Institutional Factors influencing Non-Performing Assets (NPA) in Indian Banking Sector and use of Artificial Intelligence as a remedial tool

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Abstract

Indian banking sector has not yet recovered from the problem of rising Non-Performing Assets (NPAs), especially the PSBs (Public Sector Banks). NPAs beyond a certain level are a cause for concern for everyone involved because credit is essential for economic growth and NPAs affect the smooth flow of credit. On the other hand, AI (Artificial Intelligence) technologies have matured now and are ready to be imple¬mented. They offer an exciting opportunity to establish new operational models and can provide scope to identify gaps in current financial sector functioning; uncovering opportunities and advantag¬es that can be seamlessly helpful to address the problem of rising NPAs.

Keywords: Artificial Intelligence (AI), Non-Performing Assets (NPA), Know Your Customer (KYC)

Introduction

Artificial intelligence (AI) is a recent technology enabler which refers to cognitive science where human brain simulations are carried out by machines for functions like logical reasoning, learning, self-correction, robotics, data interpretation etc. Big Data Analytics refers to the extraction of relevant insights from data using various techniques from fields like machine learning, computer programming, statistical modelling, pattern recognition, data warehousing, cloud computing etc. to discover unrecognized hidden patterns, unknown correlations, current market trends, basic customer preferences and other useful information that can help organizations make strategic business decisions. AI has been around since 1956 and it has continued to be a topic of experimentation for corporates, but it never really found its way into real world applications. However, the recent developments and maturity of certain underlying technologies meant that AI powered applications have now become commercially viable.

The key challenge going forward for Indian banks is to expand credit portfolio and effectively manage NPAs while maintaining profitability. Asset quality continues to be the basic function and also the biggest challenge for banks in the present dynamic environment. In order to overcome the perceived risks, there is an urgent need for banks to have well-structured and effective credit appraisal and monitoring system in place coupled with appropriate business models which can be powered by Artificial Intelligence technologies to effectively manage all the current issues revolving around recovery in stressed assets and thereby help in reduction of NPAs across all banks.

Significance of Study

In order to overcome the associated risks, there is an urgent need for banks to have well-structured and effective credit appraisal/monitoring system in place coupled with appropriate business models which can be powered by Artificial Intelligence technologies to effectively manage all the stages of Loan Delivery Mechanism & Factors

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affecting the NPA management process in India as shown in Fig, 1 below –

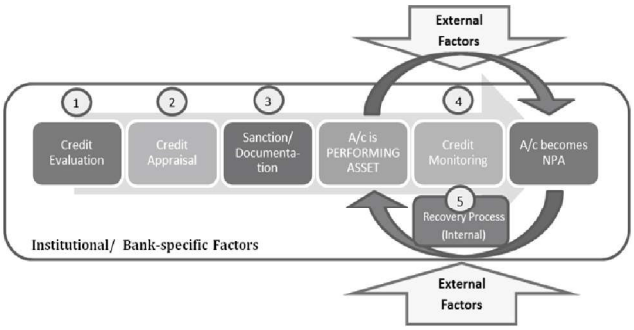


Fig.1: Stages of Loan Delivery Mechanism

Source: initiated by the researcher

This study therefore, seeks to fill this gap by establishing the link between NPAs, its practical determinants (bank-specific/institutional factors) and how AI technologies resolve the issue of NPA Management.

Research Objective

The objectives of the Research are to study the institutional/bank specific factors (at each stage of loan delivery mechanism) resulting in rise of NPAs in Indian Banking Sector and to suggest remedial mechanisms /strategies of how Artificial Intelligence (AI) technologies and Big Data Analytics can help in faster resolution of Non-Performing Assets.

Literature Review

A large number of researchers have studied the issue of NPA in banking industry but only a few studies have shown how Artificial Intelligence (AI) can be used in banking sector. A review of the relevant literature has been described. Sabharwal, M. (2014), concluded that only a few private sector banks in India are using AI technologies and its usage is also very limited to some common operations related work like cheque book-reorder facility etc. Selvarajan, B. & Vadivalagan, G. (2013) observed that NPAs of public sector banks are increasing very rapidly which impact the development of economy. The government has to park funds to bail out banks with budgetary provisions periodically and ultimately taxpayers bear the cost. Also, money which is borrowed for investment, if not utilized properly, affects asset creation. Chaudhary, S. & Singh, S. (2012) suggested that effective and controlled recovery management along with technological development are the key areas to look into, when it comes to reduction of NPAs in banking sector. Messai, A. S. & Jouini, F. (2013) talked about Insider lending as one of the main reasons of increase in NPLs. The study stated that loans are given by bias and favour to certain borrowers which results in accumulation of NPLs. As per the study, the interest rates also influence the level of NPLs, mostly in the case of floating interest rates. The study focussed that growth in GDP increases the income of borrowers and hence increases repayment capacity, which in turn helps in reduction of NPLs.

Shaardha, C. & Jain, A. (2016) noted that when Debt Recovery Tribunals (DRTs) were set up for loan recovery of banks and FIs, it resulted in quick recovery of loans in about 0-1 years as against 5 to 7 years which was earlier taken in civil suits. When we observe the recovery aspects of NPAs in public sector banks, inspite of having various recovery channels, like Lok Adalat, DRT, SARFAESI Act 2002, the study shows that the percentage of recovery of NPAs through SARFAESI Act, 2002 are more than any other recovery mode. Pandey, R., Patnaik, I. and Shah, A. (2016), in their study, have identified three main episodes of recession from 1996 to 2014. He asserted that understanding business cycles helps in estimating the phases where non-performing loans are expected to increase and have an impact on overall growth of the economy. He also suggested that it is important to see business cycles in order to understand the economic impact of various sectors when it comes to lending. Bank lends to sectors which are in growth phase and avoids stress-related sectors as they have to make more provisioning on lending to sensitive sectors as per Bank's loan policy and conditions changed from time to time.

Thiagarajan, S., Ayyappan, S. & Ramachandran, A. (2011) studied the NPA level of 22 public sector banks and 15 private sector banks. The study found that both macro-economic and bank-level factors are responsible for rise in NPAs. Even though NPA level in India had decreased from maximum in 1990s to minimum in 2008, the gradual increase of NPA during last few years has caused concerns for everyone. The study suggested that banks must have prudent credit policies to restrict bad effects of credit risk.

There is a significant inverse relationship between GDP growth and credit risk for both public sector and private sector banks. Sengupta, R. & Harshvardhan. (2017) suggested that timely recognition of bad assets and resolution action will help the banks to prevent crisis. In order for banks to take such speedy action, good governance and proactive banking regulation is required. Baruah, A.(2018) studied the applications of AI in top 4 Indian banks and concluded that Machine Learning in data analytics and customer service create the opportunity for exponentially more personalized and faster customer experiences, significantly better insights, and, automation of back-end workflows. D'Monte, L. (2018), concluded that Artificial Intelligence can process queries to answer the questions, finding information, and connecting the users with various banking service that allows users to make money transfers by talking to a robot computer system. AI can also monitor the spending behaviour and pattern of a user and flag any transaction which is questionable and out of its character. Ranjan, R. & Dhal, S.C. (2003) assessed how banks' NPLs are influenced by three major factors – Credit terms, Bank Risk preferences and Macroeconomic fluctuations. Credit Terms have significant impact on bank's NPLs as compared to other two factors. With regards to Credit terms, fluctuations in the cost of credit in terms of higher interest rates can spurt rise in NPAs. Dong, H. (2002) emphasized on the role of AMC (Asset Management Companies) in resolution of NPA problem in Indian Banking system. Policymakers should give importance to the role of AMCs and can be given independent goals for faster resolution of NPAs. Incentives can be devised for AMCs, they can have legal enforcement powers and AMCs in India should follow international best practices for better results. There should be transparency between banks and AMCs on terms and conditions. Banks should speed up process for debt restructuring in case of small unviable borrowers. Ahmad, N.H. & Ariff, M. (2007) studied credit risk determinants in developed economies of Australia, US, Japan, France and in emerging economies of India, Malaysia, Thailand, Mexico. The study, based on eight credit risk determinants, concluded that leverage is irrelevant to Bank's credit risk in several economies. Credit risk in banks of emerging economies is higher than that in developed economies. Credit risk is formed by more number of bank-specific factors in emerging economies in comparison to their peers.

Data Collection Methodology

Primary Data is collected through Structured personal interviews and Observation method with bankers at all management levels along with research scholars/corporates/Govt. officers.

Since the population size is very big it was not feasible to study the entire population, so the researcher identified around 130 bankers (comprising of Loan recommending officers, Sanctioning officers, Zonal heads and Top management executives) along with 40 corporate borrowers, 20 research scholars, 10 Govt. officers for the study (200 in total), out of which total following respondents were used to obtain normality of data -

Sr. No.	Description	Total
1	Loan Recommending Officers	47
2	Loan Sanctioning Officers	38
3	Regional/Zonal Heads	13
4	Top Management Executives (Chairman/ MD&CEO)	8
5	Others	
	1) Corporates	21
	2) Research Scholars	7
	3) Govt. Officers	4
	TOTAL	**137**

The justification for sample size is done to take the benefits of the Central limit Theorem. As the determination of sample size was based on the fact of known population (N=200), we followed the Yamane method: $n = N / (1 + Ne^2)$; where n = minimum sample size, e=0.05, N = 200. In our case, "n" comes out to be n = 133.33 , and hence our sample size of 137 is justified.

Data Interpretation/Theoretical Results

Respondents were asked to indicate various factors responsible for rise in NPAs in Indian Banking Sector due to **Institutional/Bank-specific factors** (covering various stages of loan delivery mechanism). Using Factor analysis, the Top 5 major reasons have been interpreted and mentioned below -

Institutional or Bank-Specific Factors Affecting NPAs

At Credit Evaluation Stage

Sr. No.	Top 5 Major Factors affecting NPAs at this Stage
1	Proof of Income / IT Returns of borrower not verified
2	Statement of Bank Accounts of the borrower not studied/verified; Confidential Report from other Existing Bankers not obtained
3	CIBIL /External Credit Scoring Report not scrutinized properly
4	Employment/Business verification not conducted properly; Residence verification not conducted as per Site Map / approved plan/ original title deed documents
5	Market Report of borrower including its suppliers/ customers not taken properly

The above table depicts five major factors affecting NPAs at Credit Evaluation stage. The major factors emanating from the research is that most often, in public sector banks, income proof is not verified by bank account statements / IT returns are not verified from Govt. websites. This results in incorrect calculation of permissible loan income and excess disbursement is made to borrowers who are later not able to repay high EMIs on time.

At Credit Appraisal Stage

Sr. No.	Top 5 Major Factors affecting NPAs at this Stage
6	Inordinate delay in sanctioning of loan (absence of TAT – turnaround time tracker) in many banks/FIs
7	Faulty Internal Rating by Appraiser due to personal bias/ Faulty External Credit Rating by Rating Agencies
8	KYC documents not verified; Certified copy of title deeds not verified from respective Registrar Office resulting in acceptance of fake title deeds
9	Overvaluation of Mortgaged Property done by Valuer based on influence/personal bias
10	Faulty Legal Search Report by advocate / Warning signals in Title Clearance report not properly scrutinized

The above table depicts major factors contributing to NPA at Credit Appraisal stage. In many cases of MSME loans, it was observed that mortgaged property is overvalued based on influence/personal bias. This results in permitting higher loan recommendation and when the account becomes NPA, it becomes difficult to sell the property at such high valuations. Also, at times, fake title deeds are submitted to banks which are not verified from Sub Registrar Offices. In these cases, bank is not able to recover any amount when the account becomes NPA. Mohnani, P., Deshmukh, M. (2013) suggested that banks should appoint a Regulatory/Review Committee to check the credit appraisal of banks through well documented and thought-after loan policy. Review should be done on weekly basis in order to curtail the increase of new accounts becoming stressed assets. The study considered SBI, PNB, ICICI, HDFC and analysed the NPA position during 2003 to 2012.

At Sanction/ Documentation Stage

Sr. No.	Top 5 Major Factors affecting NPAs at this Stage
11	Assets not created out of Bank Finance
12	Company Stamp/Signature of Borrowers not taken in important documents/ Proper Acknowledgement of Sanction credit terms not taken by borrower
13	Sanction Terms & Conditions not properly defined as per loan scheme
14	Abuse of power with Sanctioning authority (absence of layered structure); Deviation of Bank Policy resulting in over-financing/ wrong financing due to personal bias
15	Multiple financing done on same asset fraudulently

The above table depicts factors at sanction/disbursement stage when the assets are not created as per terms and conditions of sanction. Also, many times required documentation is incomplete. When the account becomes NPA and the bank approaches court of law, due to lack of proper documentation, the recovery action is delayed or the account remains NPA.

At Credit Monitoring Stage

Sr. No.	Top 5 Major Factors affecting NPAs at this Stage
16	A/c transactions not checked from time to time; Borrower is unaware about delays in repayment, correct EMI amount, sanction terms like submission of stock statement etc.
17	Disbursement carried out without compliance of sanction terms and conditions
18	Data cleansing/correction of system generated errors not handled properly by appraiser
19	End use of funds not ensured/ Diversion of funds done by the Borrower; Periodical inspection not done by appraiser from time to time
20	Insurance of property mortgaged/hypothecated not endorsed in favour of the Bank (In case of vehicle loans, hypothecation charge not endorsed in favour of the Bank etc.)

The above table shows irregularities at Credit Monitoring stage where end use of funds is not ensured and the borrower indulges in diversion of funds. Many large corporate loans are not monitored properly for diversion of funds which result in increasing NPAs of banks to a large extent. Ahmad, Z. & Jegadeeshwaran, M. (2013), in their study on level of NPAs of different nationalised banks, concluded that level of Gross NPA and Net NPA is having upward trend in all the nationalised banks but the growth rate is different which shows their relative efficiency in NPA management. Wilful defaults, improper due diligence and processing of loans, lack of proper monitoring are the causes for accounts for becoming bad assets.

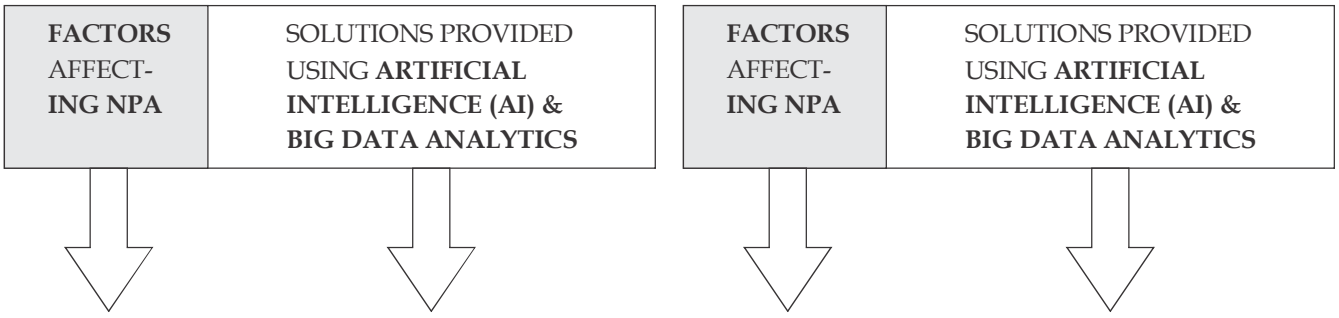
At Recovery Process Stage

Sr. No.	Top 5 Major Factors affecting NPAs at this Stage
21	Recovery Recall Notice not given at the right time; SARFAESI 13(2) / SARFAESI 13(4) notices made incorrectly by recovery officer
22	Borrower files complaint against the Bank/Financial institution; takes legal recourse to prevent securitization of his assets
23	Suitable action delayed by recovery officer due to personal bias with the borrower
24	Delays in getting Permission for recovery of assets by DM/ other competent court or authority
25	Expiry of validity of legal documents signed with borrower

The above table depicts factors why recovery process is delayed when the account becomes NPA. Many times, due to incorrect newspaper publications, the borrower challenges the banks in return. Borrower files complaint against the Banks and requests local authorities like District Magistrate to delay the recovery process. Many times, after legal documents get expired, there is inordinate delay in recovery of Bank dues in court of law. Kumar, P.T. (2013) studied the impact of NPAs in Indian Banking Sector and how it has impacted the profitability and development of economy. The study concluded that timely action for recovery should be initiated by Banks. NPA control measures should be taken with due diligence and proper credit appraisal techniques should be used.

Role of Artificial Intelligence in NPA Reducation

Based on level of expressivity and complexity of above factors, Arithmetic computational models can be designed to solve the particular problem. AI can use various logics in current practice (like propositional, temporal, first order logic etc.) to study the patterns that can prevent rise of NPA at various levels of Loan delivery mechanism. Various solutions in a nutshell (based on 30 factors list in point no.7) are given below –



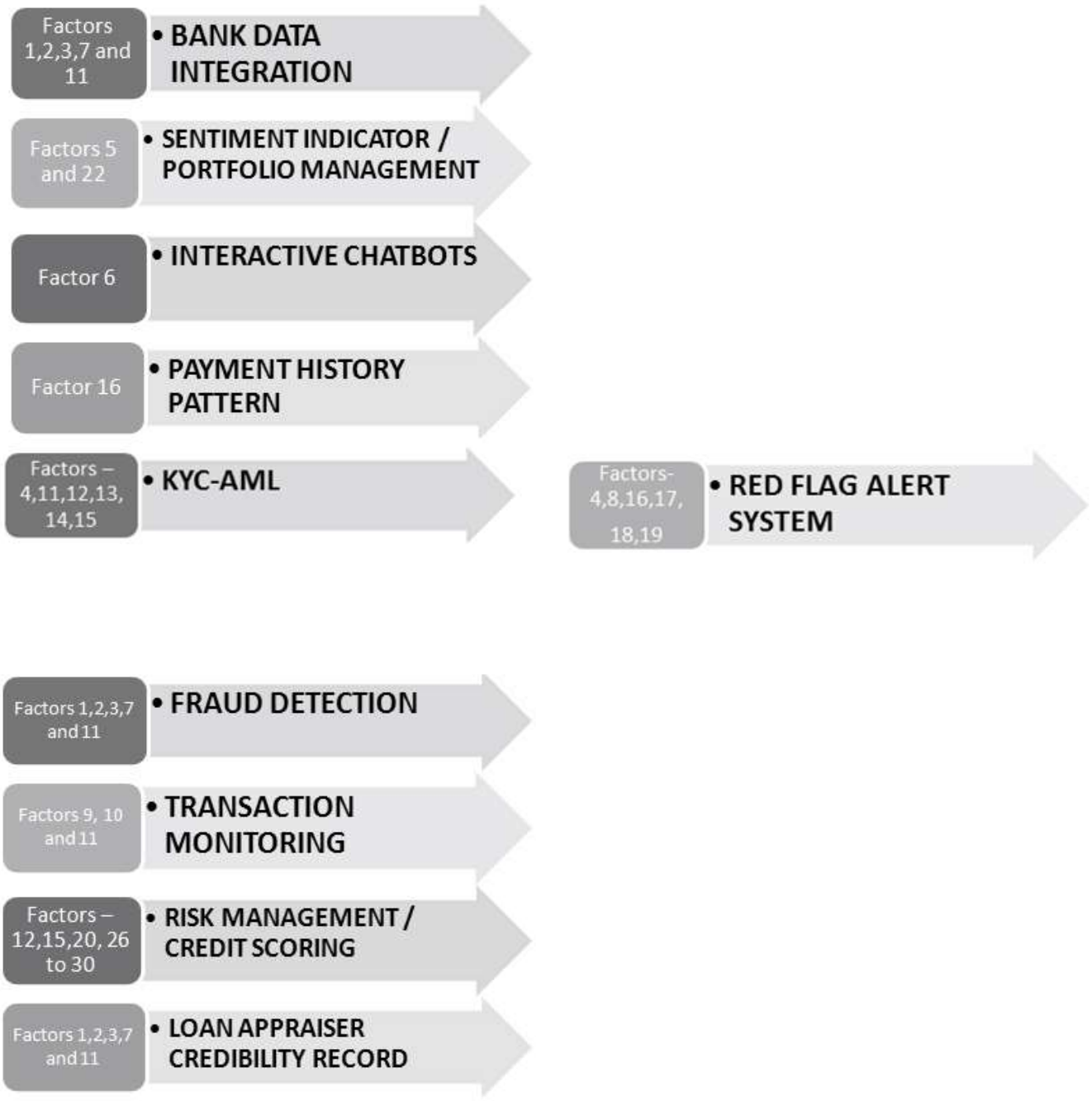


Fig. 2: NPA management using AI technologies and Big Data Analytics

Source: initiated by the researcher

The above figure depicts how NPA management can be done using Artificial Intelligence technologies and Big Data Analytics. Majority of the factors listed in above tables (like Factors – 1,2,3,7 and 11) are solved using Bank Data integration where Artificial Intelligence comes into play. In many cases, if Payment History pattern is generated beforehand, the probability of default can be minimised to a great extent. This can result in selection of creditworthy borrowers for loan sanctions.

The following are the AI related solutions that can help in NPA reduction -

Bank Data Intergation

Many customers maintain undisclosed accounts with other banks for doing transactions, that enables them to divert funds for other purposes, thereby leading to increase in default rate. Artificial Intelligence can help in integration of Data of a customer at one place by using his basic KYC details like Aadhar Card details; the data can be accessible to any banker at any point of time. This will help in knowing the current status of Banking of the customer INSTANTLY. Also, integration of Bank Data with various external agencies like Credit Scoring & Rating agencies (CRISIL, ICRA, CARE, Bloomberg), CIBIL, ECGC, RBI etc. will enable the Banks to know about customer instantly and prevent rise in NPA.

Sentiment Indicator/Portfolio Management

Social media data analytics companies use AI and machine learning techniques to provide 'sentiment indicators' to a number of financial services. This tool can be used to provide Market information about the loan applicant which can further help in increasing credit quality, thereby reducing the chances of NPA conversion. Along with this, the sentimeter indicators can help in cross-selling/portfolio management of various other banking products like recurring deposits, mortgage loans, vehicle loans etc. based on creditworthiness and customer preference data obtained using Data analytics.

Interactive Chatbots

Interactive chatbots can be used to make customers aware about their overdue amount, required to be deposited in the Bank. This service, available 24x7, can help customers with useful reminders on the due date of repayment, thereby reducing the chances of NPA conversion.

Payment History Pattern

Does the borrower repay the EMI in advance? Does he repay after 15 days/20 days/30 days from the due date? The Artificial Intelligence can help in recognizing Repayment habit patterns of a particular customer, which in turn will be helpful to bankers to take any credit decision.

Fraud Detection/KYC-AML

AI is being utilized to proactively monitor and prevent various instances of fraud, money laundering, malpractice and the detection of potential risks. For example, firms draw on individual's spending data and behaviour to determine patterns, enabling them to identify irregular transactions.

Transaction Monitoring

The transaction history of a customer contains valuable information about their purchasing and investment preferences. Though this transaction-related data is available with banks at an individual customer level, lack of appropriate business intelligence (BI) and data analytics capabilities has resulted in a less than optimal use of this data in providing customized products, services and investment solutions to customers. It will further help in monitoring of transactions of the borrower to prevent diversion of funds, which can in turn result in rise in NPA.

Risk Management

Internal and external rating of borrowal accounts also plays a vital role in determining credit quality of a loan application. AI helps in integrating data and providing correct information about the probability of default, by appropriately rating the loan applications into various categories like Management quality, Industry scope, Repayment capacity, networth of the borrower etc.

Credit Scoring

Banerjee, A.V., Cole, S. & Duflo, E. (2004) opined that banks are reluctant to make fresh lending decisions. In most of the cases, there is no significant change in growth of advances. Turnover-based lending may not be the best practice of lending, as is the case with most of the bankers because in such cases, borrowers may be able to finance growth out of

internal accruals and therefore do not need any external funds. Also, bank officers in India have a fear of being investigated when the account becomes NPA, which in turn reduces the intention of lending by honest bankers.

AI is being harnessed by lenders to calculate credit scores and develop credit profiles. With the use of AI algorithms that draw from various data entries such as an individual's banking transactions, their past decisions, their spending and earning habits and, familial history, mobile data etc. firms can make fast credit decisions.

Loan Appraiser Credibility Record

It is important for an organization to recognize the history pattern of loan sanctioning/recommending officers which have resulted in conversion of their accounts into NPA in the past and rate of default. Also, the records of frequent customer complaints, peer to peer review and overall outlook of the appraiser should be updated from time to time. For example – An officer continuously sanctioning a particular scheme of loan like collateral-free loans etc. should raise credibility issues and with the help of AI, the management can be warned if any unethical practices are being met. This will prevent NPA conversion of accounts to a large extent.

Red Flag Alert System

The AI technologies are capable of raising red flags in systems where layered structure is not followed properly. Many of the banks have concentration of power at one place where raising of red flags becomes even more important to avoid any unwanted financing/prevent appraiser bias. AI uses technologies which can raise red flags at the appropriate level of credit appraisal like overvaluation of mortgaged property, disbursement of loan only after proper title deed verification, avoiding multiple financing on the same property etc.

Conclusion

While the concept of Artificial Intelligence has been around for decades, it is only recently that the AI fantasy has started to turn into reality. Srivastava, V. & Bansal, D. (2012) observed that public sector banks are having largest advances portfolio and it is their NPA management measures which are going to affect NPA resolution in a major manner. NPAs impact profitability and therefore, banks should focus on monitoring of loan assets and take timely action.

Many banks have made a start by incorporating several AI components into their processes and have experienced early results. As we have seen in this paper, most of the issues of handling NPA Management can be handled using AI and Big Data Analytics, which will help in strengthening balance sheets of banks and further enhance credit quality. In global context, many banks have already started using AI and Data Analytics for Risk management and Fraud detection, which has not only reduced the level of rising NPAs but also improved identification of creditworthy customers to create a foundation of a good loan profile. Banks and other lenders are increasingly turning to additional, unstructured and semi-structured data sources, including social media activity, mobile phone use and text message activity, to capture a more detailed view of creditworthiness, and improve the rating accuracy of loans. Applying machine learning algorithms to the abundance of new data has enabled assessment of qualitative factors such as consumption behaviour, willingness to pay, payment history terms etc. AI and machine learning enable decision-making based on past correlations among prices of various assets. Tools that mitigate unavoidable risks could be especially beneficial for the overall system. Also, AI and machine learning could be used for anticipating and detecting fraud, suspicious transactions, default, and the risk of cyber-attacks, which could result in better risk management.

Applications of AI and machine learning may enhance the interconnectedness of financial markets and institutions in unexpected ways. Institutions' ability to make use of big data from new sources may lead to greater dependencies on previously unrelated macroeconomic variables and financial market prices, including from various non-financial corporate sectors (e-commerce, sharing economy, etc.). As institutions find algorithms that generate uncorrelated profits or returns, there is a risk these will be exploited on a sufficiently wide scale that correlations actually increase. These potentially unforeseen interconnections will only become clear as technologies are actually adopted.

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