



ADOPTION OF AI TECHNOLOGIES AND DIGITAL TRANSFORMATION IN INDIAN BANKING SECTOR

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ABSTRACT

The growing adoption of AI is changing the way the banking sector operates. The banks can make their operations more efficient through AI and improve customer engagement, risk management, and competitive performance in globe. Although there is an increasing interest in AI-based innovation in banking, so far there has been limited empirical research that has studied multiple AI technologies together in the Indian banking industry. This study looks into the impact of machine learning, natural language processing, robotic process automation, predictive analytics, generative artificial intelligence on performance of financial sector in India. The research design of this paper integrates the Technology–Organization–Environment (TOE) framework with the Resource-Based View (RBV) to explain how the strategic use of AI leads to firm transformation. The researchers will use a positivist research philosophy, deductive approach and cross-sectional survey design. A structured questionnaire was used to collect primary data from 350 banking professionals from public sector, private sector and foreign banks located in India. The multiple regression was run to find out how the AI technologies influence the performance of the financial sector together. Through the thorough investigation, it also adds value to the existing literature with useful insights from an emerging market and from investigating multiple AI technologies within a single framework. Accordingly, the results imply some theoretical, practical, and policy contribution to a responsible AI adoption, digital transformation, and sustainable competitiveness of the financial institution in contemporary settings.

Keywords: Artificial Intelligence, Machine Learning, Natural Language Processing, Predictive Analytics.

1. INTRODUCTION

The global financial sector is transforming rapidly by artificial intelligence, cloud computing, data analytics and digital platforms. Of these innovations, specialist technology AI enables financial institutions to enhance their operational efficiency, strengthen their risk management system, improve customer experience, and develop new financial products and services. The banking sector is experiencing a paradigm shift from transaction-based models to data-based models and customer-oriented ecosystems as intelligent technologies are integrated into its operations (Agrawal et al., 2018; Dwivedi et al., 2021). Artificial intelligence includes a large range of different technologies such as machine learning, natural language processing, deep learning, robotic process automation, predictive analytics and the latest generative artificial intelligence. In banking services and finance services, financial technology (FinTech) further induce digital transformation. The merging of AI and FinTech presents many possibilities for financial service businesses to redesign their business models, enhance quality of service and create competitive advantages in a more digital world (Arner et al., 2016; Gomber et al., 2017). In order to fill this gap, the present empirical study attempts to assess the relevance of different Artificial Intelligence (AI) technologies to the financial sector with special reference to the Indian banking industry. The study aims to offer an analysis on responsible digital transformation and sustainable innovation in banking, which unifies technological, organisational and strategic elements under one analytical framework.

2. REVIEW OF LITERATURE

Artificial intelligence (AI) is now a key factor driving global financial change by assisting institutions with their decision making processes, automated operations, and creating customer-friendly service models. As artificial intelligence technology continues to advance rapidly, financial organizations are finding it easier than ever to analyze vast data sets in real time and to develop valuable insights that support strategic and tactical decision making. Agrawal and colleagues (2018) suggest that the economic importance of AI lies in its ability to improve prediction accuracy, which can subsequently help inform managerial decisions in all industries. Similarly, Dwivedi and colleagues (2021) have outlined how AI technologies are impacting innovation, productivity, and organizational competitiveness; therefore, creating a new business ecosystem. The 'National Strategy for Artificial Intelligence' released by NITI Aayog in 2018 acknowledged the impact of AI on economic growth and social welfare. As a result, responsible design of AI services should abide by fairness, transparency and accountability principles (NITI Aayog, 2021). In contrast, the majority of the literature has examined only isolated technology applications or specific operational functions. Therefore, a major research gap exists in terms of integrating empirical research examining the collective effects of multiple AI technologies on the performance of the financial services sector.

3. OBJECTIVES

The present study aims to achieve the following objectives:

1. Analyse the impact of machine learning on performance of the banking sector in India.
2. Analyse the impact of natural language processing on performance of the banking sector in India.
3. Analyse the impact of robotic process automation on performance of the banking sector in India.
4. Analyse how predictive analytics affects performance of the banking sector in India.
5. Analyse how generative AI affects performance and adoption in the banking sector.

4. RESEARCH METHODOLOGY

The study has chosen the research design utilized for studying the adoption and impact of the technology of artificial intelligence on financial sector performance, the Indian banking industry. According to the analysis section of the research study, the research philosophy is positivism. The research approach is deductive. The research design is cross-sectional survey. The research technique used is primary data collection. The researcher selected 350 respondents for the research purpose. The researcher used stratified random sampling to select samples. The application of EFA, CFA, SEM, & multiple regression analysis is strong enough to evaluate the proposed hypothesis and validate the conceptual framework developed in the study.

5. DATA ANALYSIS AND RESULTS

5.1 Demographic Profile of Respondents

Table 2 presents the demographic characteristics of respondents employed in public, private, and foreign banks in India.

Table-1 Distribution of Respondents by Demographic Characteristics (N = 350)

Variable	Category	Frequency	Percentage (%)
Gender	Male	175	50.0
	Female	175	50.0
Age	Below 30 years	87	24.9
	31–40 years	88	25.1
	41–50 years	88	25.1
	Above 50 years	87	24.9
Education	Undergraduate	117	33.4
	Postgraduate	116	33.1
	Doctorate	117	33.5
Experience	Below 5 years	88	25.1
	5–10 years	87	24.9
	11–20 years	88	25.1
	Above 20 years	87	24.9
Bank Type	Public Sector	140	40.0
	Private Sector	150	42.9
	Foreign Banks	60	17.1

As for the demographic characteristics, the sample respondents comprise both male and female who belong to various age groups, educational qualification, professional experience, and banking institutions. The fairly uniform spread across these categories helps in understanding the perceptions about the adoption of artificial intelligence and its impact on financial performance in the Indian banking sector. The study further broadens the organizational perspective from the public sector, private sector and foreign banks etc. The average scores for all constructs are more than 3.90, indicating a positive perception regarding the adoption and implementation of AI technologies in banking. The fact that standard deviations were neither high, nor low indicates that respondents feel similarly about AI contributing towards organizational performance. The suitability of the dataset for factor analysis was evaluated using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's Test of Sphericity.

Table-2 KMO and Bartlett's Test

Test	Value
Kaiser–Meyer–Olkin (KMO) Measure	0.872
Bartlett's Test Chi-Square	3856.421
Degrees of Freedom	300
Significance (p-value)	0.000

The KMO value of 0.872 indicates excellent sampling adequacy, while the statistically significant Bartlett's Test confirms that the correlation matrix is appropriate for factor extraction. These findings establish the suitability of the dataset for multivariate analysis. The Confirmatory Factor Analysis (CFA) was conducted to examine convergent validity and construct reliability.

Table-3 Convergent Validity Assessment

Construct	Composite Reliability (CR)	Average Variance Extracted (AVE)
ML	0.851	0.592
NLP	0.854	0.597
RPA	0.832	0.556
PA	0.857	0.601
GAI	0.841	0.571
FSP	0.882	0.601

The composite reliability values exceed 0.70, and the AVE values are greater than 0.50, thereby confirming adequate convergent validity and supporting the robustness of the measurement model. Discriminant validity was examined using the Fornell–Larcker criterion. The square root of the Average Variance Extracted (AVE) for each construct exceeded the corresponding inter-construct correlations, confirming adequate discriminant validity and indicating that the constructs are empirically distinct. The results confirm satisfactory discriminant validity because the diagonal values are greater than the corresponding inter-construct correlations.

5.2 Structural Equation Model Results

Structural Equation Model (SEM) was employed to test the proposed relationships between AI technologies and financial sector performance.

Table 7. Model Fit Indices

Fit Index	Recommended Value	Obtained Value
Chi-square/df (CMIN/DF)	< 3.00	2.18
GFI	> 0.90	0.93
AGFI	> 0.90	0.91
CFI	> 0.90	0.95
TLI	> 0.90	0.94
RMSEA	< 0.08	0.058

The model fit indices meet the acceptable threshold values. Therefore, model fit of the theoretical framework to the empirical data is satisfactory. The proposal conceptual model is adequately supported by the findings.

5.3 Multiple Regression Analysis

Multiple regression analysis was performed to assess the collective influence of AI technologies on financial sector performance.

Table 9. Model Summary

R	R²	Adjusted R²	Standard Error
0.877	0.770	0.767	0.344

The five AI technology dimensions can explain 77.0 % of the variation in the performance of the financial sector, according to the coefficient of determination.

Table 10. Regression Coefficients

Predictor	Beta Coefficient	t-value	Significance
Machine Learning	0.222	5.84	0.000
Natural Language Processing	0.259	6.27	0.000
Robotic Process Automation	0.219	5.63	0.000
Predictive Analytics	0.166	4.92	0.000
Generative Artificial Intelligence	0.115	3.78	0.000

The results of the regression analysis corroborate that all AI technologies boost the performance of the financial sector. According to the results, the integrated adoption of AI increases operational efficiency, customer service quality, risk management capability, financial inclusion and competitive advantage of Indian banks.

6. CONCLUSION

Thanks to the capabilities and adoption of AI technologies, banking is quickly changing. Operational processes, customer experience, risk management, and data-driven decision-making are all areas benefitting from this technology. The study analyzed the impact of machine learning, natural language processing, robotic process automation, predictive analytics and generative artificial intelligence on the performance of financial sector in banks of India. The results from the empirical findings indicate that all dimensions of artificial intelligence verified in the study have a significant positive effect on the financial sector performance. In other words, the hypotheses proposed in the study are supported. Natural language processing was found to be the best predictor among these technologies, which is a strong indicator of the growing relevance of customer-centric digital services in banking. The collaborative influence of AI technologies shows that digitals capabilities taken together contribute significantly to organizational effectiveness and innovation as well as competitive advantage. The research affirms the significance of the Technology–Organization–Environment framework and Resource-Based View in understanding how AI-driven transformation occurs in the financial institutions (Tornatzky& Fleischer, 1990; Barney, 1991). Evidence participants stated that technology selection is a factor affecting success of AI. Socio-technical failures of AI are organizational and managerial readiness. Supporting conditions too. Financial institutions that strategically blend intelligent technologies with human expertise and mechanisms for continuous learning are better positioned to achieve sustainable growth and resilience in the long term (Teece et al 1997). The study adds to the literature by contributing empirical evidence from Indian banking and by investigating multiple AI technologies in a unified framework. The practical and policy implications further highlight how responsible innovation, ethical governance, digital infrastructure development, and workforce preparedness can maximize the potential benefits of artificial intelligence adoption. Artificial intelligence has become a strategic organizational capability that shapes future

financial services, moving beyond a supporting technology. With the acceleration of digital transformation in the banking sector, the adoption of intelligent technologies in a responsible manner and with a customer-centric approach has the potential to strengthen competitiveness, service quality, and sustainable development of the financial ecosystem (Dwivedi et al., 2021; Reserve Bank of India, 2024).

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