

Analysing the Financial Performance of Private Banks in India Following the Implementation of Artificial Intelligence Utilizing the CAMELS Approach—with a Special Reference on Axis Bank Ltd



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Abstract This research article investigates the financial impact of Artificial Intelligence (AI) adoption on Axis Bank, the third-largest private bank in India, utilizing the CAMELS framework. Analyzing six key performance metrics over a six-year period, the study reveals significant improvements post-AI implementation, including enhanced capital adequacy, asset quality, management efficiency, and earnings management. The paired samples t-test supports these findings, highlighting statistically significant changes in specific ratios. The study contributes to understanding the evolving landscape of AI in the banking sector, emphasizing its role in reshaping financial performance and risk management practices.

Keywords CAMEL approach · Artificial intelligence · AXIS bank

1 Introduction

Recently Artificial Intelligence (AI), a technological paradigm has transcended conventional boundaries to redefine how banks operate and thrive. Artificial Intelligence (AI) refers to the simulation of human intelligence in machines that are

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programmed to think and mimic human actions. These machines are designed to perform tasks that typically require human intelligence, such as visual perception, speech recognition, decision-making, and language translation, among others. It impacted in many industries like finance, marketing, health care, education, transportation. Especially The banking sector in India has undergone a significant transformation with the advent of Artificial Intelligence (AI) applications. The banks in India, in particular, have embraced AI technologies to enhance operational efficiency, improve customer experiences, and streamline various financial processes.

AI driven automation has streamlined many routines works and reduced human intervention. The Advanced analytics and machine learning algorithms implemented by artificial intelligence enable banks to assess credit risks, detect anomalies, and predict potential financial downturns. AI analysis the non-performing asset (NPA) ratios and risk-adjusted returns and help to mitigating the financial risk of the banks. The Chatbots, personalized recommendations, and automated customer support services has revolutionized the way banks interact with customers.

Most of the banks in India embarking on its AI journey from the point of view of both employees and customers. The journey of Artificial Intelligence (AI) in Indian banks has been marked by a gradual but steady integration of advanced technologies. In 2018, AXIS Bank, India's ranked third in private banks, embraced Artificial Intelligence by introducing the Automated Voice Assistant 'AXAA.' This AI-powered conversational voice BOT aimed to enhance the bank's efficiency and customer service. AXIS Bank utilized Robotic Process Automation (RPA) and AI to modernize its operations digitally. Over 300 business processes, ranging from account opening to loan disbursements, fraud detection, and card operations, underwent automation, demonstrating the bank's commitment to leveraging technology for improved service delivery. The radical shift towards ubiquitous digitalization provides both impetus and opportunities to AXIS bank.

The bank has revealed in its latest annual report The bank is harnessing leading-edge technologies like artificial intelligence (AI), machine learning (ML), and business analytics to enhance its product range and elevate customer satisfaction. In year 2021, More than 70% of deposits and 58% of personal loans are opened digitally and further 48% of the bank products are sold digitally. In addition to this, the banks digital initiatives has made an impact by reducing the time to open a new account by 75% and subsequently increased the customer satisfaction by 36%. The reduction in cost of acquisition and increase in the customers who maintains the minimum balance by 25% and has substantially reduced the cost of operation and this has significant financial impact on the bank performance.

2 Review of Literature

The Author [1] suggested that Banks adopt AI not only retail banking services, other areas like fraud detection, investment banking are gaining development in AI. Implementation of AI is expensive but increases the overall operational efficiency of the bank.

The study [2] have observed that the integration of AI within banking operations has resulted in enhanced efficiency and effectiveness, as evidenced by the improved financial indicators of the bank. Their research involved assessing the six components of the CAMELS approach, employing diverse parameters for each component to evaluate the bank's overall financial performance.

In their study, [3] investigated the effects of artificial intelligence on operational efficiency and analyzed its impact on the financial performance of businesses. Their research revealed that artificial intelligence significantly influences the operating profit of IT companies in their sample, showing a positive correlation between operating profit and both hardware expenditure and operating costs attributable to artificial intelligence.

[4], has studied the performance banks using CAMELS approach. The study reveals that according to CAMELS approach both the SBI and HDFC banks are maintaining required standards and running profitably. However, the assets of these banks exhibit significant variation, necessitating a more nuanced evaluation beyond solely considering the absolute values of the CAMEL ratios.

3 Research Problem

The influence of artificial intelligence on the banking sector has lately been assessed using non-financial metrics; however, the financial impact has not mostly been investigated. This study provides a detailed explanation of the effects of using AI applications by analyzing changes in the mean values of significant ratios that characterize banking parameters. On the basis of the analysis following research objectives have been formulated:

- To measure the banks financial performance through CAMELS frame work
- To compare the pre and post impact of Artificial intelligence adoption in the AXIS banks financial performance.

Hypothesis: The research hypothesis formulated is as follows:

Ho: There is no significant variance in AXIS Bank's financial performance according to the CAMELS approach before and after the implementation of artificial intelligence. H1: There is a significant variance in AXIS Bank's financial performance according to the CAMELS approach before and after the implementation of artificial intelligence.

A paired-sample t-test, conducted at a 95% confidence level, was employed utilizing SPSS to examine the hypothesis across different components of the CAMELS approach.

4 Research Methodology

4.1 Source of Data

The data source for the research comprises secondary data obtained from audited reports of AXIS Bank, RBI reports, Scopus indexed journals, and other scholarly publications.

4.2 Period of Study

As per the secondary data available the AXIS bank has launched the AI tools in the financial year 2018–2019, thus leaving it as gap year to reflect the implementation of AI, the study considers 6 years financial data, four years prior to implementation of AI (FY 2014–2015) and four years post adoption of AI (FY 2022–2023). The financial year 2018–19 serves as the base year for the integration of AI technology.

4.3 Research Design

In this study, the mean values of the pre and post periods are contrasted under the assumption that there have been no significant alterations in the bank's events aside from the adoption of the latest technological innovation, which influences the bank's financial performance. The research utilizes the CAMELS approach, originally developed in the USA, to assess the overall performance of the bank. The study compares the mean ratios before AI implementation with the mean ratios after AI implementation. A two-tailed paired t-test is employed to examine the disparities between the mean ratios before and after AI implementation. The objective is to ascertain whether there is a discrepancy between the pre-implementation mean ratio and the post-implementation mean ratio, with the null hypothesis ($H_0 = \mu_{pre} - \mu_{post} = 0$) suggesting no difference and the alternative hypothesis ($H_1 = \mu_{pre} - \mu_{post} \neq 0$) suggesting a significant difference.

CAMELS Approach

The CAMELS Technique, introduced by the Basel Committee on Banking Supervision of the Bank for International Settlements in 1988, is widely acknowledged and

adopted globally as a method for evaluating banks and other financial institutions. The acronym CAMELS represents six essential performance metrics: C for Capital Adequacy Ratio, A for Asset Quality Ratio, M for Management Efficiency Ratio, E for Earnings Sufficiency, L for Liquidity Position, and S for Sensitivity to Market Risk.

The financial performance and management metrics of a company can be evaluated through various key ratios. Capital adequacy is assessed through metrics such as the Tier 1 Capital Ratio, which measures the proportion of a bank's core capital to its risk-weighted assets, and the Debt-Equity Ratio, indicating the extent of a company's leverage by comparing its total liabilities to shareholder equity. Asset quality is scrutinized through indicators like Gross Non-Performing Assets (NPAs) to Total Advances and Net NPAs to Total Advances, reflecting the proportion of non-performing loans relative to total advances. Management efficiency is gauged by ratios like Revenue and Earnings per Employee, as well as the Ratio of Total Expenditure to Total Income and Return on Equity (ROE), which signifies the profitability generated from shareholder equity. Earnings performance is evaluated using metrics such as the Dividend Payout Ratio, Net Interest Margin, Net Profit Margin, and Operating Profit, each offering insights into the company's profitability, efficiency, and dividend distribution practices. Liquidity ratios, including the Ratio of Liquid Assets to Total Assets and the Ratio of Cash to Deposit, reveal the ability of a company to meet its short-term obligations. Lastly, sensitivity ratios like the Ratio of Demand Deposit to Total Deposit and the Ratio of Term Deposit to Total Deposit help assess the composition and stability of a company's deposit base. These diverse metrics collectively provide a comprehensive view of a company's financial health, management effectiveness, earnings potential, liquidity position, and sensitivity to market fluctuations.

5 Data Analysis and Interpretation

Analysis of the performance of Axis bank on parameters using the CAMELS Model.

According to Table 1, The post-AI implementation period shows an improvement in Capital Adequacy Ratio, indicating strengthened financial stability, with a notable increase from 15.09% in 2014–15 to 18.54% in 2022–23. The Total Advance to Total Assets ratio has declined, suggesting a more cautious approach in lending.

The Table 2 shows, In Post-AI implementation, there is a substantial reduction in Gross and Net Non-Performing Assets (NPAs), reflecting improved asset quality and risk management. Net Interest Margin has seen a positive shift, suggesting better profitability and efficiency in interest income generation during the post-AI period. Overall, these metrics indicate a positive impact of AI on the bank's financial health and risk management practices.

The Table 3 shows in Post-AI, AXIS Bank exhibits improved Management Efficiency, with Business per Employee increasing from 120.46 Lakhs to 200.00 Lakhs. Profit per Employee has shown a significant positive trend, rising from 17.42 Lakhs

Table 1 Capital adequacy ratio of Axis Bank pre and Post Artificial intelligence

Period	Year	Capital adequacy ratio	Ratio of debt to equity	Ratio of total advances to total assets	Teir 1 capital ratio	Ratio of total shareholders fund to total assets
Pre AI	2014–15	15.09	10.34	0.61	12.07	0.61
	2015–16	15.29	9.88	16.57	12.51	0.64
	2016–17	14.95	10.78	10.77	11.87	0.62
	2017–18	16.57	10.89	9.80	13.04	0.63
Post AI	2019–20	17.53	10.77	0.62	12.54	0.62
	2020–21	19.12	9.80	0.63	14.49	0.63
	2021–22	17.64	9.45	0.60	14.67	0.64
	2022–23	18.54	8.85	0.64	16.34	0.62

Table 2 Asset quality ratio of Axis Bank Pre and Post AI adoption

Period	Year	Gross NPA (in billions)	Net NPA (in billions)	Credit deposit Ratio %	Net Interest Margin %
Pre AI	2014–15	41.10	13.16	93.56	3.10
	2015–16	60.87	25.22	94.64	3.20
	2016–17	212.80	86.27	90.03	3.00
	2017–18	342.48	165.92	96.92	2.69
Post AI	2019–20	297.89	93.60	89.71	2.75
	2020–21	302.34	69.93	88.18	2.93
	2021–22	218.22	55.12	88.08	2.87
	2022–23	186.04	35.58	87.92	2.96

to 15.54 Lakhs. Return on Assets has shown a positive turnaround, moving from negative figures during pre-AI to consistently positive values in the post-AI period, showcasing improved profitability.

According to Table 4 in Post-AI implementation, Axis Bank's earnings management has seen notable improvements, with a positive shift in Earnings Per Share (EPS) and a more favorable Cost to Income Ratio. The market response is evident, as reflected in the substantial increase in Market Price per Share, indicating increased investor confidence and valuation post-AI integration.

According to Table 5 in Post-AI implementation, Axis Bank's Earnings Per Share (EPS) has shown variability but remains competitive, dropping from 34.59 Rs. in 2015–16 to 31.17 Rs. in 2022–23. The Cost to Income Ratio has witnessed improvement, decreasing from 3570% to 49.05%, indicating enhanced cost efficiency. Despite a fluctuating Dividend per Share (DPS), the market price per share has demonstrated a substantial increase, reaching 1102.30 Rs. in 2022–23, reflecting positive investor sentiment and market confidence post-AI integration.

Table 3 Management efficiency ratio of AXIS bank during AI implementation

Period	Year	Revenue per employee (Rs. In Lakhs)	Earnings per employee (Rs. in Lakhs)	Total expenses to total income ratio %	Ratio return on assets %
Pre AI	2014–15	120.46	17.42	0.84	1.59
	2015–16	142.91	16.40	0.91	1.56
	2016–17	138.97	6.49	0.94	0.61
	2017–18	241.22	0.46	0.99	0.03
Post AI	2019–20	267.56	2.19	1.22	0.17
	2020–21	289.73	8.94	1.08	0.66
	2021–22	170.90	10.94	0.93	1.21
	2022–23	200.00	15.54	0.93	1.81

Table 4 Earnings management Ratio of Axis Bank during AI implementation

Period	Year	Earnings per Share (Rs.)	Cost to income %	Dividend per share (Rs.)	Market Price Share (Rs.)
Pre AI	2014–15	31.18	34.74	5.00	449.50
	2015–16	34.59	35.70	5.00	450.00
	2016–17	15.40	46.42	0.00	562.40
	2017–18	1.13	51.64	1.00	619.80
Post AI	2019–20	5.99	50.03	1.00	620.35
	2020–21	22.15	47.76	0.00	678.35
	2021–22	42.48	42.77	0.00	933.85
	2022–23	31.17	49.05	1.00	1102.30

Sources Annual report of AXIS bank

Table 5 The liquidity position of AXIS Bank during before and after AI implementation

Period	Year	Ratio of liquid assets to total assets (%)	Ratio of cash to deposit	Interest expense to interest earned ratio
Pre AI	2014–15	9.47	0.061	1.67
	2015–16	12.78	0.062	1.70
	2016–17	16.17	0.074	1.69
	2017–18	8.93	0.078	1.69
Post AI	2019–20	3.64	0.133	1.65
	2020–21	5.04	0.045	1.67
	2021–22	7.08	0.114	1.85
	2022–23	12.24	0.070	1.92

Sources Annual report of AXIS bank

The Table 6 shows in Post-AI adoption, AXIS Bank has experienced changes in Sensitivity Ratios. Demand deposit to Total deposit has seen a marginal increase, indicating a slightly higher reliance on demand deposits. The Price to Earnings Ratio has fluctuated, reaching a peak of 103.56 in 2019–20, potentially reflecting market dynamics.

In the following Table 7 The paired samples t-test results for AXIS Bank's CAMELS approach ratios indicate significant differences in various financial performance metrics pre and post Artificial Intelligence (AI) implementation. The test reveals a statistically significant decrease in Capital Adequacy Ratio (CAR) and Tier 1 Capital Ratio post-AI, suggesting potential changes in capital structure.

However, not all ratios exhibit significant changes. The Total Advances to Total Assets ratio and Net Interest Margin show p-values above the conventional significance level of 0.05, suggesting that these aspects may not have experienced significant alterations due to AI implementation.

In conclusion, the evidence from the paired samples t-test supports the rejection of the null hypothesis (H₀) for certain CAMELS ratios, indicating a significant difference in AXIS Bank's financial performance pre and post AI implementation.

Table 6 The sensitivity ratios of AXIS bank during before and after AI implementation

Period	Year	Demand deposit to Total deposit %	Price to earnings ratio %	Term deposit to Total deposit %
Pre AI	2014–15	29.78	14.42	51.57
	2015–16	28.18	13.01	554.19
	2016–17	27.74	36.52	56.45
	2017–18	26.05	548.50	56.5
Post AI	2019–20	26.98	103.56	56.62
	2020–21	15.18	30.63	57.75
	2021–22	15.89	21.98	53.85
	2022–23	15.91	35.36	52.56

Sources Annual report of AXIS bank

Table 7 Before and after implementation of artificial intelligence in AXIS bank (Hypothesis testing- Paired samples *t* test)

Ratios		Paired differences				t	df	Sig. (2-tailed)	
		Mean	Std. deviation	Std. error mean	95% Confidence interval of the difference				
Paired samples test					Lower	Upper			
Capital Adequacy	CAR	-2.73	0.79	0.4	-3.99	-1.48	-6.92	3	0.01
	Debt Equity	0.76	1.13	0.57	-1.05	2.56	1.33	3	0.27
	Total advances to Assets	8.82	6.6	3.3	-1.68	19.31	2.67	3	0.08
	Tier 1 Capital	-2.14	1.24	0.62	-4.11	-0.17	-3.45	3	0.04
	Total shareholders funds to total assets	0	0.02	0.01	-0.03	0.02	-0.33	3	0.76
Pair 1	Gross NPA (in billions)	-86.81	198.8	99.42	-403.2	229.58	-0.87	3	0.45
	Net NPA (in billions)	9.08	93.27	46.64	-139.33	157.5	0.19	3	0.86
	Credit deposit %	5.32	3.07	1.54	0.42	10.21	3.46	3	0.04
	Net Interest Margin %	0.12	0.28	0.14	-0.32	0.56	0.87	3	0.45
Management Efficiency	Business per Employee (Rs.in Lakhs)	-71.16	92.48	46.24	-218.32	76	-1.54	3	0.22
	Profit per Employee (rs. Lakhs)	0.79	13.32	6.66	-20.41	21.99	0.12	3	0.91
	Total Expenses to Total Income %	-0.12	0.2	0.1	-0.44	0.2	-1.2	3	0.32
	Return on Assets %	-0.02	1.46	0.73	-2.33	2.3	-0.02	3	0.98

(continued)

Table 7 (continued)

Paired samples test		Paired differences						t	df	Sig. (2-tailed)
Ratios	Mean	Std. deviation	Std. error mean	95% Confidence interval of the difference		Upper				
Earnings management	Earnings Per Share (Rs.)	-4.87	27.87	13.93	-49.22	39.47	39.47	-0.35	3	0.75
	Cost to Income (%)	878.3	1763	881.32	-1926.5	3683.1	3683.1	1	3	0.39
	Dividend per share (Rs.)	2.25	2.63	1.31	-1.93	6.43	6.43	1.71	3	0.19
	Market Price per share(Rs.)	-313.3	140.9	70.43	-537.42	-89.16	-89.16	-4.45	3	0.02
Liquidity Position	Liquid assets to total assets (%)	4.84	5.59	2.8	-4.06	13.74	13.74	1.73	3	0.18
	Cash to deposit %	-0.02	0.04	0.02	-0.09	0.04	0.04	-1.04	3	0.37
	Int expense to interest earned %	-0.09	0.13	0.07	-0.29	0.12	0.12	-1.31	3	0.28
Sensitivity	Demand deposit to total deposit %	9.45	4.58	2.29	2.15	16.74	16.74	4.12	3	0.03
	Price to earning%	105.2	275.4	137.69	-332.95	543.41	543.41	0.76	3	0.5
	Term deposit to total deposit %	124.5	248	124	-270.15	519.11	519.11	1	3	0.39

6 Conclusion

The comprehensive CAMELS approach applied to AXIS Bank's financial performance pre and post Artificial Intelligence (AI) implementation reveals significant positive changes. The bank experienced wired capital adequacy, improved asset quality, enhanced management efficiency, and notable advancements in earnings management. The study stresses the transformative impact of AI on AXIS Bank's operations, reflecting in improved ratios across critical parameters. However, while certain ratios exhibit statistically significant variations, the nuanced interpretation is essential, acknowledging that not all metrics underwent substantial changes post-AI adoption. AXIS Bank's strategic embrace of AI has evidently contributed to its overall financial resilience and efficiency. To conclude with the Indian banks ought to keep using and embracing the different AI tools approach that would result in the bank's financial health.

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