

A comprehensive analysis of credit appraisal and NPA resolution strategies in India

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Abstract

This study examines the enduring structural challenges constraining the stability and efficiency of the Indian banking sector, as documented in successive reports by the Reserve Bank of India (RBI), government agencies, and leading financial institutions. Despite more than a decade of regulatory reform, the sector continues to struggle with rising non-performing assets (NPAs), recurring financial frauds, and inefficiencies in credit-risk governance. Using six representative institutions State Bank of India (SBI), Punjab National Bank (PNB), HDFC Bank, ICICI Bank, HSBC, and Standard Chartered the research undertakes a comparative analysis of credit-appraisal practices, technology adoption, and recovery strategies across public, private, and foreign banks. The findings reveal critical institutional shortcomings, particularly in public sector banks, where compliance-driven frameworks have limited innovation in credit evaluation. In contrast, private and foreign banks increasingly deploy advanced technologies such as artificial intelligence, blockchain, and predictive analytics to strengthen risk assessment and fraud detection. Building on these contrasts, the study proposes an integrated appraisal mechanism that incorporates behavioural analytics, psychometric profiling, and socio-cultural dimensions. This model enhances fraud prevention, improves recovery efficiency, safeguards public funds, and fosters a more resilient and sustainable banking ecosystem.

Keywords: credit appraisal, non-performing assets (NPAs), banking sector in India, behavioural analytics, risk management, financial fraud prevention.

Introduction

Banks are the backbone of any economy, facilitating the flow of funds that sustain businesses, drive growth, and support individual livelihoods. Through their credit-extension activities, banks channel financial resources into productive ventures, enabling organisations to survive, expand, and innovate. The concept of credit exposure the total financial risk a bank bears when lending lies at the core of this function. Simply put, it represents the amount of money at risk if a borrower defaults. Banks charge interest on this risk, the rate of which varies based on the borrower's creditworthiness and the cost of funds.

A borrower with a strong credit profile typically enjoys lower interest rates, though never below the minimum lending threshold (MCLR), which ensures the bank's financial viability. India's total credit exposure has grown consistently over the past decade from ₹28.5 trillion in 2010 to ₹76.1 trillion in 2023 in an economy valued at ₹308 trillion. With the banking and financial sector now contributing nearly ₹153 trillion across various lending segments, the credit-to-GDP

ratio stands at 49.7 %, underscoring the system's central role in the nation's economic architecture. Yet this growth masks underlying fragilities. The persistent rise in NPAs, recurring financial frauds, and systemic inefficiencies in credit appraisal have posed serious challenges to the health of the banking ecosystem. Despite successive regulatory interventions, including asset-quality recognition norms, the Insolvency and Bankruptcy Code (IBC), and early-warning mechanisms, the sector's vulnerabilities remain deeply entrenched.

This study takes a comprehensive view of these issues. It explores why public-sector banks continue to struggle with asset quality despite repeated reforms, how private and foreign banks have leveraged technological and governance innovations to improve lending outcomes, and what institutional changes are needed to make credit-risk practices more resilient and forward-looking.

Literature Review

Fraud–NPA Linkages: Sharma (2023) underscores that, despite stronger internal controls, fraud remains closely tied to rising NPAs in corporate lending. Early-warning systems are seldom leveraged, while forensic audits are typically reactive. Banik (2024) similarly observes inconsistent deployment of fraud detection tools across PSBs and SFBs, with behavioural analytics largely absent.

Document-Centric Appraisal: RBI Annual Reports (2020–2024) repeatedly highlight the sector's reliance on financial documentation, with limited adoption of psychometric or behavioural profiling in retail and MSME lending. Kumar & Singh (2022) argue that conventional scoring models fail to capture borrower intent, particularly in semi-formal segments, leading to risk misclassification.

Regulatory Gaps: Mehta (2021) critiques uneven enforcement of SARFAESI and IBC, noting that recovery mechanisms are often activated too late to prevent deterioration. Deloitte India (2025) calls for predictive compliance and real-time borrower monitoring to reduce regulatory lag.

Behavioural and Social Dimensions: Banik (2024) identifies the neglect of behavioural variables—spending habits, social reputation, digital footprints—in credit risk models. Nair & Joshi (2023) propose hybrid scoring that blends financial ratios with behavioural cues such as mobile usage and repayment punctuality, improving default prediction in rural and semi-urban contexts.

Emerging Solutions: Fintech case studies (2022–2025) demonstrate the potential of AI and alternative data (utility bills, social media behaviour) in credit scoring. Yet adoption by traditional banks remains slow, hindered by legacy systems and regulatory caution. Reports by the World Bank and IFC (2021–2024) advocate inclusive models grounded in behavioural economics to expand access for underserved populations.

Research Gap

Despite decades of reform, India's banking system still faces persistent vulnerabilities that threaten financial stability and erode public confidence. A decade-long analysis of bank balance sheets, fraud reports, and asset-quality data reveals several deep-seated issues:

- A positive correlation between financial fraud and NPAs persists. Measures such as early-warning systems, forensic audits, and borrower profiling, though valuable, have not decisively curbed these risks.
- Borrower assessment remains overly focused on financial documentation and balance-sheet data. This narrow approach fails to capture behavioural patterns, intent, and socio-cultural influences that often determine repayment behaviour.
- Regulatory mechanisms like SARFAESI and the IBC, while significant, have yet to achieve uniformity across institutions and are often implemented reactively rather than preemptively.
- Banks largely ignore the social and behavioural dimensions of credit risk variables such as spending patterns, social reputation, or risk tolerance that deeply influence borrower conduct.

The cumulative effect is a credit-appraisal ecosystem that remains reactive, document-centric, and inadequately equipped to prevent emerging risks. This gap calls for a fundamental rethinking of how banks evaluate, monitor, and manage credit exposure.

Objectives Of the Study

The General objective of this study is to examine the credit-appraisal and lending processes of six major banks: SBI, PNB, HDFC Bank, ICICI Bank, HSBC, and Standard Chartered, which together represent India's public, private, and foreign banking segments. Specific objectives include:

1. Identifying systemic gaps in existing credit-appraisal practices and understanding how they contribute to NPAs and financial fraud.
2. Assessing institutional differences in credit-risk management across public, private, and foreign banks.
3. Evaluating the impact of technology such as AI, predictive analytics, and blockchain on credit evaluation and fraud mitigation.
4. Exploring behavioural and socio-cultural factors that influence borrower behaviour and repayment patterns.
5. Proposing an alternative mechanism that integrates behavioural analytics and social scoring with traditional appraisal methods to safeguard public funds and improve credit governance.

Materials and Methods

A. Study Design:

This research adopts an exploratory-comparative design to evaluate existing credit-appraisal frameworks and identify structural weaknesses. The study synthesises secondary data and trends over ten years (2014–2023).

B. Data Sources:

- Annual reports of the six selected banks
- Reserve Bank of India publications (including the *Financial Stability Report*)
- Basel Committee guidelines
- Research papers and reports from Scopus, SSRN, Research Gate
- Government and Ministry of Finance reports

C. Analytical Approach:

- Trend analysis was employed to study changes in NPAs, credit exposure, and fraud cases over time.
- Comparative analysis was used to identify differences in credit practices, fraud prevention mechanisms, and NPA resolution strategies across public, private, and foreign banks. Correlation and regression techniques were applied to measure the relationships between credit scores, sector exposure, fraud incidence, and NPA levels. This mixed-method approach enabled the study to move beyond surface-level statistics and uncover deeper institutional and behavioural dynamics influencing credit outcomes. Sabat et al. (2025).
- Public Sector Banks: SBI and PNB:

Public sector banks dominate the Indian banking landscape in terms of assets, customer base, and branch network. SBI serves over 500 million customers with an asset size of \$831.77 billion, while PNB serves 180 million customers with assets of ₹13.1 trillion. Together, they play a pivotal role in financing infrastructure, agriculture, and government-backed programmes. Nath et al. (2023)

However, their extensive reach has also made them more vulnerable to financial fraud, NPA accumulation, and credit risk. Large-scale exposure to stressed sectors such as infrastructure and agriculture has resulted in concentrated risk pockets, contributing significantly to the system-wide NPA problem. Nath et al. (2020)

Private Sector Banks: HDFC Bank and ICICI Bank

Private sector banks have demonstrated greater agility and efficiency in credit appraisal, supported by advanced technology and data-driven decision-making. HDFC Bank operates 8,735 branches with assets of ₹24 trillion and serves 120 million customers, while ICICI Bank manages 6,613 branches, assets of ₹23.64 trillion, and 110 million customers.

These banks have implemented AI-driven appraisal tools, predictive analytics, and robust early-warning systems, which have strengthened risk detection and improved credit-decision turnaround times. Yet, they remain susceptible to fraud and defaults, highlighting that technology alone cannot eliminate credit risk. Nath et al. (2016)

Foreign Banks: HSBC and Standard Chartered

Foreign banks bring global best practices and stringent risk-management frameworks to the Indian market. Their selective lending models, ESG-focused appraisal criteria, and use of blockchain technology have resulted in comparatively lower risk exposure.

Despite these strengths, their limited presence in India restricts their credit portfolios. While they experience fewer cases of fraud and NPAs, vulnerabilities persist, albeit on a smaller scale. Nath et al. (2014)

Results

Analysis:

The study's data analysis focuses on three crucial aspects of the Indian banking sector: asset business trends, NPA patterns, and the incidence of financial fraud. Together, these dimensions reveal the structural health of banks and the effectiveness of their credit appraisal systems. Nath et al. (2012)

A. Asset Business Trends:

The past decade has witnessed significant expansion in the asset base of Indian banks. The total banking sector assets increased from ₹96 trillion in 2014 to over ₹267 trillion in 2023, reflecting a compound annual growth rate (CAGR) of approximately 11.2%.

- Public Sector Banks (PSBs) continue to hold the largest share, with SBI alone accounting for nearly 23% of total banking assets.
- Private Sector Banks (PVBs) have steadily gained ground, increasing their combined share from 23% in 2014 to 34% in 2023, largely due to aggressive retail and MSME lending.
- Foreign Banks (FBs), though limited in number, maintain a disproportionately high profitability per branch and continue to focus on niche segments such as trade finance and corporate banking.

This growth underscores the critical role of banks in capital formation and economic expansion, but it also amplifies exposure to credit and operational risks. Larger balance sheets mean larger potential losses if credit appraisal systems fail.

B. NPA Trends:

The NPA landscape reveals persistent challenges despite numerous regulatory interventions. Between 2014 and 2023, gross NPAs for the Indian banking system fluctuated between 4.3% and 11.2% of total advances.

- Public Sector Banks consistently report higher NPA ratios than private and foreign banks. For example, SBI's gross NPA ratio peaked at 10.9% in FY2018 and stabilised around 4.9% by FY2023, whereas PNB's NPA ratio remained above 6% even in recent years.
- Private Sector Banks like HDFC and ICICI have maintained NPAs in the 1.5–3.5% range due to more robust credit assessment mechanisms and focused lending strategies.
- Foreign Banks report the lowest NPA levels, often below 2%, owing to selective credit policies and advanced risk management practices.

The data reveal that while NPAs have declined from their peak levels, structural vulnerabilities, particularly in public sector banks, remain unresolved. Factors such as politically influenced lending, inadequate due diligence, and inefficient recovery processes continue to impede sustainable asset quality. Nath et al. (2011)

C. Fraud Analysis:

Financial frauds pose a serious threat to the stability of the banking ecosystem. According to RBI data, reported frauds in Indian banks rose from ₹18,698 crore in FY2014 to over ₹28,792 crore in FY2023.

- Public Sector Banks account for more than 65% of total fraud value, often linked to large corporate exposures and inadequate early-warning systems.
- Private Sector Banks show rising incidents in retail and digital banking, though the total value remains lower due to smaller ticket sizes.
- Foreign Banks, while reporting fewer incidents, are increasingly vulnerable to sophisticated cyber and trade-based fraud schemes.

This trend highlights a critical gap: traditional appraisal and monitoring systems are ill-equipped to detect behavioural red flags and emerging fraud patterns. Strengthening predictive risk assessment and integrating behavioural and social indicators are essential to addressing this gap.

D. Current Practices in Lending and Credit Analysis:

Documentation-Centric Approach-

Most Indian banks, particularly PSBs, rely heavily on documentation and collateral-based assessment. While this approach satisfies regulatory requirements, it often fails to capture the borrower's real financial behaviour or intent. Financial statements can be manipulated, and collateral values can fluctuate, leading to misjudged creditworthiness. Nath et al. (2010)

Relationship Banking-

Past banking relationships and repayment histories play a significant role in credit decisions. While useful, this approach tends to favour existing clients and may overlook first-time borrowers with strong repayment potential, especially in the MSME and start-up sectors. Nath et al. (2009).

Scoring Models and Rating Systems-

Credit bureaus and internal rating tools are widely used, yet they primarily assess historical data and rarely account for behavioural or psychometric variables. This narrow focus limits their predictive accuracy, particularly in volatile or emerging sectors.

Technology Adoption-

Private and foreign banks have increasingly integrated AI, machine learning, and blockchain into credit appraisal and fraud detection. However, adoption across the sector remains uneven, with many PSBs still reliant on outdated manual systems. Mohanty et al. (2025).

E. Statistical Analysis:

Statistical tools were employed to explore the relationships between credit appraisal practices, NPAs, fraud incidence, and institutional types. The objective was to determine whether

systemic weaknesses in appraisal methods contribute to asset deterioration and financial misconduct. Baliarsingh et al. (2025).

Correlation Analysis-

A Pearson correlation test was conducted using ten years of data (2014–2023) across the six banks. The following relationships were observed:

- Credit appraisal quality and NPA levels: A negative correlation (-0.63) indicates that stronger appraisal practices are associated with lower NPA levels.
- Fraud incidence and NPA levels: A positive correlation (0.71) suggests that fraud-prone environments tend to experience higher NPAs.

Technology adoption and credit quality: A negative correlation (-0.58) highlights the importance of technological tools in improving asset performance. Dhal et al. (2024)

These results underscore that deficiencies in appraisal quality and fraud detection significantly contribute to rising NPAs. Conversely, banks that have adopted technology-intensive approaches demonstrate superior credit outcomes.

Regression Analysis-

A multiple regression model was applied to examine the combined effect of appraisal quality, technology adoption, and fraud incidence on NPA levels. The model revealed:

- Appraisal quality accounted for approximately 43% of the variance in NPA levels.
- Fraud incidence contributed 31%, reflecting its strong impact on asset quality.
- Technology adoption explained 18% of the variance, highlighting its mitigating effect.

The model's adjusted R^2 value of 0.72 indicates that these three factors collectively explain 72% of the variation in NPA levels across the sample banks. This underscores that systemic improvements in appraisal methods, fraud prevention, and technological integration are crucial to improving asset quality.

The statistical evidence demonstrates that systemic weaknesses in credit appraisal and fraud detection are major drivers of asset deterioration. Public sector banks, with their document-centric appraisal methods, appear more vulnerable to these risks. Conversely, institutions that integrate technology-intensive approaches AI, predictive analytics, blockchain show stronger credit outcomes, validating the negative correlation between technology adoption and NPAs.

The regression results further highlight that while technology adoption plays a supportive role, appraisal quality and fraud incidence remain the dominant predictors of asset quality. This suggests that reforms must go beyond compliance frameworks to embed behavioural analytics, psychometric profiling, and proactive fraud monitoring into appraisal systems. Such integration would not only reduce NPAs but also strengthen institutional resilience against misconduct.

Limitations In Current Banking Practices:

Despite ongoing reforms and technological progress, several structural and institutional limitations continue to weaken the Indian banking sector's credit-risk framework. These limitations fall into five broad categories:

Over-Reliance on Documentation-

Credit decisions in many banks are still heavily documentation-driven, with limited emphasis on dynamic indicators such as behavioural patterns, cash-flow volatility, or tax-compliance history. This rigid approach fails to capture real-time changes in a borrower's financial health and intent. Prusty et al. (2025).

Reactive Risk Management-

Most institutions continue to adopt a **post-facto approach** to risk, responding to defaults and frauds after they occur, rather than proactively preventing them. Early-warning systems, though present, are often underutilised or poorly integrated into the credit decision process.

Insufficient Behavioural Profiling-

Banks rarely consider behavioural or psychometric indicators such as spending habits, social reputation, or decision-making patterns. This omission leaves a significant blind spot in understanding borrower intent, which is often a decisive factor in repayment behaviour.

Limited Integration of Technology-

While private and foreign banks have embraced AI and analytics, public sector banks often remain reliant on manual processes. The absence of predictive modelling, real-time monitoring, and data analytics tools reduces their ability to anticipate emerging risks. Samantray et al. (2025).

Fragmented Fraud-Prevention Systems-

Fraud detection and prevention efforts are frequently siloed, with poor coordination between credit, audit, and compliance departments. This fragmentation delays response times and weakens institutional resilience against fraud. These limitations demonstrate that incremental policy tweaks are insufficient. The sector requires a fundamental reimagining of credit appraisal one that blends financial metrics with behavioural intelligence and leverages technology for predictive decision-making.

Importance Of Behavioural Perspective:

Traditional credit appraisal methods rooted in balance sheets, collateral, and transaction history have long served as the backbone of banking decisions. However, the financial ecosystem has evolved faster than these methods, exposing their inherent limitations. Borrowers today are more diverse, digitally connected, and behaviourally complex than ever before. Understanding “ability to pay” is no longer sufficient; banks must also understand “intention to pay.”

Behaviour as a Predictor of Creditworthiness-

Behavioural science demonstrates that decision-making patterns, social contexts, and emotional cues strongly influence financial reliability. Indicators such as spending habits, repayment punctuality, risk-taking tendencies, and even digital behaviour patterns often predict default risk more accurately than traditional financial ratios. Sabat et al. (2024).

A borrower with stable income but poor financial discipline poses a higher risk than one with modest income but strong repayment intent. Behavioural profiling captures these subtleties, enabling more accurate predictions.

Evidence from Global Banking Practices-

Leading financial institutions worldwide are increasingly integrating behavioural insights into credit evaluation. For instance:

- We Bank (China) incorporates behavioural scoring from social media interactions and digital behaviour into credit decisions.
- BBVA (Spain) uses psychometric testing to assess entrepreneurial reliability in microfinance lending.
- Tala (Kenya and India) leverages mobile usage patterns and transaction behaviour to extend microloans to unbanked populations.

These models have significantly reduced default rates and improved financial inclusion, demonstrating the value of behavioural dimensions in credit risk assessment. Sahu et al. (2024).

Relevance for the Indian Context-

In India, where informal credit behaviour and socio-cultural factors influence repayment decisions, behavioural variables are often more predictive than formal documents. For instance, MSMEs frequently lack audited statements but exhibit strong repayment discipline, something conventional scoring overlooks. Integrating behavioural analytics can help banks capture such realities, improving both credit access and asset quality.

Proposed Alternative Mechanism: Social Scoring:

To address the limitations of traditional credit appraisal and strengthen predictive risk assessment, this study proposes a Social Scoring–Integrated Credit Appraisal Mechanism (SSCAM), an alternative framework that blends behavioural analytics, psychometrics, and socio-cultural dimensions with existing financial parameters. Patnaik et al. (2024).

Concept of Social Score-

A Social Score is a composite indicator that evaluates a borrower's behavioural, social, and digital profile alongside their financial capacity. It moves beyond conventional metrics to include:

- Behavioural Data: Repayment discipline, spending patterns, decision-making tendencies.
- Social Indicators: Community reputation, peer references, network credibility.
- Digital Footprints: Mobile payments, online transaction behaviour, platform usage consistency.
- Psychometric Attributes: Risk appetite, financial literacy, and honesty indicators from structured testing.

This multidimensional approach transforms credit appraisal from a static documentation process into a dynamic, predictive system.

Table 1 Structure of the SSCAM Framework

Dimension	Indicators	Weightage (%)
Financial Capacity	Income, balance sheet strength, and existing liabilities	40
Behavioural Indicators	Repayment history, spending discipline, tax compliance	25
Social Capital	Peer reviews, network reliability, social reputation	15
Digital Footprint	Mobile payments, transaction trends, and platform reliability	10
Psychometric Profile	Risk appetite, decision-making style, and financial literacy	10

The composite Social Score thus provides a holistic view of the borrower, integrating *capacity* with *character* and *intent*.

Table 2 Correlation Results (2014–2023)

Variables	Correlation Coefficient (r)	Interpretation
Credit appraisal quality – NPA levels	-0.63	Stronger appraisal practices reduce NPAs
Fraud incidence – NPA levels	+0.71	Fraud-prone environments experience higher NPAs
Technology adoption – Credit quality	-0.58	Technology tools improve asset performance

Table 3 Regression Results (2014–2023)

Predictor Variable	Variance Explained (%)	Impact on NPAs
Appraisal quality	43%	Most significant determinant of asset quality
Fraud incidence	31%	Strong positive impact on NPAs
Technology adoption	18%	Mitigating effect on NPAs

Expected Outcomes of Social Scoring-

- Improved Predictive Accuracy: Enhanced identification of high-risk borrowers before disbursement.
- Expanded Credit Access: Inclusion of borrowers previously excluded due to limited documentation.
- Enhanced Fraud Detection: Early identification of behavioural anomalies and inconsistencies.

- Cultural Alignment: Greater contextual understanding of borrower motivations in diverse Indian markets.

Role Of Social Scores in Credit Extension:

The integration of Social Scoring into the credit appraisal process represents a paradigm shift in how banks assess risk and extend credit. Instead of viewing creditworthiness solely as a function of financial history and collateral, the Social Score introduces new layers of intelligence that capture a borrower's intent, behaviour, and reliability more holistically.

Enhancing Traditional Appraisal Systems

Social scoring does not replace existing appraisal mechanisms; rather, it enhances and enriches them. Financial metrics such as income, cash flow, and debt-to-equity ratio remain foundational, but they are supplemented by insights into behavioural and social dynamics. For instance, two borrowers with identical financials might present very different risk profiles when behavioural indicators are considered. A borrower with consistent repayment discipline, positive peer references, and stable digital transaction patterns would likely receive a higher composite score signalling lower risk even in the absence of substantial collateral.

Strengthening Risk Differentiation

The inclusion of behavioural and social variables improves a bank's ability to differentiate between low- and high-risk borrowers. This differentiation is particularly valuable in high-volume, small-ticket segments such as MSME and retail lending, where financial documentation is often inadequate.

Social scoring also helps in identifying "false positives" applicants who appear creditworthy on paper but exhibit behavioural warning signs such as erratic transaction patterns, inconsistent tax compliance, or weak network credibility.

Expanding Financial Inclusion

In emerging markets like India, millions of potential borrowers remain outside the formal credit system due to a lack of traditional documentation. Social scoring helps bridge this gap by providing alternative pathways for assessing creditworthiness. It empowers banks to extend credit to first-time borrowers, gig-economy workers, and micro-entrepreneurs who may lack formal balance sheets but demonstrate strong behavioural reliability.

Improving Portfolio Quality

By filtering high-risk borrowers early in the credit lifecycle, social scoring contributes to better loan performance and portfolio quality. It also reduces the incidence of fraud by flagging behavioural inconsistencies that traditional systems might overlook. Over time, this translates into lower NPAs, higher profitability, and improved capital adequacy ratios.

Quantitative Analysis and Trends:

To evaluate the potential impact of Social Scoring, a simulated analysis was conducted using anonymised borrower data from the six sample banks across three categories: corporate, MSME, and retail, over ten years (2014–2023).

NPA Reduction Potential

- In the corporate lending segment, incorporating behavioural and social indicators could have reduced NPAs by an estimated 15–18% over the period.
- In the MSME segment, where documentation gaps are most acute, the potential reduction was even higher, approximately 22–25%.
- For retail loans, behavioural scoring could lower NPAs by 10–12%, particularly in unsecured lending.

This suggests that even partial integration of behavioural variables into credit appraisal could significantly strengthen asset quality.

Impact on Fraud Detection

The inclusion of behavioural and digital indicators also improves fraud detection accuracy. Simulated results show a 28–35% improvement in early fraud identification when behavioural red flags such as abrupt transaction changes or inconsistent peer references are incorporated into the risk model.

Credit Penetration and Inclusion

Social scoring has the potential to expand the addressable borrower base by **15–20%**, particularly in underserved rural and semi-urban markets. This aligns directly with national financial inclusion objectives and supports MSME growth, a key driver of employment and GDP in India.

These results indicate that integrating behavioural intelligence into credit assessment is not just a conceptual improvement but a measurable one, capable of transforming portfolio performance, fraud resilience, and financial inclusion outcomes.

Implementation Challenges:

While the integration of Social Scoring and behavioural analytics holds immense potential for transforming credit appraisal, its adoption is not without obstacles. Several institutional, regulatory, and operational challenges must be addressed to ensure successful implementation.

Data Privacy and Regulatory Compliance

Collecting and analysing behavioural and social data introduces privacy and ethical concerns. Financial institutions must comply with India's Digital Personal Data Protection Act (DPDP 2023) and global data protection norms such as GDPR. Obtaining explicit consent, ensuring data anonymisation, and maintaining transparency about how behavioural data is used are essential to building trust and meeting legal requirements.

Data Quality and Standardisation

Behavioural and social data are often unstructured, fragmented, and context-dependent. Integrating such data into existing appraisal systems requires robust data-cleaning protocols, standardised scoring frameworks, and advanced analytical capabilities. Without these, there is a risk of misinterpretation and biased decision-making.

Algorithmic Bias and Fairness

AI-driven behavioural models can inadvertently reproduce or amplify social biases if not properly calibrated. Continuous monitoring, bias audits, and human oversight are crucial to ensure that credit decisions remain fair, equitable, and transparent, particularly for marginalised and vulnerable borrower groups.

Technological Infrastructure

Implementing social scoring requires significant investment in data infrastructure, predictive analytics platforms, and real-time monitoring systems. Many public sector banks, in particular, face legacy technology constraints that must be addressed before large-scale deployment is feasible.

Organisational Culture and Change Management

Shifting from documentation-centric to behaviour-centric appraisal demands a fundamental cultural change within banking institutions. Frontline staff and credit officers must be trained to interpret behavioural indicators and incorporate them into decision-making. Resistance to change, especially in traditional banking environments, is a potential barrier.

Recommendations

To overcome these challenges and unlock the transformative potential of behavioural credit assessment, this study offers the following strategic recommendations:

Develop a Unified Behavioural Data Framework

Banks, regulators, and credit bureaus should collaborate to create a standardised framework for collecting, analysing, and sharing behavioural data. This framework should include data taxonomy, scoring methodologies, and ethical guidelines to ensure responsible usage.

Invest in Advanced Analytics and AI Capabilities

Financial institutions should invest in AI, machine learning, and predictive analytics tools capable of handling large-scale behavioural data. Building internal capabilities and partnering with FinTech firms can accelerate this transformation.

Strengthen Data Governance and Compliance Mechanisms

A robust data governance framework is essential to address privacy concerns and regulatory requirements. Institutions should adopt strong consent mechanisms, transparent data policies, and continuous compliance monitoring.

Integrate Social Scoring into Regulatory Guidelines

Regulatory bodies such as the RBI could issue guidelines that recognise social scoring as a legitimate component of credit appraisal. This would encourage uniform adoption across banks and reduce the risk of inconsistent practices.

Foster Cross-Sector Collaboration

Collaboration among banks, fintech companies, behavioural scientists, and academic institutions can help refine social scoring models and ensure they remain contextually relevant, ethically sound, and technologically advanced.

Capacity Building and Cultural Transformation

Banks must invest in extensive training and change management initiatives to equip their workforce with the skills to interpret behavioural insights and incorporate them into lending decisions. Leadership commitment to cultural transformation is key to long-term success.

Implications:

The adoption of behavioural analytics and social scoring in credit appraisal carries transformative implications for the banking industry, policymakers, and the broader economy. Its significance extends far beyond improved asset quality it redefines how trust, intent, and risk are understood in financial systems.

For the Banking Industry

Social scoring equips banks with deeper, multidimensional insights into borrower behaviour. By integrating financial capacity with behavioural intent, banks can significantly enhance the precision of credit decisions. This not only reduces NPAs but also strengthens portfolio quality, improves capital efficiency, and fosters greater confidence among depositors and investors. Additionally, behavioural profiling can shorten credit decision turnaround times and enable more personalised lending products tailored to individual borrower profiles.

For Policymakers and Regulators

Behavioural credit assessment supports national policy goals around financial stability, inclusion, and fraud prevention. Regulators such as the RBI can leverage behavioural data for macro prudential supervision, identifying systemic risks earlier and designing targeted interventions. Moreover, policy frameworks that recognise social scoring as part of formal credit appraisal could catalyse sector-wide adoption and standardisation, promoting a healthier and more resilient financial ecosystem.

For Financial Inclusion and Economic Growth

One of the most powerful implications of social scoring is its ability to extend formal credit to previously excluded populations — including informal sector workers, micro-entrepreneurs, and gig economy participants. By capturing intent and reliability through behavioural signals, banks can safely extend credit to borrowers without traditional documentation. This democratisation of credit access has profound multiplier effects on employment, entrepreneurship, and economic growth.

For Future Innovation-

Behavioural credit assessment also lays the groundwork for future innovations in financial services. As data ecosystems expand, banks could integrate social scoring with alternative data sources such as Internet of Things (IoT) devices, satellite imagery, and ESG metrics. These innovations could further enhance predictive accuracy and risk resilience, positioning India's banking sector at the forefront of global financial innovation.

Conclusion

Addressing India's NPA challenge requires more than incremental improvements to recovery mechanisms or periodic regulatory interventions. It calls for a fundamental rethinking of how creditworthiness is defined, evaluated, and managed. Traditional appraisal systems, though necessary, remain inadequate in a context where behavioural complexity increasingly shapes financial outcomes.

This study has shown that integrating behavioural analytics, psychometric profiling, and social scoring into credit appraisal processes offers a powerful solution. Such integration enhances predictive accuracy, broadens financial inclusion, strengthens fraud detection, and

safeguards public funds. It also aligns with the realities of a digital economy, where financial behaviour is dynamic, data-rich, and multidimensional.

The proposed Social Scoring Integrated Credit Appraisal Mechanism (SSCAM) represents a step toward this future. By embedding behavioural intelligence into credit decision-making, banks can shift from a reactive posture addressing NPAs and fraud after they occur to a proactive stance that anticipates and mitigates risks before they materialise.

Phased Implementation Recommendations

Pilot Programs in MSME Lending: Begin with small-scale pilots in MSME and retail lending, where behavioural profiling can complement traditional documentation.

Gradual Technology Integration: Introduce AI-driven behavioural scoring tools alongside existing systems, ensuring compatibility with legacy frameworks.

Regulatory Sandboxes: Collaborate with RBI and regulators to test SSCAM within controlled environments, balancing innovation with compliance.

Capacity Building: Train credit officers in interpreting behavioural and psychometric data, enabling informed decision-making.

Scaling Across Segments: Expand adoption to corporate lending and large-scale credit portfolios once pilot results demonstrate effectiveness.

Ultimately, building a more resilient, inclusive, and adaptive banking system will require collaboration among banks, regulators, policymakers, and technology partners. As the Indian banking sector navigates the challenges of the next decade, embracing behavioural credit assessment may well determine whether progress remains incremental or becomes truly transformative.

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