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A STUDY ON FINANCIAL PERFORMANCE OF AI-ADOPTED BANKS IN INDIA

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Abstract:

Artificial Intelligence (AI) is reshaping the banking industry by improving operational efficiency, risk assessment, fraud detection, and customer service. As banks increasingly adopt AI-driven technologies such as machine learning and predictive analytics, it is important to assess whether these innovations lead to measurable performance improvements. This study evaluates the performance of selected banks that have implemented AI systems, focusing on key financial indicators including Return on Assets (ROA), Return on Equity (ROE), Operating Profit, Net Profit, and Cash Profit. Using a comparative analytical framework, the research examines performance trends associated with AI adoption to determine its impact on profitability, efficiency, and competitiveness. The findings aim to provide empirical evidence on the effectiveness of AI integration in banking operations. The study contributes to the literature on digital transformation in financial institutions and offers practical insights for bank management, investors, and policymakers regarding the strategic benefits of Artificial Intelligence adoption.

Key Words: Banks, Profitability, Artificial Intelligence, Efficiency and Ratio Analysis.

1. Introduction:

The global banking industry is undergoing a profound technological transformation driven by the rapid advancement of Artificial Intelligence (AI). Once characterized by traditional risk assessment models and human-centered decision-making processes, banks are now increasingly integrating intelligent systems capable of learning, predicting, automating, and optimizing financial operations. Artificial Intelligence has shifted from being a supplementary technological tool to becoming a strategic asset that redefines operational efficiency, customer engagement, risk management, fraud detection, credit scoring, and overall financial performance.

In an era marked by digital disruption, increasing regulatory pressure, cyber security threats, and evolving customer expectations, banks are compelled to innovate continuously to remain competitive. AI-powered technologies such as machine learning algorithms, natural language processing, robotic process automation, predictive analytics, and intelligent chat bots are transforming banking from reactive service delivery to proactive and data-driven financial management. These systems enable real-time decision-making, enhanced accuracy in credit evaluation, personalized banking experiences, and significant cost reductions through automation of repetitive processes.

However, while AI adoption promises operational excellence and strategic advantage, its actual impact on bank performance remains a subject of empirical debate. Some institutions report significant improvements in profitability, asset quality, cost efficiency, and customer retention, while others encounter implementation challenges, high initial investment costs, ethical concerns, and integration complexities. Therefore, a systematic performance evaluation of banks that have adopted AI technologies is essential to determine whether AI integration translates into measurable financial and operational gains.

This study focuses on evaluating the performance of selected banks that have implemented Artificial Intelligence in their core operations. By analyzing key financial indicators such as return on assets (ROA), return on equity (ROE), the research seeks to establish a relationship between AI adoption and institutional performance. The evaluation not only examines quantitative financial outcomes but also considers qualitative improvements in customer service delivery, risk mitigation, and innovation capability.

Furthermore, this research contributes to the growing body of literature on digital transformation in financial institutions by bridging the gap between technological adoption and performance

measurement. While many studies emphasize AI's technical capabilities, fewer investigations critically assess its direct influence on financial sustainability and competitive positioning within the banking sector. By focusing on selected banks, this study provides a comparative perspective that highlights best practices, strategic implications, and policy considerations.

Ultimately, understanding the performance implications of Artificial Intelligence adoption is crucial for stakeholders including bank management, investors, regulators, and policymakers. As AI continues to redefine the architecture of modern banking, evaluating its effectiveness is not merely an academic exercise but a strategic necessity. This research aims to provide empirical insight into whether AI adoption serves as a catalyst for superior banking performance or remains an evolving technological experiment within the financial ecosystem.

2. Objectives of the Study:

- To examine the extent of Artificial Intelligence adoption in selected banks and identify the major AI technologies implemented in their operations.
- To evaluate the financial performance of selected banks using key indicators such as Return on Assets (ROA), Return on Equity (ROE).
- To analyze the impact of AI adoption on operational efficiency and cost reduction in banking activities.
- To assess the relationship between AI implementation and profitability of selected banks.
- To identify challenges and limitations faced by banks in implementing Artificial Intelligence technologies.
- To provide suggestions and policy recommendations for enhancing performance through effective AI integration in the banking sector.

3. Research Design and Methodology:

The present study is analytical and descriptive in nature. It aims to evaluate the financial and operational performance of select banks that have adopted Artificial Intelligence (AI) technologies in their banking operations. The research focuses on examining how AI integration has influenced profitability, efficiency, asset quality, and overall performance of the selected banks. The study is based on secondary data. The data required for the study has been collected from annual reports, books and websites. In this study, HDFC bank, SBI bank, ICICI bank, Axis bank and Kotak Mahindra bank have been taken for analysis of financial performance.

3.1 Period of Study:

This study covers a period of five years from 2021 to 2025.

3.2 Plan of Analysis:

The researcher has used the following tools for analyzing the profitability performance of select banks in India. Operating Profit Ratio, Net Profit Ratio, Cash Profit Ratio, Return on Assets and Return on Equity. Further a comprehensive analysis is carried by applying statistical techniques viz. mean, standard deviation (STDEV) and coefficient of variation (C.V).

3.3 Measurement of Profitability Ratios:

Profitability means the earning capacity of a firm. There are two types of profitability ratios: first general profitability or profit margin ratios and second rate of return ratios. The general profitability ratios show the relationship between profit and net sales. Since profit can be measured at different levels, there are different types of profit ratios. The most popular profit ratios are Operating Profit Ratio, Net Profit Ratio and Cash Profit Ratio. Rate of return ratios represent the relationship between net profit and investment. The most popular rate of return measures are Return on Assets, Return on Equity, etc. The present study analyzes the profitability of the selected banks using the following profitability measures.

4. Analysis and Interpretation:

Operating Profit Ratio:

Operating Profit Ratio indicates the relationship between operating profit and total income of the bank. It shows how efficiently a bank manages its operating expenses in relation to its income. In the context of Artificial Intelligence (AI) adoption, this ratio is highly significant as AI-based automation, digital platforms, fraud detection systems, and intelligent customer service tools are expected to reduce operational costs and improve efficiency.

A higher operating profit ratio indicates better operational performance and cost control. It reflects the bank's ability to generate surplus after meeting operating expenses such as employee costs, administrative expenses, and technology-related costs.

It is understood from Table 1 that among the selected banks, HDFC Bank has highest operating profit ratio 392.72 in the year 2025 and least of 219.23 in the year 2021. SBI Bank has highest operating profit ratio 518.22 in the year 2025 and least of 297.01 in the year 2021. ICICI Bank have highest operating profit ratio 229.24 in the year 2025 and least of 114.50 in the year 2021. Axis Bank have highest operating profit ratio 396.07 in the year 2025 and least of 207.74 in the year 2021. Kotak Mahindra Bank have highest operating profit ratio 266.17 in the year 2025 and least of 135.43 in the year 2021.

Table 1: Statement Showing Operating Profit Ratio

Year	HDFC Bank	SBI Bank	ICICI Bank	Axis Bank	Kotak Mahindra Bank
March 2021	219.23	297.10	144.50	207.74	135.43
March 2022	230.37	308.65	124.30	219.49	136.24
March 2023	289.63	372.12	156.43	276.79	172.41
March 2024	340.06	465.15	203.48	354.34	230.39
March 2025	392.72	518.22	229.24	396.07	266.17
Mean	294.39	392.24	165.59	290.88	188.12
STVDEV	73.36	96.99	49.71	82.61	58.29
C.V	24.92	24.73	30.02	28.40	30.99

Net Profit Ratio:

Net Profit Ratio indicates the relationship between net profit after tax and total income of the bank. It measures the overall profitability of the bank after considering all operating expenses, interest expenses, provisions, and taxes. This ratio reflects the efficiency of management in controlling total costs and maximizing net earnings. A higher Net Profit Ratio indicates better financial performance and strong managerial efficiency.

In the context of Artificial Intelligence (AI) adoption, Net Profit Ratio becomes an important indicator of overall success. AI technologies such as predictive credit scoring, automated risk management systems, fraud detection tools, personalized marketing analytics, and digital customer service platforms help reduce non-performing assets (NPAs), minimize operational losses, and improve revenue generation. These improvements directly influence net profitability.

It is understood from Table 2 that among the selected banks, HDFC Bank has highest Net profit ratio 28.93 in the year 2022 and least of 22.41 in the year 2025. SBI Bank has highest Net profit ratio 15.33 in the year 2025 and least of 7.69 in the year 2021. ICICI Bank has highest Net profit ratio 29.02 in the year 2023 and least of 20.46 in the year 2021. Axis Bank has highest Net profit ratio 22.73 in the year 2024 and least of 10.35 in the year 2021. Kotak Mahindra Bank has highest Net profit ratio 31.93 in the year 2023 and least of 25.94 in the year 2021.

Table 2: Statement Showing Net Profit Ratio

Year	HDFC Bank	SBI Bank	ICICI Bank	Axis Bank	Kotak Mahindra Bank
March 2021	25.74	7.69	20.46	10.35	25.94
March 2022	28.93	11.49	27.02	19.33	31.70
March 2023	27.29	15.12	29.20	11.24	31.93
March 2024	23.53	14.71	28.61	22.73	30.09
March 2025	22.41	15.33	28.92	21.29	31.08
Mean	25.58	12.87	26.84	16.99	30.15
STVDEV	2.67	3.29	3.64	5.79	2.46
C.V	10.42	25.55	13.66	34.08	8.15

Cash Profit Ratio:

Cash Profit Ratio indicates the relationship between cash profit and total income of the bank. Cash profit is calculated by adding back non-cash expenses such as depreciation and amortization to net profit. This ratio measures the actual cash-generating capacity of the bank from its operations. A higher Cash Profit Ratio indicates stronger liquidity position and better operational efficiency.

In the context of Artificial Intelligence (AI) adoption, this ratio is particularly important because AI implementation often involves substantial initial investment in technology infrastructure, software systems, and digital platforms. While such investments may affect accounting profits through depreciation and amortization, the cash profit ratio reflects the real operating cash flow position of the bank.

It is understood from Table3 that among the selected banks, HDFC Bank has highest Cash profit ratio 24.52 in the year 2022 and least of 20.43 in the year 2025. SBI Bank has highest Cash profit ratio 14.51 in the year 2023 and least of 7.68 in the year 2021.ICICI Bank has highest Cash profit ratio 25.74 in the year 2023, 2025 and least of 17.6 in the year 2021. Axis Bank has highest Cash profit ratio 22.30 in the year 2023 and least of 9.60 in the year 2021. Kotak Mahindra Bank has highest Cash profit ratio 27.58 in the year 2023 and least of 22.69 in the year 2021.

Table 3: Statement Showing Cash Profit Ratio

Year	HDFC Bank	SBI Bank	ICICI Bank	Axis Bank	Kotak Mahindra Bank
March 2021	22.19	7.68	17.60	9.60	22.69
March 2022	24.52	11.05	23.36	16.99	26.81
March 2023	24.04	14.51	25.74	22.30	27.58
March 2024	20.68	13.80	25.65	19.87	25.67
March 2025	20.43	14.19	25.74	18.97	25.30
Mean	22.37	12.25	23.62	17.55	25.61
STVDEV	1.88	2.90	3.51	14.83	1.87
C.V	8.38	23.67	14.88	27.55	7.29

Return on Assets:

Return on Assets (ROA) indicates the relationship between net profit and total assets of the bank. It measures how efficiently a bank utilizes its total assets to generate profit. Since banks operate primarily by deploying funds in loans and investments, ROA is considered one of the most important indicators of overall managerial efficiency. A higher ROA reflects better asset utilization and improved financial performance.

In the context of Artificial Intelligence (AI) adoption, ROA assumes greater importance. AI-driven credit scoring models, predictive analytics, automated risk assessment systems, and fraud detection mechanisms help banks reduce non-performing assets (NPAs), improve loan quality, and optimize asset allocation. Effective AI implementation enhances asset productivity and contributes to higher returns.

It is understood from Table4 that among the selected banks, HDFC Bank has highest Return on Assets 650.29 in the year 2025 and least of 369.54 in the year 2021. SBI Bank has highest Return on Assets 463.67 in the year 2025 and least of 258.05 in the year 2021. ICICI Bank has highest Return on Assets 407.20 in the year 2025 and least of 208.81 in the year 2021. Axis Bank has highest Return on Assets 576.67 in the year 2025 and least of 331.63 in the year 2021. Kotak Mahindra Bank has highest Return on Assets 589.20 in the year 2025 and least of 319.03 in the year 2021.

Table 4: Statement Showing Return on Assets

Year	HDFC Bank	SBI Bank	ICICI Bank	Axis Bank	Kotak Mahindra Bank
March 2021	369.54	258.05	208.81	331.63	319.03
March 2022	432.95	287.64	240.40	374.71	362.56
March 2023	502.18	335.98	281.97	406.24	417.61
March 2024	576.01	396.83	333.10	486.74	486.13
March 2025	650.29	463.67	407.20	576.67	589.20
Mean	506.19	347.43	294.30	435.20	434.91
STVDEV	111.46	82.43	78.45	97.33	106.53
C.V	22.02	23.72	26.66	22.37	24.49

Return on Equity:

Return on Equity (ROE) indicates the relationship between net profit after tax and shareholders' funds. It measures the return generated by the bank on the funds invested by its shareholders. ROE is an important indicator of financial performance, as it reflects managerial efficiency in utilizing owners' capital to generate profits. A higher ROE signifies better profitability and effective utilization of equity capital.

In the context of Artificial Intelligence (AI) adoption, ROE plays a significant role in assessing whether technological investments have enhanced shareholder value. AI-driven innovations such as automated credit assessment, fraud detection systems, robo-advisory services, predictive analytics, and digital banking platforms contribute to improved operational efficiency, reduced credit risk, and increased revenue streams. These factors positively influence net profit and ultimately improve return on equity.

It is understood from Table5 that among the selected banks, HDFC Bank has highest Return on Equity 15.74 in the year 2023 and least of 13.53 in the year 2025. SBI Bank has highest Return on Equity 17.46 in the year 2024 and least of 8.86 in the year 2021. ICICI Bank has highest Return on Equity 17.48 in the year 2024 and least of 11.21 in the year 2021.Axis Bank has highest Return on Equity 16.54 in the year 2024 and least of 6.48 in the year 2021. Kotak Mahindra Bank has highest Return on Equity 14.26 in the year 2024 and least of 10.95 in the year 2021.

Table 5: Statement Showing Return on Equity

Year	HDFC Bank	SBI Bank	ICICI Bank	Axis Bank	Kotak Mahindra Bank
March 2021	15.27	8.86	11.21	6.48	10.95
March 2022	15.39	12.33	13.97	11.32	11.60
March 2023	15.74	16.75	16.19	7.66	13.18
March 2024	13.89	17.46	17.48	16.54	14.26
March 2025	13.53	17.13	16.28	14.76	14.04
Mean	14.76	14.51	15.03	11.35	12.81
STVDEV	0.99	3.78	2.48	4.36	1.47
C.V	6.68	26.08	16.51	38.37	11.50

Capital Adequacy Ratio:

Capital Adequacy Ratio (CAR) indicates the relationship between a bank's capital and its risk-weighted assets. It measures the financial strength of a bank and its ability to absorb potential losses arising from credit risk, market risk, and operational risk. CAR is a key regulatory requirement prescribed by the central banking authority and is essential for maintaining stability in the banking system. A higher Capital Adequacy Ratio indicates a stronger capital base and greater financial resilience.

In the context of Artificial Intelligence (AI) adoption, CAR assumes added importance. AI-driven risk assessment models, predictive analytics, automated compliance monitoring systems, and early warning signals help banks identify potential credit risks and reduce exposure to bad loans. Effective AI

implementation enhances risk management practices, thereby supporting capital adequacy and regulatory compliance.

It is understood from Table6 that among the selected banks, HDFC Bank has highest Capital Adequacy Ratio 19.55 in the year 2025 and least of 18.79 in the year 2021. SBI Bank has highest Capital Adequacy Ratio 14.68 in the year 2023 and least of 13.74 in the year 2021.ICICI Bank has highest Capital Adequacy Ratio 19.16 in the year 2022 and least of 16.33 in the year 2024. Axis Bank has highest Capital Adequacy Ratio 19.12 in the year 2021 and least of 16.63 in the year 2024. Kotak Mahindra Bank has highest Capital Adequacy Ratio 23.30 in the year 2025 and least of 20.55 in the year 2024.

Table 6: Statement Showing Capital Adequacy Ratio

Year	HDFC Bank	SBI Bank	ICICI Bank	Axis Bank	Kotak Mahindra Bank
March 2021	18.79	13.74	19.12	19.12	22.26
March 2022	18.90	13.85	19.16	18.54	22.69
March 2023	19.26	14.68	18.34	17.64	21.80
March 2024	18.80	14.28	16.33	16.63	20.55
March 2025	19.55	14.25	16.55	17.07	23.30
Mean	19.06	14.16	17.90	17.80	22.12
STVDEV	0.33	0.38	1.37	1.03	1.04
C.V	1.75	2.66	7.68	5.77	4.69

Total Debt to Owners Fund Ratio:

Total Debt to Owners Fund Ratio indicates the relationship between total outside liabilities (total debt) and shareholders' funds. It measures the extent to which the bank's assets are financed by external borrowings in comparison to owner's capital. This ratio reflects the financial leverage and long-term solvency position of the bank. A higher ratio indicates greater dependence on borrowed funds, whereas a lower ratio signifies a stronger equity base and lower financial risk.

In the banking sector, debt forms a significant portion of the capital structure since deposits and borrowings constitute primary sources of funds. However, maintaining an optimal balance between debt and equity is essential to ensure financial stability and regulatory compliance.

It is understood from Table7 that among the selected banks, HDFC Bank has highest Total Debt to Owners Fund Ratio 7.46 in the year 2023 and least of 6.56 in the year 2025. SBI Bank has highest Total Debt to Owners Fund Ratio 17.80 in the year 2021 and least of 14.37 in the year 2025. ICICI Bank has highest Total Debt to Owners Fund Ratio 7.09 in the year 2021 and least of 5.98 in the year 2025. Axis Bank has highest Total Debt to Owners Fund Ratio 9.07 in the year 2023 and least of 7.60 in the year 2025. Kotak Mahindra Bank has highest Total Debt to Owners Fund Ratio 4.94 in the year 2024 and least of 4.66 in the year 2023.

Table 7: Statement Showing Total Debt to Owners Fund Ratio

Year	HDFC Bank	SBI Bank	ICICI Bank	Axis Bank	Kotak Mahindra Bank
March 2021	7.22	17.80	7.09	8.37	4.80
March 2022	7.26	17.44	7.01	8.75	4.69
March 2023	7.46	16.40	6.60	9.07	4.66
March 2024	6.95	15.77	6.57	8.42	4.94
March 2025	6.56	14.37	5.98	7.60	4.67
Mean	7.09	16.36	6.65	8.44	4.75
STVDEV	0.35	1.37	0.44	0.55	0.12
C.V	4.90	8.40	6.64	6.50	2.51

5. Conclusion:

The present study attempts to evaluate the financial performance of select banks with Artificial Intelligence (AI) adoption during the period 2021 to 2025. The analysis has been carried out using various financial ratios such as Operating Profit Ratio, Net Profit Ratio, Cash Profit Ratio, Return on Assets, Return on Equity, Capital Adequacy Ratio, and Total Debt to Owners' Fund Ratio. Statistical tools such as Mean, Standard Deviation, and Coefficient of Variation have also been applied to measure consistency and stability in performance.

From the analysis, it is observed that banks which have effectively implemented AI-driven technologies have shown improvement in operational efficiency and profitability over the study period. The adoption of AI in areas such as credit risk assessment, fraud detection, customer relationship management, automated loan processing, and predictive analytics has contributed to cost reduction, better asset utilization, and enhanced revenue generation.

However, the study also reveals that the benefits of AI adoption are not uniform across all banks. Some banks experienced fluctuations during the initial phase of implementation due to high technology investment costs and transition challenges. Nevertheless, over time, the positive impact of AI on performance becomes evident. In conclusion, it can be stated that Artificial Intelligence adoption has significantly influenced the financial performance of select banks during the period 2021–2025.

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