A Review of Credit Appraisal Process through the Existing Loan Management Software Systems in Indian Banks – Gravity of AI

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Abstract: After digitalization, the Bank's Credit appraisal process has shifted from traditional-based to Credit decisions with technology, and loan management software without AI initiatives. Due to this, the technology expenses of the banks have become huge. Loan origination and loan servicing systems are together known as loan management systems. Loan management software enables banks to complete the loan process, with less time and removing human error. The present study is to review the credit appraisal process done through the existing Loan management software without AI initiatives in minimizing the NPAs for banks. The banks selected for analysis are Axis Bank and Canara Bank. The study is to find the growth percentage of NPAs in both banks through geometric mean, and through which, a trial to review the suitability of the credit appraisal process and efficiency of the existing loan management soft wares of banks in appraising a borrower. Further, the study also emphasizes, the role of AI and ML initiatives in credit appraisal. The data is collected from the websites of banks, newspapers, blogs, and research articles of various authors.

Keywords: Loan Management software; GNPAS; Credit Appraisal; Axis Bank; Canara Bank; AI and ML initiatives; Loans; Technology; Geometric mean; Credit

Introduction:

Credit appraisal and non-performing assets in Banks

Banks funding plays a significant role in satisfying the long-term and short-term financial needs of individual borrowers and corporates. Banks' primary responsibility is to lend loans to priority sectors. The lending process includes credit risk, which surfaces from the borrower's failures in repaying the loans. Banks rely on loans and advances for income generation. Despite many precautions and credit analysis, banks face the problem of NPAs. The rise in non-performing assets in Indian banks may be for several reasons: interest rates, inflation, Employment instability, Debt waiver policy, wilful defaults, poor credit appraisal process, and poor recovery techniques.

The credit appraisal process by Indian banks checks the creditworthiness of an individual by studying his income and trends in the history of payments. The bank considers the CIBIL score of the borrower before lending the loans. In 2000 the economy was on the boom and many businessmen were thirsting for expansion of their businesses. Banks funded for lot of projects from the infrastructure and power sectors which later could not survive due to the rise in costs and the recession effect in 2008. The balance sheet of banks accumulated losses because of NPA's in 2013. Apart from this, wilful defaults from the borrowers have almost doubled the NPA's in 2021.
The number of public sector banks is reduced to 12 from 27 by merging the banks. It was the biggest move in the Indian economy to stabilize banks' financial health and also to curb NPAs. The NPA not only affects the banking sector but also slows down the economic growth of a country. Given the above circumstances, there is a need for a shift from traditional loan processing to a Loan management system which includes loan origination to closing of loan account.

Digitalization and Credit Decisions:

After digitalization, loan processing has shifted from traditional methods to technology-based with the assistance of loan management software. Loan management software removes human error and the time taken to process the loan application is less when compared with the traditional method. (**Sudeep Srivastava 2023).**
Loan management software has made lending easy and helps generate reports digitally. Loan management software is used to remove human error and better credit decisions are made. Despite the technology innovation and implementation, GNPAs for banks have not been minimized.
The present study is a trial to review and suitability of the credit appraisal system with existing loan management software, and how banks can avoid the credit risk that arises from lending to borrowers.

Loan Management Software – Benefits.

India's banking sector has the potential to become the third-largest banking sector by 2025. Indian bankers have to address millions of customers and borrowers. Not only a full-fledged loan system software, it also has to maintain security for the customer's transactions and also has to provide end-to-end services to the customers.
According to "**Software Suggests, 2020**" There are 20 loan management system software. They are, Finn Craft, Finn One Neo, Cloud Bank in, the mortgage office, Autopal software, etc., The recent trends in banking services with the advent of loan management software are:

1. Digitization made banks' jobs easier and also can improve the lending function, including collection of customer information, and the customer's credit analysis.

2. Unified microservices permit banks to incorporate cloud-based microservices modules like CIBIL, statement analyzer, and net banking that work as a one-stop solution to disburse loans at a fast rate and also adapt to regulatory requirements.
3. With the advent of new technology, it has become easier for the customer to apply for a loan and disburse of loan amount by sitting at home.
4. Financial institutions incorporate Artificial intelligence and machine learning into the loan lending process.
5. Automation has been made to complex processes like credit score retrieval, fraud checking, loan application underwriting, and loan offer generation.
6. The efficiency will be increased by introducing blockchain technology in banks.

The Loan Management Software Process:

The loan management software allows the banks to manage the complex processes of loans from loan application to loan disbursement and borrowers' final payment. It replaced the traditional loan processes that were done manually with a lot of paperwork. The COVID has created a need for all financial institutions to follow these technologies. Several steps are included in the lending process, they are loan application, underwriting, credit approval, documentation, pricing, funding, and disbursement or rejection of the loan.

According to **(Lendfoundry,2021)** some features make the loan management system perfect;

1. **Adaptability:** The loan management system has to enhance growth in operations and exceptional financial services to the customers through diversification of the products. The software system should enable the bank to profits increase.

2. **Ease of deployment:** The IT team should have 24*7 access to maintain, service, and troubleshoot the issues arising out of the technology. Most of the cloud-based loan management software technology provides quick implementation but also provides regular maintenance services, including bug fixes, frequent upgrades, and IT support when needed.
3. **Centralised access:**The lenders should have centralized access to the customers' information throughout the customer loan life cycle. This helps the lending organization to check the stages of loan life cycles, credit rating, and other loan-related issues from anywhere in the world.
4. **Credit Assessment:** Most of the start-ups and peer-to-peer lenders will be looking for customers, who have no credit history at all. They will need access to software or AI initiatives, that provide alternative credit rating methods and databases such as social media behaviour, utility bills, payment behaviour, tax

data, or bank statement analysis to lower their risk and make informed decisions on such issues as interest rates and repayment terms.

5. **Process Automation:** Robotic process automation reduces the time in processes like application submission, credit analysis, and approval. The ideal loan management system should have automation levels and customized bank requirements.
6. **Transparency:** More transparency should be there in the processes so that clients and stakeholders should have a better view and more trust.

Technology expenses by Indian banks:

According to **Romita Majumdar (2020)**, banks have to increase IT investments from 2% to 8% to 10%. To meet the growing demand for digital transactions. Load-bearing backend infrastructure to be focussed to meet the demand of digital growth. Globally, the average spending on IT services is from 4.5% to 9.5% in operating expenses (Sai Gopalan et 2010). In 2020 the average amount spent by Indian public sector banks is around 2% (200-300 crores) of their operating expenses. In the subsequent years, the amount spent by the public sector banks was around 5% of their operating expenses.

Table: 1Gartner's forecast for IT spending by the banking and securities industry in India. (US millions)

Segment	2019	2020	2021	2022
IT services	$3250million	$3357million	$3657million	$3814million

Source: Gartner.

According to the **Gartner 2021** forecast, the Indian banking industry is spending millions of dollars, on IT services to enable themselves in digital banking processes. Technology includes Artificial intelligence and data science, Machine learning algorithms for providing end-to-end customer service.

Technology spending in Canara Bank:

In 2015, the Canara bank has gone for digitization. The Canara Bank has spent on IT services around 5% on average of its operating expenses every year since digitalization. The bank has spent around 1,000 crores in 2022, 1200 crores in 2023, and estimated to spend 1500 crores in 2024. Canara Bank is imposing Artificial Intelligence in various operations from customer service to employee skills upgrading and training.

Due to AI initiatives in lead generation, (**Shilpa Phadnis & Sujit John, Jan 17, 2024,**) the bank has shown an incremental growth of 8% to 11% in current and

savings accounts, housing, and vehicle loans. The bank estimates a 20-25% growth in loans and deposit accounts at the end of 2024.

Technology spending in Axis Bank:

The Axis Bank is considered the first digitalized bank in all the banking activities. The Axis Bank's annual ICT spending amounted to $381 million in 2021. In 2024 the estimated tech expenses are around 867 crores. 38% of total cost increased because of technology investments in 2023. IN CASA there was a growth of 92%, because of Axis 2.0. In loans and advances, 55% of personal loans are sourced digitally. Axis Business Intelligence Unit (BIU) has focused on creating distinctiveness in the areas of Cloud computing, Big-data platforms, Hyper personalization, and Alternate data, to create differentiated customer experiences, through digitalization.

Significance of the study:

After digitalization banks have shifted from traditional appraisal to credit decisions with technology and loan management software, for this reason, banks are spending a huge amount on technology without Credit AI, to ease and accurate the processes in all the lending activities and other financial services, banks are spending 7 to 9% amount on technology, hiring tech-based employees, and other software that assists them in providing financial services. The result should be more profits and no GNPAs. Despite introducing all these technologies banks are facing NPA problems. Because of this, there is a need to review the existing loan management software, through which credit appraisal of customers is done. The present study reviews the efficiency and suitability of existing loan origination systems, loan management software, and end-to-end services to customers.

Literature review:

Mara Nikolaidou, Dimosthenis Anagnostopoulos, and Aphrodite Tsalgatidou (2008) have presented a paper on business process modeling and automation of a loan monitoring system in a small bank. The business processing model was operated through the Modified Petri model which allows collaborative business activities and loan tracking systems.

K. N., Meera; Giri, and Sasmita (2017) have compared manual loan origination and automated loan origination as risk management tools. They found that many Indian banks are following their global counterparts and automating their lending processes and the entire loan life cycle to avoid irregularities caused by manual loan origination systems. Their conclusion was automation helps the banks process lending operations with more transparency and accuracy. They have to balance automated systems with human touch.

Hao Wang, **Chaonian Guo, and Shuhan Cheng (2019)** have identified that data privacy systems are not robust enough to prevent cyber-attacks. Given this, the researchers proposed a loan on Blockchain LoC, a novel financial loan management system based on smart contracts. They have studied Chinese poverty alleviation loans as a case study.

Martin Leo; Suneel Sharma and K. Maddulety (2019), have reviewed the literature on the influence of Machine learning on business applications and banking risk management. The review has shown the application of machine learning in credit risk, operational risk, market risk, and liquidity risk.

Abhishek Pandey1, Ankita Agrawal2, Aditya Kartikeya Dubey3, Nikhil Bhatt4, and Utkarsh Yadav (2021), describe the idea of developing loan application system online for Car loans, home loans, and Education loans. They emphasized that loan application should include, the uploading of documents that are necessary for loan approval. The banker after downloading the documents has to complete the loan formalities. The conclusion was the authors suggested increased technological inputs to avoid any defaults in the loan assets.

Elijah C. Carranto (2021) has studied on Tupmmpc Loan Monitoring and Management System. The study recognized the importance of an automated loan management system. They also identified the significance of the loan management system for better financial performance. The study also aimed to design a loan management system with a web portal and mobile app for users of loan management systems.

Mohammed ShijasThekkethil; Vinod Kumar Shukla; Fatima Beena; and Ashok Chopra(2021) have researched robotic process automation**.** The paper discusses how RPA can mitigate fraud risks through various methods such as reassessing current processes, eliminating human errors, enhanced trade monitoring, automated threat detection, searching for anomalies, and much more.

Narayana Darapaneni; Akshay Kumar; ArchannaDixet; Manikandan Suriyanarayanan; Shabd Srivastava; and Anwesh Reddy (2022), have discussed loan default prediction with software. They emphasized on high-level process of loan application with an alternative credit scoring model with machine learning.

M.J. Shaikh, Sanket Jagtap, Snehal Dhanokar, Faizan Deshmukh, and Akash Damodar (2023), have surveyed loan management systems and tried to identify the role of loan management systems in the financial industry. They recognized that the main objective of a loan management system is to reduce manual intervention and increase operational efficiency through technology.

Arunkumar J, Privietha P(2023), Wants to introduce an automated Loan monitoring and management system for Veritas Private Limited where the current system is Manually operated system. They proposed an automated system for applying for loans and a loan tracking system to avoid defaults.

Abdulrahman Saeed Almheiri(2023), has studied developing machine learning models to approve or disapprove loan applications based on customer characteristics. He used algorithms with statistical models such as tree-based models, boosting models, and voting/stacking models to make lending decisions.

Pravin; and Sunil (2024), have identified the changes in the banking sector due to AI and ML They concluded that AI is fast evolving as the go-to technology for banking across the world to personalize for individuals.

Objectives:

1. To study the growth of the non-performing assets of the select banks through geometric mean, and correlation is used to examine the relationship between ROA and non-performing assets.
2. To review, the efficiency of the loan management software in the credit appraisal system.
3. To identify the role of artificial intelligence and machine learning in credit analysis.

Research Methodology:

The present study is a trial to review the suitability of loan management software used to manage the Bank's loan portfolios profitably, by reducing the GNPA ratio. The banks' geometric mean and correlation are calculated between non-performing assets data and Return on Assets data, Collected from the banks' Annual reports. The efficiency of loan management software in the credit appraisal of both banks is reviewed based on the Calculations of Geometric mean and correlation. Further, the study also highlights the role of AI and ML algorithms in credit assessment and decision.

Table: 2 The geometric mean of GNPA's for Axis Bank

	2011	2012	2013	2014	2015	2016
GNPA	159.94	1,806.30	2,393.42	2,393.42	4,110.19	6,087.51
ROA	1.68	1.68	1.7	1.78	1.83	1.72

2017	2018	2019	2020	2021	2022	2023
21,280.48	34,248.64	29,789.44	30,233.82	25,314.84	21,822.32	18,604.23
0.65	0.04	0.63	0.2	1.11	1.21	0.8

Geo metric Mean: 7594.049235

Arithmetic Mean: 15249.58077

Table: 3 Correlation of coefficient of GNPA's and ROA for Axis Bank

year	G.NPA's.	ROA	Growth rate of GNPA's	Growth rate of ROA
2011	159.94	1.68		
2012	1,806.30	1.68	0.911454354	0
2013	2,393.42	1.7	0.24530588	0.011764706
2014	3,146.41	1.78	0.23931719	0.04494382
2015	4,110.19	1.83	0.23448551	0.027322404
2016	6,087.51	1.72	0.324815894	-0.063953488
2017	21,280.48	0.65	0.713939253	-1.646153846
2018	34,248.64	0.04	0.378647444	-15.25
2019	29,789.44	0.63	-0.149690629	0.936507937
2020	30,233.82	0.2	0.01469811	-2.15
2021	25,314.84	1.11	-0.194312111	0.81981982
2022	21,822.32	1.21	-0.160043478	0.082644628
2023	18,604.23	0.8	-0.172976253	-0.5125
Correlation coefficient:			**-0.932106225**	

Authors own creation.

T-test Results.

	Variable 1	*Variable 2*
Mean	15249.58077	1.156153846
Variance	161337109	0.402558974
Observations	13	13
Pooled Variance	80668554.71	
Hypothesized Mean Difference	0	
df	24	
t Stat	4.328421219	
P(T<=t) one-tail	0.000114569	
t Critical one-tail	1.71088208	
P(T<=t) two-tail	0.000229138	
t Critical two-tail	2.063898562	

Interpretation:

From the above tables, it is examined that the Geometric mean of NPA's of Axis Bank is 7594.04. However, the growth of the changes of G NPA's of the Axis Bank are conflicting. It is a mix of adverse and favorable GNPAs. It is an unenthusiastic state when we measure the bank's profitability. To Interpret and conclude we can say that, the bank is facing GNPA's problem.

The Axis Banks's GNPA's and ROAs are negatively correlated. This means that when GNPA increases, ROA decreases.

The P value of the t-test is 0.000229138. Hence it is proved that there is statistical significance between ROA and GNPAs.

Despite spending crores of rupees on Technology, considered the first in transforming to digital, AI initiatives in credit appraisal, and identifying borrower behaviour, the Axis Bank is facing GNPA's problem.

Table: 4 Geometric Mean of GNPA's for Canara Bank.

year	2011	2012	2013	2014	2015	2016
GNPA	3,089.21	4,031.75	6,260.16	7,570.21	13,039.96	31,637.83
ROA	1.42	0.95	0.77	0.54	0.55	-0.52

2017	2018	2019	2020	2021	2022	2023
34,202.04	47,468.47	39,224.12	37,041.15	60,287.84	55,651.58	46,159.51
0.2	-0.75	0.06	-0.32	0.23	0.48	0.51

Arithmetic Mean:	**29,666.45**
Geometric Mean:	**20127.19**

Table: 5 Coefficient of correlation of GNPA's and ROA for Canara bank.

year.	GNPA's.	Growth rate	ROA	Growth rate ROA
2011	3,089.21		1.42	
2012	4,031.75	0.23	0.95	-0.49474
2013	6,260.16	0.36	0.77	-0.23377
2014	7,570.21	0.17	0.54	-0.42593
2015	13,039.96	0.42	0.55	0.018182
2016	31,637.83	0.59	-0.52	2.057692
2017	34,202.04	0.07	0.2	3.6
2018	47,468.47	0.28	-0.75	1.266667
2019	39,224.12	-0.21	0.06	13.5
2020	37,041.15	-0.06	-0.32	1.1875

2021	60,287.84	0.39	0.23	2.391304
2022	55,651.58	-0.08	0.48	0.520833
2023	46,159.51	-0.21	0.51	0.058824
The coefficient of correlation= -0.60 Authors own creation.				

T Test :

	Variable 1	*Variable 2*
Mean	29666.44846	0.316923077
Variance	420670713	0.36020641
Observations	13	13
Pooled Variance	210335356.7	
Hypothesized Mean Difference	0	
df	24	
t Stat	5.215085767	
P(T<=t) one-tail	1.20642E-05	
t Critical one-tail	1.71088208	
P(T<=t) two-tail	2.41284E-05	
t Critical two-tail	2.063898562	

Interpretation:

From the above tables, Canara Bank's GNPA's are in increasing mode up to 2019. Unpredictable after 2019. It is a combination of adverse and favorable GNPAs. One of the reasons might be the merger of Syndicate Bank with Canara Bank. To interpret it is not a promising state for the Bank.

The correlation between GNPAs and ROA is negative. This means the G NPA's and ROAs are moderately inversely related.

The P value is more than 0.05 Hence there is no statistical significance between ROA and GNPA.

Canara Bank is spending crores of rupees on AI and Machine learning technologies to outperform its competitors. The unpredictable GNPAs indicate that the technology has not been implemented appropriately. Mere investing in technology is not enough for the bank. The bank also has to train existing employees to handle the technology comfortably, or the bank has to hire tech-based employees.

Findings and Discussion:

From the study, it is understood that both the selected banks are spending billions of rupees on technology for incremental growth in lending activities and profitability. Banks should increase their investment in IT services, to enable the growing demand

in digital transactions. According to Gartner, Banks are spending millions of dollars on IT services in India. Mere processing the loan application is not enough in the credit appraisal process, the system has to qualify the customer for a loan. The loan management software used by the selected banks cannot adequately assess credit. However, there is no evidence, to prove that Indian banks are applying AI technologies, for credit analysis. Only HDFC Bank is planning to process the loan application with AI technologies for better credit appraisal of customers. Given this, we suggest that banks should include AI initiatives in the credit appraisal of a borrower.

Role of AI in Credit decision making and reducing the default risk.

Leading banks, the State Bank of India, HDFC, Axis Bank, and ICICI Bank have adopted AI solutions. The State Bank of India launched "**The SBI Intelligent Agent** "a chat assistant, that acts as a bank's representative, in May 2018. HDFC has launched "**Electronic Virtual Assistant",** an AI power chatbot for answering the queries of customers. Axis Bank has launched "**AI-powered chatbots**" for improved customer services. The AI technology used in banks is only chat assistants, chatbots for answering queries of customers.

AI along with Machine learning algorithms and natural language processing, helps the banks to identify the borrowing pattern of the customers to reduce the default risk. AI helps in analyzing the structured and unstructured data to identify, whether a particular customer qualifies for a loan. AI also can help in assessing the number of applications processed for borrowing.

The areas where banks can initiate the help of AI are:

Credit decisions:

AI along with machine algorithms can forecast the risk. Companies that adopted with best AI initiatives profited in the credit world. AI can be used in Credit approval, risk determination, and portfolio management.

Monitoring:

AI technology assists the banks to have a 360-degree perspective of the customer including his social interaction in the social media. As a result, the bank proactively implements suitable collecting strategies.

Warning Signals:

AI helps in fraud detection and sees that compliance is there with regulations Because this prevents losses and litigation for the banks.

Credit Risk Analysis:

Credit Risk Analysis can be made with AI and ML tools like the Random Forest method, Logistic regression, Support Vector Machines, and Natural Networks resulting in better credit decisions.

Credit AI:

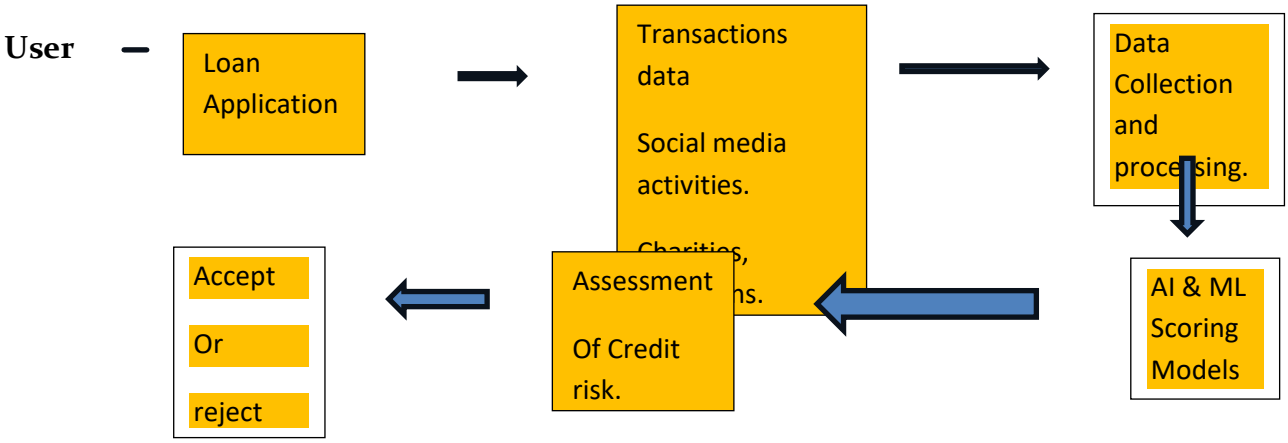
Credit AI helps in three areas, price determination, credit qualification, and limit assessment. It also detects the fraud system in banks—however, more loan applications, more fraud, and unstable credit risk management.

Challenges:

Apart from the benefits mentioned above, certain challenges may hinder the banks' credit risk management.

Compliance, governance, and quality should be there. To impart AI technologies, certain challenges have to be answered. If there are no compliance guidelines for the Banks using AI technology, then AI needs to be governed properly with a well-functioning internal communication system. Finally, the quality of data also matters in the credit analysis.

Suggested AI Model: Based on **Akshay Thakur's (Leeway Hertz)** model author has developed a model for better credit assessment with AI and ML tools.



Authors own creation based on Source: Leeway Hertz.

User: The person who is aspiring for a loan.

Loan application: Through Loan management software the person sitting at home may apply for a loan.

Data collection and Processing: The data is collected stored and processed and sent to AI and ML models for assessment.

AI and ML Credit Score models: The models may be decision trees, linear regression, Random Forest, etc.,

Assessment of Credit: The models analyze, social media activities, charities, donations, and customer transactions.

Approve or Reject: an AI credit score will decide whether to approve or reject.

Conclusion:

The Axis Bank, the leader in digitization with the existing loan management software without Credit AI has evidenced GNPAs.But compared with Canara Bank's GNPAs, they are considerably low. The study which reviews the suitability of existing loan management software, meant to remove human error, has identified that Axis Bank with even, updated technology has GNPAs. This means the existing loan management system has failed to appraise the customer and make banks' GNPAs zero, because of not implementing credit AI. So far there is no evidence of AI initiatives in the lending process among Indian banks. There is no proof of AI initiatives in the credit appraisal process of an aspiring borrower. It has been proved that banks' loan management software, with AI and ML initiatives,has profited well in the United States. Finally, simply spending on technology is not enough. AI and ML technologies have to be introduced in the credit appraisal process.Not only the introduction, but for better implementation, skill updation on these initiatives, and awareness of this software should be there for those who apply for credit assessment. Otherwise, more tech-based employees should be hired. In the credit assessment process, not only the customer's financial status but also their social interaction on social media platforms should be analyzed before a credit decision is made. With AI initiatives, social interaction analysis may be possible. Indian banks cannot proceed with social credit scores like in China and Europe, because the penalties for poor social credit scores are considered against the Indian constitution and the basic fundamental rights cannot be deprived of. When it comes to the Canara Bank the GNPAs are huge and it may be for several reasons, one among them being, the merger of Syndicate Bank. However, by including AI initiatives, in generating leads, Canara Bank has an incremental growth in Lending activities and savings accounts. In the same way, the bank with credit AI initiatives, may further minimize the GNPAs and increase profits.

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