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Exploring The Impact of Artificial Intelligence On Service Quality and Financial Outcomes in Indian Banks

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Abstract
This study investigated the impact of Artificial Intelligence (AI) applications—specifically Expert Systems, Genetic Algorithms, Artificial Neural Networks, and Intelligent Agents—on both the dimensions of financial services quality (Tangibility, Reliability, Responsiveness, Assurance, and Empathy) and financial performance within the Indian banking sector. Data was collected via a questionnaire distributed to a sample of 384 managers from Indian banks. The survey was conducted online using a snowball sampling technique. For data analysis, Structural Equation Modeling (SEM) was performed with Smart PLS 4.0, complemented by IBM SPSS 26. The results revealed that AI applications generally influence financial services quality; however, Artificial Neural Networks did not significantly affect Tangibility and Reliability. Additionally, Intelligent Agents showed no significant impact on Responsiveness, indicating partial support for hypothesis H1. Furthermore, AI applications demonstrated a significant positive effect on the financial performance of Indian banks, fully supporting hypothesis H2.

Keywords: Financial Performance, Structural Equation Modeling, Customer Queries

1. Introduction

Rapid technological advancements characterize the contemporary era, with artificial intelligence (AI) leading due to its capacity to foster innovation and efficiency across diverse industries. AI constitutes intelligent technology that empowers businesses to execute tasks swiftly and effectively by generating substantial volumes of high-quality data, emulating human intelligence via sophisticated computer systems. AI has fundamentally reshaped numerous sectors, including financial services, where emerging markets like India witness profound shifts in banking operations and strategies. In the Indian banking sector, AI streamlines essential processes such as risk assessment, customer relationship management, and fraud detection, thereby elevating operational efficiency. AI-powered chatbots and virtual assistants are revolutionizing banking through natural language processing and machine learning, enabling efficient handling of customer queries, complaints, and transactions like transfers and account openings.

These tools manage high query volumes continuously, minimize operational costs by reducing staffing needs, and enhance customer satisfaction with personalized, round-the-clock service. Recent scholarly work underscores AI's pivotal role in financial services, leveraging machine learning and natural language processing to refine decision-making and operational performance. Within India, research indicates AI bolsters credit evaluation and fraud prevention, though empirical evidence linking it directly to financial performance metrics remains sparse[i]. (P.V.V.Satyanarayna, 2025) The financial services industry forms the backbone of the global economy, spanning banking, insurance, investments, and markets while overseeing transactions, risks, and offerings like loans and savings products. Financial performance serves as a critical measure of organizational success, evaluating resource efficiency in revenue generation, cost control, and profitability via analyses of income statements, balance sheets, and cash flows—key insights[1] for stakeholders including investors and management. This paper encompasses the subsequent sections: Literature Review, Hypotheses Development, Research Objectives, Methodology, Results, Discussion, Conclusion, Implications, Limitations, and Future Research.

Literature Review

Artificial Intelligence (AI) refers to the development of computer systems capable of performing tasks that typically require human intelligence. These tasks include learning, reasoning, problem-solving, understanding natural language, and interacting with the environment. AI systems simulate cognitive functions by learning from data and adapting to new information. Babina et al. (2024) define AI as computer systems designed to perform such intelligent tasks, while[ii] Parekh & Olivia (2024) describe AI as advanced technology that can simulate human intellectual abilities, simplifying and automating many human professions including speech recognition, language translation, visual perception, and decision-making.

In the context of banking, several AI dimensions are particularly relevant. Expert Systems are specialized computer systems that gather domain-specific knowledge and apply it to solve complex problems, supporting decision-making processes by simulating experts' reasoning. Genetic Algorithms use principles of natural selection to solve both constrained and unconstrained optimization problems, making them useful for various banking challenges. Artificial Neural Networks are data processing systems modeled after biological neural networks that perform tasks such as pattern recognition and forecasting. Intelligent Agents are intelligent, computer-based systems that work effectively using embedded knowledge to perform autonomous tasks[iii] (P.V.V.SATYANARAYAN, 2013).

The researchers in this study adopt these dimensions as the most applicable AI components for the banking sector, reflecting their ability to enhance operational efficiency, decision accuracy, and problem-solving capabilities within banks.

Banking financial services quality:

Artificial intelligence (AI) is transforming the financial services sector, particularly digital banking, by enabling banks to deliver personalized experiences, streamline processes, and reduce costs through analysis of vast data volumes and accurate predictions.

Scholars offer varied definitions of e-banking. Some view it as an electronic link between banks and customers for preparing, managing, and controlling financial transactions. Others describe it as remote delivery channels allowing customers to access accounts, transfer funds, and make payments. Generally, e-banking encompasses retail services via electronic channels, large-value payments, and wholesale banking delivered digitally, including distance banking that manages information flow, solicitation, sales, distribution, and service access without physical presence.

Experts agree that e-banking provides 24/7 access to all financial transactions through systems like ATMs, PCs, the internet, and mobile phones. Banking service quality comprises five key dimensions.

Tangibility refers to physical facilities, equipment, branch safety, convenience, access, and employee appearance that directly support customer service delivery.

Reliability involves delivering promised services accurately and on time, including error- free records, proper billing, problem resolution, security, privacy, and assurance against financial or physical risks—critical for online banking where customers prioritize transaction safety.

Responsiveness entails employees' willingness to provide prompt service, such as instant transaction slips, quick mortgage confirmations, and timely account updates, which boosts customer satisfaction by minimizing wait times and addressing demands efficiently.

Assurance builds customer trust through knowledgeable, courteous, and loyal employees who resolve complaints effectively, reinforced by transparent annual reports detailing bank background, mission, vision, data handling, and revenues.

Empathy focuses on personalized attention, care, understanding, and treating customers as valued individuals through kindness, better communication, convenient timing, and tailored services, fostering loyalty and satisfaction.

Financial performance:

Financial performance evaluates a company's overall financial health and its success in meeting financial objectives, covering revenue generation, expense management, asset utilization, and structural stability.

Assessing financial performance holds critical importance for multiple reasons. Strong results build investor confidence, elevating shareholder value and drawing capital. They also enhance creditworthiness, easing access to loans and funding.

Moreover, financial analysis empowers management with data for strategic decisions on resource allocation, planning, and risk mitigation. It reveals operational inefficiencies, guiding improvements in processes and cost control.

Hypotheses Development

AI applications and financial services quality:

A growing body of research highlights the transformative potential of artificial intelligence (AI) in the financial services industry. Studies have shown that AI can greatly enhance the efficiency and accuracy of various financial processes. For example, AI-powered chatbots and virtual assistants offer 24/7 customer support, reducing response times and improving customer satisfaction. Additionally, AI algorithms analyze large volumes of data to detect fraudulent activities more effectively, helping to mitigate financial losses. The adoption of AI applications in banking services, such as fraud detection and risk prevention, is now recognized as an essential approach to improving the quality of financial services offered to customers. Research has also demonstrated that using AI in banks can increase financial service quality and operational efficiency. Consequently, these positive effects of AI on service quality support the formulation of a related hypothesis for further investigation.

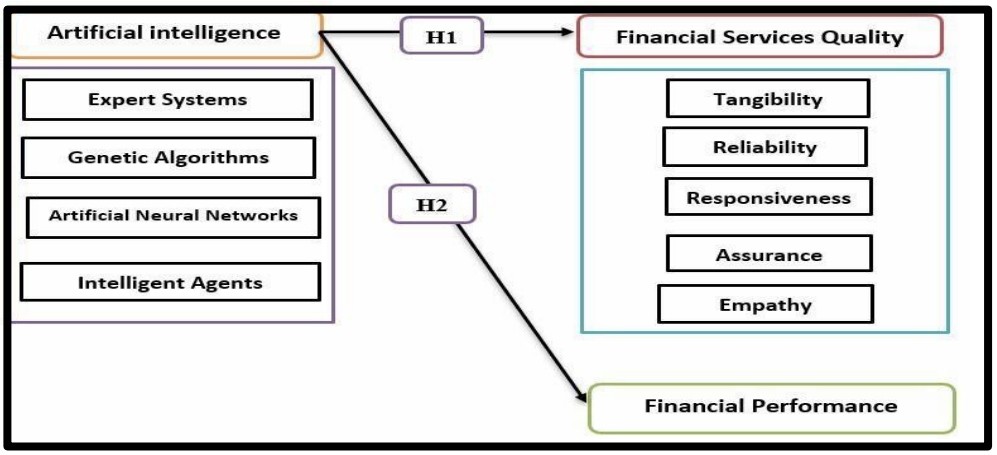
Hypothesis 1 (H_1) states that AI applications have a significant effect on the quality of financial services. AI has notably impacted financial performance within the banking sector by addressing inefficiencies in traditional, manual processes. AI-powered solutions such as chatbots, automated loan underwriting, and fraud detection systems have streamlined banking operations. For example, chatbots provide 24/7 customer service, enhancing satisfaction while reducing labor costs. AI algorithms are also utilized for credit risk assessment, enabling banks to offer more personalized lending options, improve loan approvals, and reduce defaults. Research indicates that fintech innovations, including AI, can improve financial performance, urging banks to adopt inclusive strategies for sustainable development.

Additionally, AI enhances fraud detection and prevention by employing machine learning to analyze large volumes of transaction data in real-time, detecting anomalies before fraud occurs. This reduces financial losses and supports stronger overall performance. AI's predictive analytics also help banks better understand consumer behavior, leading to targeted marketing, increased customer acquisition, and higher revenues. Various studies have confirmed AI's positive influence on financial performance, including examples from Jordanian banks showing that incorporating AI technologies in operations and disclosures positively impacts financial outcomes.

Hypothesis 2 (H_2)

AI applications exert a significant effect on financial performance.

Drawing from the theoretical discussions outlined above, researchers have formulated a conceptual research model, illustrated in Figure 1.



Research Objectives

The researchers aim to achieve the following objectives:

1. To measure the impact of AI applications, including Expert Systems, Genetic Algorithms, Artificial Neural Networks, and Intelligent Agents, on the dimensions of financial services quality—specifically Tangibility, Reliability, Responsiveness, Assurance, and Empathy.
2. To examine the influence of AI applications (Expert Systems, Genetic Algorithms, Neural Networks, and Intelligent Agents) on overall financial performance.

These objectives seek to understand how AI technologies affect both the quality of banking services and the financial results of banks.

Methodology

Survey measures

Researchers utilized an online questionnaire survey distributed via Google Drive to collect data for testing the research hypotheses. The questionnaire incorporated validated scales to measure all variables: a 20-item scale for Artificial Intelligence (AI), a 33-item scale for financial services quality, and a 3-item scale for financial performance. All items employed a five-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree).

Convenience sampling guided participant selection, with questionnaires shared through email, social media, and messaging apps. Prior to full deployment, a pilot test on 50 participants assessed the instrument's reliability and validity, incorporating feedback to refine the final version. Ultimately, 341 valid responses were obtained, deemed adequate for structural equation modeling analysis.

The questionnaire underwent back-translation by bilingual experts, first from English to Arabic and back to ensure accuracy. Data analysis proceeded using Smart PLS 4.0 and IBM SPSS 26 software.

Sampling technique

The study targeted managers from the Indian banking sector as the research sample. A snowball sampling technique was employed to recruit participants. Of the 384 questionnaires distributed, 341

were returned complete and suitable for analysis, yielding an 88.8% response rate.

Results

Demographic profile of respondents

Demographic variables		**Frequency**	**Valid Percent (%)**
Gender	Male	209	61.3%
	Female	132	38.7%
Age	from 30 to less than 40 years	96	28.2%
	from 40 to less than 50 years	142	41.6%
	50 years and more	103	30.2%
Education	Graduated	221	64.8%
level	postgraduate	120	35.2%
Job level	Head of department	119	34.9%
	Department manager	131	38.4%
	Branch manager	91	26.7%
Experience Years	less than 10 years	89	26%
	from 10 to less than 15 years	143	42%
	15 years and more	109	32%

Source: primary data with statistical analysis

Table 1 reveals the demographic profile of respondents. Males comprised 61.3% (n=209), while females accounted for 38.7% (n=132). The largest age group was 40-49 years at 41.6% (n=142), followed by 30-39 years at 28.2% (n=96). Education levels showed 64.8% (n=221) held graduate degrees and 35.2% (n=120) postgraduate qualifications. Job positions included 38.4% (n=131) department managers and 26.7% (n=91) branch managers.Experience distribution peaked at 10-15 years with 42% (n=143), while under 10 years represented 26% (n=89).

Measurement Model Assessment:

The structural equation model was relied upon to ensure the structural validity of the scale, in addition to ensuring the validity of the model before conducting the hypothesis test, by determining the reliability of the loading factors, calculating composite reliability (CR), Alpha Cronbach coefficient (α), measuring the convergent Validity and Discriminant Validity, moreover, calculating model fit indices.

Mean, standard deviation, loading Factors, Cronbach’s Alpha, CR and AVE for all variables

Variables	Dimensions	Items	Loading Factor	Mean	S. D	α	CR	AVE
Artificial Intelligence (AI)	Expert Systems	ES.1	0.703	3.93	0.642	0.841	0.849	0.724
		ES.2	0.632					
		ES.3	0.552					
		ES.4	0.662					
		ES.5	0.711					
	Genetic Algorithms	GA.1	0.556	4.08	0.533	0.826	0.831	0.716
		GA.2	0.574					
		GA.3	0.621					
		GA.4	0.608					
		GA.5	0.585					
	Artificial Neural Networks	AN.1	~~0.341~~	3.88	0.446	0.818	0.822	0.641
		AN.2	0.641					
		AN.3	0.529					
		AN.4	0.708					
		AN.5	0.686					
	Intelligent Agents	IA.1	0.677	4.02	0.722	0.804	0.811	0.687
		IA.2	~~0.402~~					
		IA.3	0.594					
		IA.4	0.642					
		IA.5	0.714					
		IA.6	0.707					
		TG.1	0.660	3.83	0.332	0.788	0.793	0.631
		TG.2	0.549					
		TG.3	~~0.382~~					
Financial Services Quality	Tangibility	TG.4	0.532					
		TG.5	~~0.411~~					
		TG.6	0.588					
		TG.7	0.636					
	Reliability	RB.1	~~0.291~~	4.01	0.841	0.802	0.807	0.562
		RB.2	0.588					
		RB.3	0.646					
		RB.4	0.577					
		RB.5	0.599					
		RB.6	~~0.242~~					
		RB.7	0.525					

	Responsiveness	RS.1	0.712	3.90	0.460	0.772	0.778	0.581
		RS.2	0.706					
		RS.3	0.694					
		RS.4	0.680					
		RS.5	0.707					
	Assurance	AR.1	0.642	3.80	0.649	0.751	0.758	0.608
		AR.2	0.814					
		AR.3	0.726					
		AR.4	~~0.362~~					
		AR.5	0.584					
		AR.6	~~0.406~~					
		AR.7	0.546					
		AR.8	0.550					
	Empathy	EP.1	0.656	3.78	0.942	0.766	0.771	0.555
		EP.2	0.548					
		EP.3	0.661					
		EP.4	~~0.286~~					
		EP.5	0.529					
		EP.6	0.514					
Financial Performance		FP.1	0.606	3.96	0.516	0.791	0.798	0.651
		FP.2	0.718					
		FP.3	0.734					

Source: primary data with statistical analysis

As shown in Table 2, factor loadings for all items were accepted because their values exceeded the threshold of 0.50, except for nine items (AN.1, IA.2, TG.3, TG.5, RB.1, RB.6, AR.4, AR.6, EP.4), which fell below this cut off and were consequently removed, following the guidelines of Hair et al. (2014). The composite reliability (CR) and Cronbach's alpha (α) values were calculated to assess the internal consistency reliability of the scales. All CR and α values satisfied the recommended criterion of exceeding 0.70, thus confirming reliability for all constructs. Convergent validity was evaluated using the average variance extracted (AVE), which should be greater than 0.50, and all variables met this standard. Furthermore, inter-construct correlations were examined to support validity assessments

Results of discriminant validity by Fornell- Larcker criterion

Variables	ES	GA	AN	IA	TG	RB	RS	AR	EP	FP
ES	**0.773**									
GA	0.621	**0.791**								
AN	0.324	0.601	**0.801**							
IA	0.511	0.587	0.622	**0.822**						
TG	0.621	0.622	0.697	0.639	**0.817**					
RB	0.552	0.545	0.702	0.647	0.703	**0.782**				
RS	0.432	0.614	0.603	0.589	0.623	0.614	**0.811**			
AR	0.660	0.503	0.612	0.456	0.584	0.523	0.642	**0.809**		
EP	0.523	0.432	0.635	0.656	0.454	0.442	0.601	0.644	**0.742**	
FP	0.501	0.401	0.587	0.588	0.497	0.404	0.580	0.637	0.551	**0.726**

(Source: primary data with statistical analysis)

Note: ES (Expert Systems), GA (Genetic Algorithms), AN (Artificial Neural Networks), IA (Intelligent Agents), TG (Tangibility), RB (Reliability), RS (Responsiveness), AR (Assurance), EP (Empathy), FP (Financial Performance)

Discriminant validity assesses the degree to which each construct is empirically distinct from others. According to the Fornell- Larcker criterion, this requires the square root of the average variance extracted (AVE) for each construct to exceed its correlations with all other constructs.

As per confirms discriminant validity, as the square root of AVE for each variable surpassed its inter-construct correlations, demonstrating the scales' overall distinctiveness and consistency.

Model Fit Indices

Indices	Symbol	Acceptance Index	Saturated Model	Estimated Model
Standardized Root Mean Square Residual	SRMR	SRMR < 0.08	0.043	0.051
Un weighted Least Square Discrepancy	d_ULS	d_ULS > 0.05	12.532	12.874
Geodesic Discrepancy	d_G	d_G > 0.05	6.771	6.932
Normed Fit Index	NFI	NFI > 0.90	0.93	0.92

Source: primary data with statistical analysis All indices fall in the acceptance area. Thus, all indices were accepted, therefore the model is fit.

Hypotheses Testing:

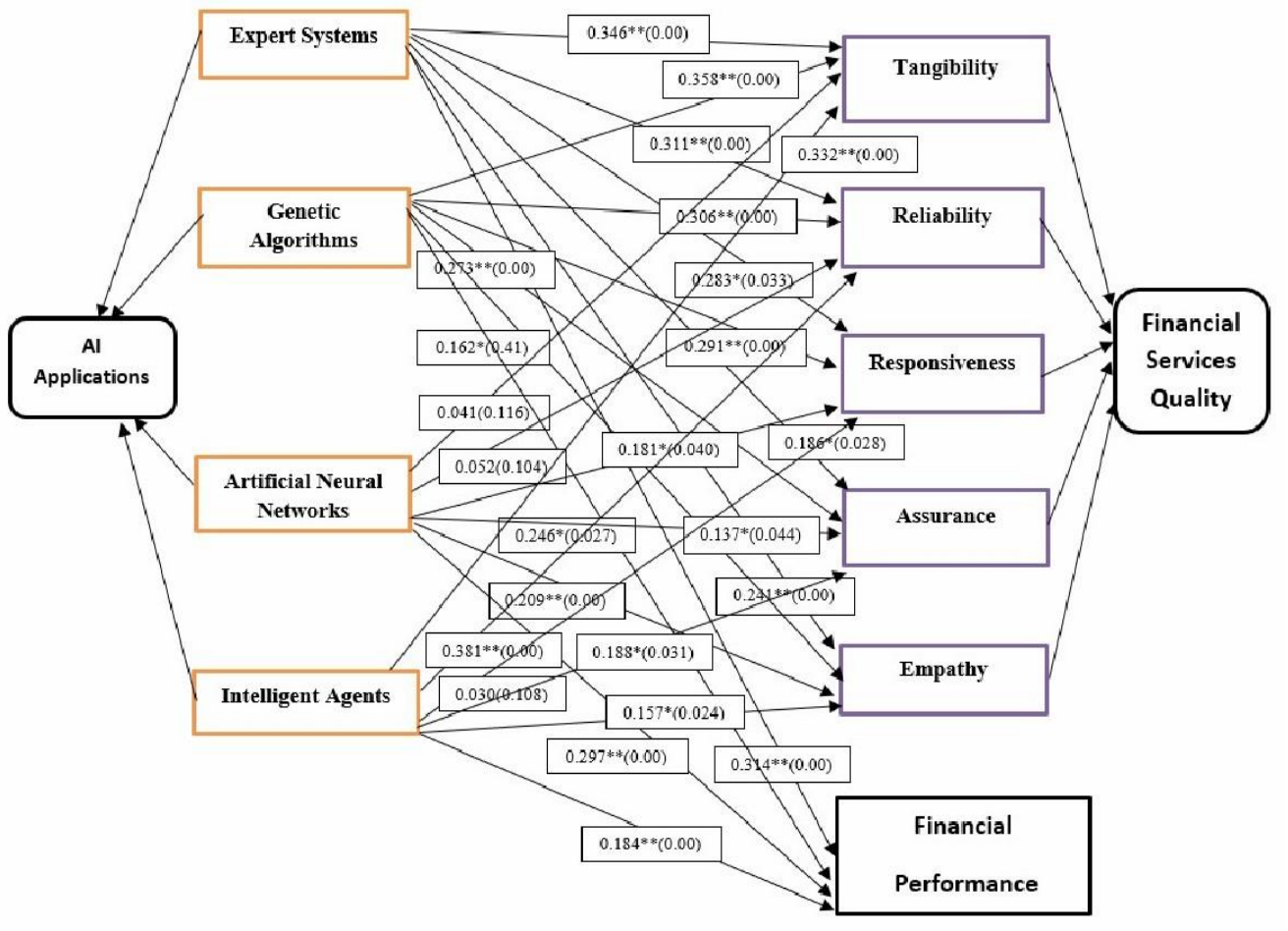
No	**Hypotheses**	**Path Coff**	**f^2**	**P-Value**	**Result**
H1					**Partially Supported**
H1a	Expert Systems → Tangibility	0.346**	0.29	0.00	Supported
	Expert Systems → Reliability	0.311**	0.24	0.00	
	Expert Systems → Responsiveness	0.283*	0.19	0.033	
	Expert Systems → Assurance	0.186*	0.17	0.028	
	Expert Systems → Empathy	0.241**	0.31	0.00	
H1b	Genetic Algorithms → Tangibility	0.358**	0.36	0.00	Supported
	Genetic Algorithms → Reliability	0.306**	0.26	0.00	
	Genetic Algorithms → Responsiveness	0.291**	0.30	0.00	
	Genetic Algorithms → Assurance	0.273**	0.38	0.00	
	Genetic Algorithms → Empathy	0.162*	0.28	0.041	
H1c	Artificial Neural Networks → Tangibility	0.041	0.01	0.116	Rejected
	Artificial Neural Networks → Reliability	0.052	0.01	0.104	
	Artificial Neural Networks → Responsiveness	0.181*	0.16	0.040	Supported
	Artificial Neural Networks → Assurance	0.137*	0.12	0.044	
	Artificial Neural Networks → Empathy	0.209**	0.22	0.00	
	Intelligent Agents → Tangibility	0.332**	0.39	0.00	Supported
	Intelligent Agents → Reliability	0.381**	0.18	0.00	

H1d	Intelligent Agents → Responsiveness	0.030	0.01	0.108	Rejected
	Intelligent Agents → Assurance	0.188*	0.17	0.031	Supported
	Intelligent Agents → Empathy	0.157*	0.22	0.024	
H2					**Supported**
H2a	Expert Systems → Financial Performance	0.314**	0.37	0.00	Supported
H2b	Genetic Algorithms → Financial Performance	0.246*	0.29	0.027	
H2c	Artificial Neural Networks → Financial Performance	0.297**	0.21	0.00	
H2d	Intelligent Agents → Financial Performance	0.184**	0.19	0.00	

Source: primary data with statistical analysis

Regarding the hypothesis H1 testing, AI applications exhibit a direct, positive, and significant impact on the dimensions of financial services quality. However, Artificial Neural Networks show no significant effect on Tangibility and Reliability, while Intelligent Agents do not significantly affect Responsiveness. Among the AI applications, Genetic Algorithms demonstrate the strongest influence on financial services quality, especially on Tangibility, with a substantial effect size ($\beta = 0.358$, $p = 0.00$, $f^2 = 0.36$). Conversely, Artificial Neural Networks exert the least impact, particularly on Assurance, with a smaller effect ($\beta = 0.137$, $p = 0.044$, $f^2 = 0.12$). Therefore, H1 is considered partially supported.

Regarding H2 testing, AI applications have a direct, positive, and significant impact on financial performance. Among these, Expert Systems exhibit the strongest influence on financial performance, highlighting their pivotal role in enhancing banking outcomes through improved decision-making, process automation, and risk management. This finding aligns with established research emphasizing AI's capacity to drive efficiency, reduce costs, and boost revenue in financial institutions. Thus, H2 is supported by the data.



Path diagram with path coefficients estimates and their significance levels

Discussion

This study primarily examines the direct effects of AI applications on financial services quality and financial performance within the Indian banking sector. The findings confirm that AI applications significantly influence both service quality and financial performance.

Hypothesis H1 received partial support, consistent with prior research indicating that AI adoption in banking enhances service quality and yields benefits such as improved customer satisfaction. Hypothesis H2 gained full support, aligning with studies demonstrating that AI applications elevate organizational financial performance.

These results underscore the critical importance of implementing AI technologies in the banking sector to optimize both service delivery and financial outcomes.

Conclusion

This study investigates the impact of artificial intelligence (AI) applications on banking service quality within the Indian banking sector. Results reveal a significant positive effect, suggesting that bank managements should prioritize the adoption and integration of AI applications to enhance service delivery. Additionally, the research explores AI's role in bolstering financial performance among Indian banks. Findings demonstrate a significant positive influence, urging bank managers to invest in AI technologies and their continuous updates to improve financial outcomes and support sustainable development in the sector.

Implications

Theoretical Implications

This study advances the literature on artificial intelligence (AI), financial services quality, and financial performance by integrating these variables into a single research model—the first of its kind. Key contributions include:

- Enhanced understanding of how AI applications influence financial services quality, essential for achieving customer satisfaction in banking.
- Positioning AI applications as reliable predictors of financial performance.
- Enriching AI literature, particularly in the Indian context, by confirming that AI adoption improves both service quality and financial outcomes.

Practical Implications

Findings offer actionable insights for the banking industry. AI applications positively impact service quality, with Genetic Algorithms emerging as the most influential factor. Bank managers should prioritize updating and optimizing Genetic Algorithms while implementing incentive programs to encourage customers to share positive AI experiences on social media. Caution is advised against unchecked AI deployment to avoid potential negative effects.

AI applications also significantly enhance financial performance, led by Expert Systems. Managers must emphasize Expert Systems implementation to drive banking efficiency and profitability.

Limitations and Future Research

Despite its theoretical and practical contributions, this study has notable limitations that inform avenues for future research.

- The analysis focused solely on specific AI applications (Expert Systems, Genetic Algorithms, Artificial Neural Networks, Intelligent Agents), excluding others like chatbots, machine learning, and deep learning. Future studies should incorporate these additional technologies to provide a more comprehensive assessment.
- No mediating or moderating variables were examined in the relationship between AI applications, service quality, and financial performance. Researchers may extend the model by including factors such as fintech adoption or risk aversion as moderators. The research was confined to the Indian banking sector. Subsequent investigations could apply the framework to other

industries, such as manufacturing or insurance, to test generalizability.

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