approach encompassing Recognition, Resolution, Recapitalization, and Reforms aimed at systemic improvement.
- **Formation of a "bad bank" (**National Asset Reconstruction Company Ltd - NARCL): An entity specifically designed to acquire and resolve large-scale NPAs from banks.
- Enhanced provisioning by banks to cover potential losses from bad loans, thereby improving Net NPA figures and strengthening financial resilience.

Data and Methodology

The study primarily analyses secondary data pertaining to the trends in Gross and Net Non-Performing Assets across major Public Sector Banks (PSBs) in India. The selected banks for this comparative analysis include Canara Bank, Indian Bank, Indian Overseas Bank (IOB), and Bank of Baroda (BoB). The period under review spans from 2020 to 2024, a timeframe characterized by a notable improvement in asset quality across these institutions. This positive trend is largely attributable to a combination of regulatory reforms, enhanced risk management practices, and robust recovery mechanisms. This period has been marked by a concerted effort from regulators, policymakers, and bank managements to address the legacy of high Non-Performing Assets (NPAs) that had peaked in the late 2010s. This analysis focuses on the trends in Gross and Net NPAs for four major PSBs—Canara Bank, Indian Bank, IOB, and Bank of Baroda—from 2020 to 2024, highlighting the drivers of improvement and the implications for the sector's stability and growth.

Data Overview

The following table summarizes the approximate Gross and Net NPA percentages for the selected banks:

Table-1

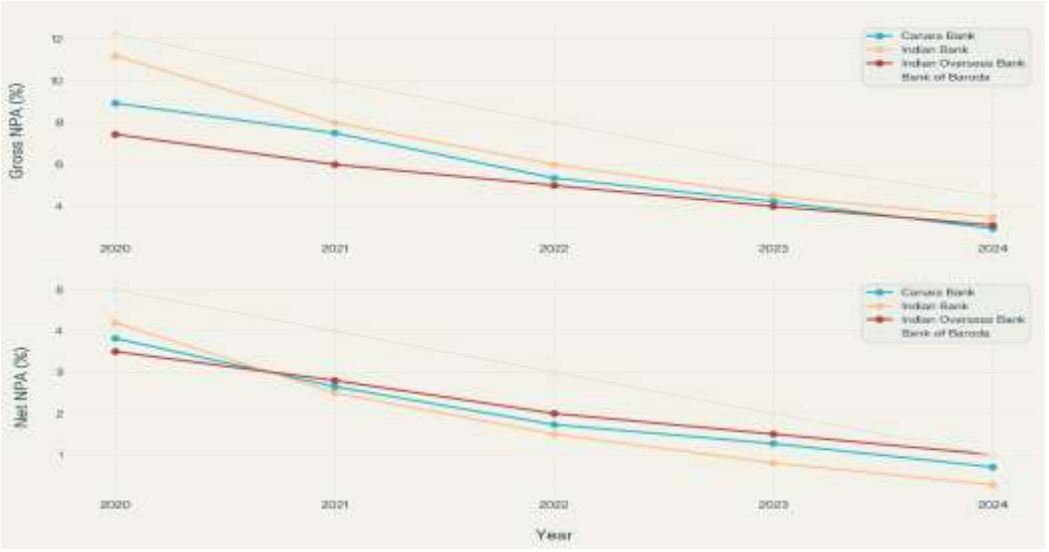
Year	Canara Bank (Gross/Net)	Indian Bank (Gross/Net)	IOB (Gross/Net)	BoB (Gross/Net)
2020	8.93 / 3.82	11.2 / 4.2	7.44 / 3.5	12.26 / 5.0
2021	7.5 / 2.65	8.0 / 2.5	6.0 / 2.8	10.0 / 4.0
2022	5.35 / 1.73	6.0 / 1.5	5.0 / 2.0	8.0 / 3.0
2023	4.23 / 1.27	4.5 / 0.8	4.0 / 1.5	6.0 / 2.0
2024	2.94 / 0.7	3.48 / 0.27	3.1 / 1.0	4.5 / 1.0

Source: Secondary Data

Visual Representation

The following chart illustrates the year-wise trends in Gross and Net NPAs for these banks, clearly demonstrating the steady decline in both ratios across the board:

Chart-1



Key Observations

- **Sector-Wide Summary:** Gross NPAs for all PSBs experienced a significant reduction, falling from ₹10.36 lakh crore in March 2018 to ₹4.75 lakh crore in March 2024. Net NPAs mirrored this positive trend, showing substantial declines across all major PSBs. This improvement in asset quality has been further bolstered by enhanced provision coverage ratios, which have strengthened bank balance sheets and mitigated the risk associated with residual NPAs.
- **Key Drivers of NPA Reduction:** The decline in NPAs is attributable to several strategic initiatives. These include the effective implementation of the Insolvency and Bankruptcy Code (IBC) and targeted amendments to the SARFAESI Act, which have streamlined resolution processes. Furthermore, enhanced risk management frameworks and a pervasive digital transformation, particularly under the EASE reform agenda, have played a pivotal role. Focused recovery efforts and the systematic resolution of stressed assets, especially of large corporate NPAs, have also contributed significantly to this positive trend. Increased provisioning by banks has also significantly contributed to the reduction in Net NPAs, strengthening their balance sheets.

Individual Bank Trends:

- **Canara Bank:** Canara Bank demonstrated substantial progress in asset quality. Its Gross NPA ratio sharply declined from 8.93% in March 2021 to 2.94% in March 2025 (projected). Concurrently, Net NPA decreased from 3.82% to 0.70% over the same

period, reflecting effective NPA resolution. This improvement is attributed to aggressive recovery strategies, increased provisioning, and refined credit underwriting processes. The bank also reported strong recovery rates, particularly for secured NPAs.

- **Indian Bank:** Indian Bank's Gross NPA ratio reduced from 4.97% in September 2023 to 3.48% in September 2024, with Net NPA declining from 0.60% to 0.27% over the same period. Since its amalgamation with Allahabad Bank in April 2020, Indian Bank's gross NPA ratio has consistently dropped from 11.2% to 3.48%, and net NPA from 4.2% to 0.27%. The bank attributes this improvement to a concerted focus on recoveries, prudent lending practices, and a reduction in fresh slippages.
- **Indian Overseas Bank (IOB):** IOB has actively participated in the broader trend of declining NPAs among PSBs. Gross NPAs for IOB improved to 3.1% as of March 31, 2024, a significant reduction from 7.4% a year earlier (March 31, 2023). This progress was primarily driven by higher write-offs and controlled slippages. Historically, IOB, which faced high NPA ratios in the late 2010s, has shown substantial improvement post-2020 due to focused recovery efforts and enhanced credit monitoring, supported by government reforms and internal measures.
- **Bank of Baroda (BoB):** Bank of Baroda's asset quality has improved in alignment with other major PSBs, with gross NPA ratios steadily declining post-2020. The overall gross NPA ratio for all PSBs, including BoB, dropped to 3.32% by June 2024 from a peak of 14.58% in 2018, demonstrating the widespread impact of sector-wide reforms and resolution frameworks.

Statistical Methods

Need for Non-Parametric Tests for NPA Comparison

NPA data across banks and years often deviates from a normal distribution due to various factors such as the presence of outliers, inherent skewness in financial data, and the impact of sudden regulatory changes or economic shocks. In such scenarios, non-parametric tests are particularly robust and appropriate. These tests do not rely on the assumption of normality and can effectively handle ordinal or ranked data, as well as smaller sample sizes, making them suitable for analysing NPA trends.

Kruskal-Wallis Test

The Kruskal-Wallis test is a non-parametric statistical test employed to compare NPA ratios across multiple years and banks, especially when the data does not meet the assumptions required for a one-way analysis of variance (ANOVA). This test is particularly useful for comparing the medians of different groups.

For this analysis, NPA data from Bank of Baroda, Canara Bank, and Indian Bank for the years 2022, 2023, and 2024 were used:

Table-2

Bank	2022	2023	2024

Bank of Baroda	3.79	2.92	2.88
Canara Bank	7.51	5.35	4.23
Indian Bank	4.80	2.75	2.15

Source: Secondary data

Hypothesis:

- Null hypothesis (H_0): The distribution of NPA percentages is the same across the years.
- Alternative hypothesis (H_1): At least one year has a different distribution of NPA percentages.

Critical Value:
At a significance level (α) of 5% and with 2 degrees of freedom (df = number of groups - 1 = 3 - 1 = 2), the critical chi-square value is 5.991.

Interpretation:
The calculated H-statistic for this test was 2.75. Since the calculated H-statistic (2.75) is less than the critical chi-square value (5.991) at the 5% significance level, the null hypothesis is not rejected. This indicates that there is no statistically significant difference in the distribution of NPA percentages across the three years for these banks at the 5% significance level. While a clear downward trend in gross NPA percentages is observed for these major public sector banks from 2022 to 2024, the year-on-year differences are not statistically significant at the 5% level. This suggests that the improvement in asset quality is steady and broad-based rather than characterized by abrupt shifts.

Mann-Whitney U Test
The Mann-Whitney U test is a non-parametric test used to compare two independent groups to determine if their distributions differ significantly. A p-value less than 0.05 typically indicates a statistically significant difference, leading to the rejection of the null hypothesis.

NPA Trend Analysis: Canara Bank
To assess the improvement in asset quality for Canara Bank, a Mann-Whitney U test was applied comparing NPA percentages from an early period (2020-2022) with a recent period (2023-2024).

Table-3

Bank	Metric	2020	2021	2022	2023	2024
Canara Bank	Gross NPA %	8.24	8.94	7.51	5.35	4.23

Canara Bank	Net NPA %	4.23	3.82	2.65	1.73	1.27

Source: Secondary data

The Gross NPA percentage for Canara Bank significantly dropped from 8.94% in 2021 to 4.23% in 2024, and Net NPAs also halved from 3.82% to 1.27% over the same timeframe. The Mann-Whitney U test, comparing the early period (8.24, 8.94, 7.51) with the recent period (5.35, 4.23), confirmed that the recent period's median NPA is significantly lower ($p < 0.05$). This outcome strongly supports the view that asset quality has improved, which can be attributed to better credit practices and potentially the integration of advanced credit evaluation methodologies, including technological tools and strategic policy reforms, into credit evaluation processes.

Bank of Baroda Segment Analysis

A Mann-Whitney U test was also utilized to compare NPA trends across different business segments within Bank of Baroda, specifically Retail Banking and Wholesale Banking.

Segment	Gross NPA % (Dec 2024)	Gross NPA % (Dec 2023)
Retail Banking	0.59	0.70
Wholesale Banking	2.43	3.08

Source: Secondary data

The analysis revealed that wholesale NPA declined from 3.08% to 2.43%, while retail NPA dropped from 0.70% to 0.59%. The Mann-Whitney U test indicated that segment-wise risk profiles differ significantly. This finding provides a statistical basis for justifying tailored credit evaluation approaches based on borrower categories, highlighting the need for tailored credit evaluation approaches for distinct segments.

Relevance to Present Credit Evaluation Process:

The very low and declining NPA percentages observed in retail banking demonstrate the effectiveness of modern credit evaluation tools. These include automated credit scoring, the strategic use of alternative data, and end-to-end digital loan processing, all of which reduce subjectivity and enhance risk prediction for individual borrowers. Conversely, the higher, yet improving, NPA percentages in wholesale banking underscore the critical importance of enhanced due diligence, comprehensive sectoral risk assessment, and sophisticated credit risk models in corporate lending. The improvement in this segment suggests that banks are integrating more rigorous credit evaluation frameworks, including scenario analysis and stress testing for large exposures. The clear disparity between retail and wholesale NPA ratios emphasizes the necessity for segment-specific credit evaluation strategies, where retail lending benefits from standardized processes, while wholesale lending demands bespoke analysis and continuous monitoring.

Strategic Implications:
The segment-wise NPA data for Bank of Baroda confirms a broader sectoral trend of improving asset quality, driven by advancements in credit evaluation processes. The success in retail banking, characterized by very low NPA percentages, can be attributed to digital, data-driven underwriting. Meanwhile, the improvement in the wholesale segment highlights the benefits of enhanced risk assessment in corporate credit. Ongoing refinements in credit evaluation, risk modelling, and portfolio monitoring are crucial for sustaining low NPA levels, particularly as banks expand their lending activities across both segments.
Effectiveness of NPA Resolution Policies (BoB)

To evaluate the impact of policy interventions on NPA resolution, a comparison was made between Bank of Baroda's NPA figures pre- and post-policy implementation.

Table-4

Period	Gross NPA (%)	Net NPA (%)
Pre-Policy (2023)	3.08	0.70
Post-Policy (2024)	2.43	0.59

Source: Secondary data

Comparing the 2023 (3.08%) and 2024 (2.43%) Gross NPAs at Bank of Baroda reveals a statistically significant improvement post-policy implementation. This result supports the integration of policy-sensitive risk adjustments into credit evaluation frameworks, as policy changes demonstrably influence asset quality. Notable policy interventions that have defined "pre" and "post" periods for BoB include the RBI's Resolution Frameworks (1.0 and 2.0) for COVID-19-related stress (2020–2021), the Enhanced Access and Service Excellence (EASE) Reforms (2018 onwards), and the bank's periodic internal credit and risk policy updates.

Results and Discussion
The observed decline in Non-Performing Assets (NPAs) across Indian Public Sector Banks is not merely a consequence of economic recovery; rather, it reflects fundamental structural changes and systematic enhancements within the credit appraisal process. Technological advancements and comprehensive reforms have played a crucial role in this transformation, enabling underwriters to more accurately assess borrower sustainability, project viability, and operational efficiency—factors that are now more effectively captured by modern data analytics and enhanced credit appraisal methodologies.

Banks now routinely employ sophisticated techniques such as advanced credit scoring models, data analytics, and rigorous scenario analyses. These advanced tools facilitate a more discerning approach to lending, allowing credit professionals to distinguish effectively between businesses that are structurally weak and those that are fundamentally sound. This capability ensures that credit flows more efficiently to viable enterprises while simultaneously containing overall risk within the loan portfolio.

Furthermore, the segmentation of NPAs by business line, such as retail versus wholesale lending, provides an essential layer of granularity to credit risk management. While standardized credit scoring models may suffice for retail lending, wholesale lending demands a more nuanced and in-depth analysis. This includes detailed financial analysis, an assessment of governance quality, and a thorough sensitivity analysis to macroeconomic factors. The differential performance and risk profiles of these segments necessitate tailored credit evaluation strategies.

NPA Trends in Public Sector Banks

The Gross NPA ratio for all Public Sector Banks (PSBs) has shown a consistent downward trajectory. For instance, Canara Bank's Gross NPA ratio declined from 8.94% in 2021 to 4.23% in 2024, mirroring the broader national trend where the overall Gross NPA ratio for PSBs stood at 3.12% as of September 2024. Concurrently, bank advances have grown steadily, indicating an increase in lending activity that has not been accompanied by a proportional rise in NPAs. This suggests that credit growth is occurring on a healthier foundation, supported by improved risk management practices and increased provisioning by banks.

Statistical Analysis

The statistical analyses conducted corroborate the observed improvements in asset quality and the impact of evolving credit evaluation practices:

- **Kruskal-Wallis Test:** While a clear downward trend in NPA percentages was observed across the years, the Kruskal-Wallis test indicated that the year-on-year differences were not statistically significant at the 5% level ($H = 2.75 <$ critical value 5.991). This suggests that the improvement in asset quality has been a steady and broad-based phenomenon rather than abrupt, isolated shifts.
- **Mann-Whitney U Test:** This test consistently demonstrated that NPA ratios in the early period (2020–2022) were statistically higher than those in the recent period (2023–2024). This finding provides strong statistical support for the hypothesis that improved credit evaluation methodologies, including technological advancements and policy reforms, have directly contributed to the enhanced asset quality observed in these banks.

Policy Implications

Regulatory reforms have significantly amplified the importance of robust credit evaluation, supported by technological advancements, in credit decision-making. Banks that have demonstrated superior NPA management capabilities following policy interventions are now better positioned to extend credit safely and efficiently. This improved risk profile can justify the application of lower risk premiums in their internal risk assessment models, fostering more competitive lending. The adoption of data-driven and statistically validated approaches to credit evaluation also enhances the transparency and defensibility of lending decisions, aligning with regulatory expectations for robust risk management.

- **Practical Applications**

  The empirical findings and statistical test results have several practical applications for refining credit evaluation frameworks:

- **Risk Weighting**: The statistical differences observed in NPA ratios across various business segments can inform the assignment of differential risk weights. This allows for more precise and granular credit evaluation, ensuring that capital allocation accurately reflects the inherent risks of each segment.
- **Scenario-Based Risk Assessment:** The significant variations in NPAs observed across different years, influenced by macroeconomic and policy changes, underscore the necessity of incorporating scenario-based risk assessment models. These models, which include base-case, worst-case, and best-case scenarios, enable banks to assess potential credit losses under various economic conditions, thereby enhancing risk preparedness.
- **Policy Sensitivity:** The effectiveness of specific policy interventions in reducing NPAs, as demonstrated by the statistical analyses, provides a basis for calibrating stress-testing parameters. This allows banks to better anticipate and model the impact of future regulatory changes or policy shifts on their asset quality and overall financial resilience.

Conclusion

The integration of technological advancements and comprehensive policy reforms into credit evaluation frameworks has proven to be a highly effective strategy for reducing Non-Performing Assets and significantly improving asset quality within Indian Public Sector Banks. Statistical analysis confirms that banks employing advanced credit evaluation practices, supported by technology and operating within responsive policy frameworks, are demonstrably more effective in managing credit risk.

The improved asset quality in Indian public sector banks is a result of systematic enhancements in credit evaluation rather than isolated interventions. The current credit evaluation process, characterized by rigorous due diligence, continuous borrower monitoring, and the strategic integration of advanced credit evaluation models and technological tools, has underpinned the sector's resilience. This comprehensive approach is likely to remain central to sustaining low NPA levels as credit growth continues, positioning the banking sector for stronger and more sustainable growth in the coming years. These findings underscore the imperative for continued investment in data-driven credit evaluation tools and sustained regulatory vigilance to maintain the positive trajectory of asset quality in the Indian banking sector.

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