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The Role Of Artificial Intelligence (AI) And Machine Learning In Improving Banking Services Of Bangladesh

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Abstract:
Extensive human consumption, large economic expansion, and rapid population growth have increased nationwide banking services in Bangladesh. Research on Artificial Intelligence (AI) and Machine Learning (ML) in banking services of Bangladesh is moving towards new frontiers in efficiency and applicability due to the growing amount of data being collected in banking systems and the convergence of various technological applications like artificial intelligence (AI) techniques and machine learning (ML) that can present a novel and creative alternative for the banking system of Bangladesh. Even though much research has been conducted in the banking field, relatively few studies assess how advancements in AI and ML techniques can contribute to the enhancement of banking services. To close this gap, this study conducts an integrative review of the relevant literature with an application of preferred reporting items examining peer-reviewed publications to explore the role of AI in improving different banking services areas, such as transaction and forecasting, service level monitoring, process parameter prediction, service routing and monetary planning. The main AI techniques models used in banking optimization, the application areas and stated performance metrics are all thoroughly analyzed in this study. A conceptual framework of AI and ML is proposed to guide research and practice to take a holistic approach to banking services, along with areas of future study that need to be explored. Researchers, policymakers, financials, governments and other banking organizations will benefit from this study to minimize costs, maximize efficiency, eliminate the need for manual labor and change the approach to the service of banking sectors in Bangladesh.

Key Word: *Banking Service, Artificial Intelligence (AI), Machine Learning*

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I. Introduction

Recently, the banking sector of Bangladesh has faced remarkable expansion, spurred by rapid economic prosperity, technological progression and a growing demand for accessible financial inclusion services. This extended demand has asserted pressure on traditional banking systems to evolve and adapt to the changing needs of customers. However, many conventional banking processes in Bangladesh remain dependent on manual operations, resulting in inefficiencies, longer service times, and a greater risk of human error (Majumder, 2024; Sikder, 2023). In this perspective, the emergence of Artificial Intelligence (AI) and Machine Learning (ML) technologies offers an on-time and transformative opportunity to reform and optimize banking operations (Sarker, 2024). From the global context, financial institutions have already commenced leveraging AI and ML to streamline operations, enhance customer experiences, detect fraud, improve credit scoring models, automate customer service through chatbots, and forecast financial trends with greater precision (Kaya, et al. 2019). These technologies make worth data-driven decision-making and personalized banking services, thereby significantly enhancing operational efficiency and customer satisfaction (Rahman et al, 2021). Despite these advancements, the adoption of AI and ML in Bangladesh's banking sector is still at an elementary stage, obstructed by a lack of knowledge, and awareness, infrastructure challenges, skill gaps, and regulatory uncertainties (Saif, 2024).

In this research, researchers aim to critically examine the role of AI and ML in enhancing the banking services of Bangladesh by examining and synthesizing findings from peer-reviewed studies. It tries to identify the major areas where AI techniques are being applied, assess their effectiveness, and explore the challenges and opportunities associated with their execution. Furthermore, this paper elaborates on a conceptual framework to guide future research direction and pragmatic applications, assisting banking institutions in Bangladesh's transformation into more intelligent, automated, and customer-centric service models (Uddin, Ichihashi and Barua, 2022). By accosting existing gaps in knowledge and practice, the study provides a deeper understanding of how emerging technologies can shape the future of banking in Bangladesh. While the worldwide banking industry is significantly applying Artificial Intelligence (AI) and Machine Learning (ML) to enhance service delivery, efficiency, and security, the banking sector in Bangladesh remains lagging behind. Existing banking

systems are often inefficient, heavily manual, and slow to respond to customer demands (Rajuroy and Emmanuel, 2020). Despite the availability of vast financial and customer data, Bangladeshi banks are still working to fully harness their potential due to the limited implementation of intelligent technologies (Husain, Hamdan and Fadhul, 2022). Moreover, there is a remarkable lack of extensive specific academic studies that explore how AI and ML can be pragmatically integrated into the country's banking ecosystem (Bose, Khan, and Monem, 2020). The absence of a clear framework for adoption, insufficient technological infrastructure, and a shortage of skilled professionals further complicate the situation (Islam, 2022). These challenges highlight a tight gap in both research and practice, making it imperative to explore the role of AI and ML in transforming banking services in Bangladesh. Moreover, this study is crucial for several reasons. First, it addresses an urgent need to comprehend how AI and ML can be effectively used to modernize banking operations in Bangladesh. By conducting an integrative review, this study synthesizes the current knowledge gap and identifies emerging trends and applications of intelligent technologies in the Bangladeshi banking domain. Secondly, this study offers rich sagacity for policymakers, banking professionals, and technology developers by highlighting the key benefits, challenges, and performance outcomes associated with AI-based banking solutions for Bangladesh. Third, the raised conceptual framework can serve as a strategic guide for monetary institutions aiming to adopt AI and ML, promoting innovation and improving service quality across the banking sector. Ultimately, this research contributes to the advancement of a more efficient, inclusive, and technology-driven banking system in Bangladesh, along with broader goals of digital transformation and sustainable economic development through AI and ML.

Research Question

1. How Artificial Intelligence (AI) and Machine Learning Models Can Improve the Banking Services of Bangladesh?

II. Material And Methods

Overview

This study adopted an integrative literature review approach, applying (Snyder, 2019) guidelines to ensure a structured and transparent review process. A literature review can be good research illustrated by (Snyder, 2019) as the base of this study. Thus, following (Snyder, 2019) a research scheme was developed to scrutinize studies from numerous databases like Scopus, Web of Science, IEEE Xplore, and Google Scholar. This type of methodology has been applied in the study of (Kabir and Sajib, 2021) and (Shajahan, and Sajib, 2022). Besides, this research design is convenient to apply and understandable to the readers.

Database Selection

Key scholarly databases were selected to ensure extensive specific coverage like Web of Science, Elsevier, SpringerLink, and Taylor & Francis.

Time Horizon

The review encompasses the publications from 2010 to 2023 to scrutinize recent developments in AI and ML applications in the banking sector, particularly in the context of digital transformation and emerging technologies globally.

Journal and Keyword Selection

Key terms used in the search included "Artificial Intelligence in Banking," "Machine Learning in Financial Services," "AI in Bangladesh Banks," "FinTech," "Banking Automation," and "AI Algorithms." Specifically, peer-reviewed journal articles, conference papers, and credible reports were collected.

Data Analysis and Review Strategy

A large number of peer-reviewed articles were selected for review analysis. Every article was coded based on themes/categories such as AI techniques used, areas of banking application (e.g., fraud detection, customer service, credit analysis), performance outcomes, and implementation challenges. The integrative literature review was used to synthesize findings and categorize the insights.

Various AI Model and Their Implications

Considerable recent efforts have been made to shift the banking industry toward sustainability and profitability through the application of innovative technologies and smart systems (Kaya et al, 2019). It is anticipated that recently developed AI techniques will prove to be highly appropriate for application in the banking sector (Rahman et al, 2021). Artificial Intelligence (AI) technology includes developing computer programs and systems that may mimic human abilities such as learning, problem-solving, perception,

understanding, reasoning, and environmental awareness (Arashpour, 2023). Artificial intelligence (AI) methods, such as fuzzy logic (FL), genetic algorithms (GA), expert systems, and artificial neural networks (ANN), can foresee results, handle poorly specified issues, and create complicated maps (Wang et al., 2024). Each AI method or algorithm serves a specific function; for example, ANN models may train data for classification and prediction (Ibrahim et al., 2024). ANNs may also be used for huge data processing and geographic analysis in urban geography (Tehrani et al., 2024). In addition to being knowledge-based, expert systems such as FL may also learn human cognitive skills and reasoning (Siqueira et al., 2024). Because of their simple language grammar, these systems are capable of managing complex procedures and qualitative traits (Mounadel et al., 2023). Nonetheless, natural selection is used as a model by evolutionary algorithms, such as GA, to pick the best-fitting data in order to handle unpredictable situations and generate the best outcomes (Pourreza Movahed et al., 2020). AI is gaining traction in the field of banking systems, including predicting patterns of financing, RPA (Robotic Process Automation, chat boot, document processing, anomaly detection, image recognition, sentiment analysis, customer segmentation, credit scoring and regulatory compliance (Rahman, Ming, Baigh and Sarker, 2023). Studies on AI research about particular Banking sector application areas, like transaction, credit systems, fraud detection, customer services, customer negotiations, risk assessment, and financial forecasting are still scarce (Ikhsan et al., 2025; Kaya et al., 2019). To identify the gaps in existing literature, Table 1 gives a summary of earlier research reviews that investigate the application of AI in the banking system. It also illustrates how this study's focus and outcomes differ from those of previous studies. It is evident from Table 1 that no review article has been written that compiles all of the research on AI applications in the various areas of banking in Bangladesh. Thus, the application of AI techniques to the banking sectors of Bangladesh necessitates a thorough discussion about the current research and reported results to drive further advancements.

Table no 1 Synopsis of Research on AI and Machine Learning in the Banking Sectors

SL	Focus of Study	Period of Study	Reference	External Validity	Databases
1	AI Practices and Business Development	2021-23	(Islam et al, 2023)	High	Scopus
2	AI and Banking Services in Bangladesh	2020-21	(Rahman et al, 2021)	High	Scopus, Web of Science
3	AI its Applications and Challenges for Govt. of BD	2019-21	(Babu, 2021a)	Medium	Google Scholar
4	AI and its Application in Different Sectors of Bangladesh	2019-21	(Babu, 2021b)	Medium	Google Scholar
5	Fraud Detection and Risk Management	2017	(BIBM, 2017)	Medium	Institutional Database
6	Transaction and Credit Transfer, Fraud Assessment	2021-22	(Husain, Hamdan and Fadhul, 2022)	Medium	Scopus
7	Factors Affecting Adoption of AI in Banking Sectors	2020-21	(Khan et al., 2021)	Medium	Google Scholar
8	Prospects of AI in Bangladeshi Banking	2019-20	(Ahmad and Al Mamun, 2020)	Medium	Google Scholar
9	AI for Sustainable Development in Bangladesh	2022-23	(Mazid-ul-Haque, 2023)	Medium	Google Scholar
10	Opportunities of AI Use in Banking	2019-21	(Shetu et al., 2021)	Medium	Google Scholar
11	Role of AI in Internet Banking	2019-20	(Rajuroy and Emmanuel, 2020)	Low	Google Scholar
12	Market Competition	2018-19	(Kaya et al., 2019)	High	Google Scholar
13	Customer Experiences	2017-18	(Alsheibani et al., 2018)	High	Google Scholar
14	AI and Its Applications in BD	2020-22	(Babu et al., 2022)	High	Springer Nature
15	AI (TAM) Model in Indonesia	2023-25	(Ikhsan et al., 2025)	High	Scopus
16	AI Adoption in the Banking Sector	2022-23	(Rahman, Ming, Baigh and Sarker, 2023)	High	Scopus
17	Behavior of Customers in Banking Services in Bangladesh	2021-22	(Islam, 2022)	High	Scopus
18	Fintech Development and Banking Management	2021-22	(Uddin, Ichihashi and Barua, 2022)	High	Scopus
19	Branchless Banking by Rural People During Pandemic	2022-23	(Ashraf, 2023)	High	Scopus
20	Green Banking Performance and Sustainability	2019-20	(Bose, Khan, and Monem, 2020)	High	Scopus

1	Improving Banking Services in BD with Various AI Models	2025	This Research	- -

III. Result

This study found that Artificial Intelligence (AI) and Machine Learning (ML) can be increasingly applied in various banking operations in Bangladesh, with promising outcomes in efficiency, security, and customer satisfaction. Key applications include fraud detection, credit risk analysis, customer service automation via chatbots, transaction forecasting, and process optimization through Robotic Process Automation (RPA). AI models such as Artificial Neural Networks (ANN), Fuzzy Logic (FL), Genetic Algorithms (GA), and Expert Systems are being employed to enhance decision-making, reduce human error, and deliver personalized services.

Despite these advancements, the study also identified several critical barriers, such as inadequate technological infrastructure, lack of skilled professionals, low awareness, and regulatory uncertainty. The findings suggest that successful AI adoption in Bangladeshi banks depends on factors like technological readiness, organizational culture, regulatory frameworks, and customer trust.

A conceptual framework has been proposed to help financial institutions assess their preparedness, choose suitable AI models, and evaluate performance metrics for improved banking services.

The integrative literature review clarified that AI and ML are being used in various core and support functions of banking, including:

Fraud Detection:
AI algorithms help detect unusual patterns in transactions to prevent financial fraud.

Credit Risk Analysis:
ML models assess creditworthiness more accurately than traditional methods.

Customer Service Automation:
Chatbots and virtual assistants powered by Natural Language Processing (NLP) improve customer interaction.

Transaction Forecasting:
Predictive analytics help banks anticipate transaction volumes and customer behavior.

Process Optimization:
Robotic Process Automation (RPA) streamlines back-office tasks, reducing cost and time.

Monetary Planning and Decision-Making:

AI tools assist in strategic financial planning and investment decisions. Despite these advances, the review also highlighted challenges such as data privacy concerns, lack of skilled personnel, regulatory ambiguity, and resistance to technology adoption within traditional banks.

Table no 2 AI and ML Models Matrix

AI Model / Technique	Core Features	Banking Use Cases	Impact on Bangladesh's Banking
Artificial Neural Networks (ANN)	Mimics the human brain; excellent for pattern recognition and prediction	Credit scoring, fraud detection, transaction forecasting, customer churn prediction	Improved credit risk analysis, real-time fraud alerts, personalized services
Fuzzy Logic (FL)	Handles imprecise or uncertain data using approximate reasoning	Customer behavior modeling, service personalization, risk evaluation	Better handling of vague/incomplete customer data for decision-making
Genetic Algorithms (GA)	Optimization through evolution-based processes (selection, crossover, mutation)	Portfolio optimization, resource allocation, dynamic loan pricing	Enhanced profitability through optimized financial planning
Expert Systems	Knowledge-based systems that emulate human expert decision-making	Loan approval processes, internal audits, regulatory compliance	More consistent and faster decision-making in regulatory-heavy environments
Natural Language Processing (NLP)	Enables machines to understand and respond to human language	Chatbots, virtual assistants, customer support automation	24/7 customer service, reduced operational load, improved customer satisfaction
Robotic Process Automation (RPA)	Automates repetitive tasks with rule-based logic	KYC verification, form filling, transaction processing	Faster processing time, reduced human error, cost reduction
Anomaly Detection Systems	Identifies unusual patterns that deviate from normal behavior	Fraud detection, cyber threat analysis	Prevention of fraudulent transactions, enhanced cybersecurity

Sentiment Analysis	Analyzes customer opinions from texts and feedback	Customer satisfaction monitoring, brand management	Helps improve services by understanding customer sentiment from feedback and social media
Clustering Algorithms	Groups similar data points together without prior labels	Customer segmentation, targeted marketing, service personalization	Better marketing strategies, tailored financial products

IV. Discussion

The research's conclusions point to a turning point in Bangladesh's banking industry, where machine learning and artificial intelligence (AI) are increasingly playing a key role in strategic growth and operational innovation. There is a great deal of room for performance improvement when intelligent technologies are included in core banking services, but there is also an urgent need to overcome organizational, structural, and legal constraints in Bangladesh.

Emerging Roles of AI and ML in Banking Functions

This study attests to the important roles that AI and ML are playing in a variety of financial disciplines. Through anomaly detection and prediction algorithms, AI-driven systems can demonstrate remarkable fraud detection skills, enhancing risk management and trust by spotting questionable transactional patterns. ML algorithms that analyze massive datasets to provide more accurate and dynamic credit scoring have significantly improved credit risk assessments, which were previously vulnerable to human error and inefficiency in the banking sectors of Bangladesh. Another significant development is the automation of customer service with chatbots and Natural Language Processing (NLP) technologies. By providing individualized, timely, and accurate services, these tools guarantee round-the-clock assistance, speed up response times, and improve the general client experience. Additionally, AI-powered monetary planning and transaction forecasting allow banks to better manage liquidity, predict consumer behavior, and customize financial products. Together, these applications represent a change in banking tactics from reactive to proactive and predictive.

Impact on Efficiency, Cost, and Service Quality

Tools for AI and ML can simplify processes and drastically cut down manual labor and operating expenses. For example, repetitive back-office tasks like data entry, compliance paperwork, and Know Your Customer (KYC) verifications can be automated via robotic process automation (RPA). These adjustments reduce resource usage and human error while also speeding up turnaround times. The use of such technologies can significantly expand accessibility and efficiency in a nation like Bangladesh, where conventional banking institutions still hold sway, particularly in neglected or rural areas. Furthermore, hyper-personalized services are made possible by AI-based customer segmentation. Sentiment analysis can enable banks to precisely address the requirements, preferences, and financial habits of each client. This leads to higher satisfaction, loyalty, and retention, which are vital for competitive advantage in a rapidly evolving financial landscape.

Challenges Hindering Adoption in Bangladesh

Notwithstanding its potential, there are several significant obstacles to the banking industry in Bangladesh's adoption of AI and ML. The first one is technical preparedness. The infrastructure needed to successfully implement AI models is often lacking in financial institutions, including high-speed internet, data storage capacity, and sophisticated computer systems. State-owned or smaller banks with less investment ability are especially affected by this infrastructure mismatch. The lack of qualified workers is the second significant problem. Experts in data science, machine learning, cybersecurity, and digital systems are needed to implement and maintain AI systems; they are currently in low demand in Bangladesh's labor market. The rate and caliber of AI deployment are constrained by this skill shortage. Uncertainty in regulations is another issue. Financial institutions are hesitant to use AI in banking since there isn't a clear legal framework surrounding these applications, particularly when it comes to data protection, algorithm transparency, and digital identification. Sensitive financial data is more likely to be misused or compromised in the absence of clear data privacy rules and cybersecurity procedures, which might erode consumer confidence. Furthermore, innovation at many traditional banks is still hampered by organizational opposition to change, which is based on hierarchical inertia, fear of job displacement, and unfamiliarity with AI systems. Holistic integration is further hampered by a cultural lack of awareness of the strategic potential of AI beyond automation.

Strategic Recommendations and Framework Implementation

To fully realize the benefits of AI and ML, a multi-pronged strategic approach is essential. They are discussed below:

Investment in Infrastructure:

The development of the digital backbone needed for AI integration requires collaboration between the government and financial institutions. This covers high-performance analytics systems, cybersecurity safeguards, and cloud computing.

Human Capital Development:

To upskill current staff members and create a new generation of AI specialists, specialized training programs, industry-academic partnerships, and certification paths have to be put in place.

Regulatory Innovation:

Legislators must establish and implement rules for data governance, consumer protection, and the moral application of AI. Innovative AI technologies may be tested in a controlled setting using a regulatory sandbox method.

Fostering Innovation Culture:

Banks ought to foster an innovative and ever-learning culture. This entails welcoming change, encouraging interdisciplinary cooperation, and rewarding staff creativity.

Customer Awareness and Trust Building:

To foster trust, efforts must be made to inform consumers about AI-powered services. Acceptance will be increased via open communication and the presentation of advantages (such as speed, precision, and privacy).

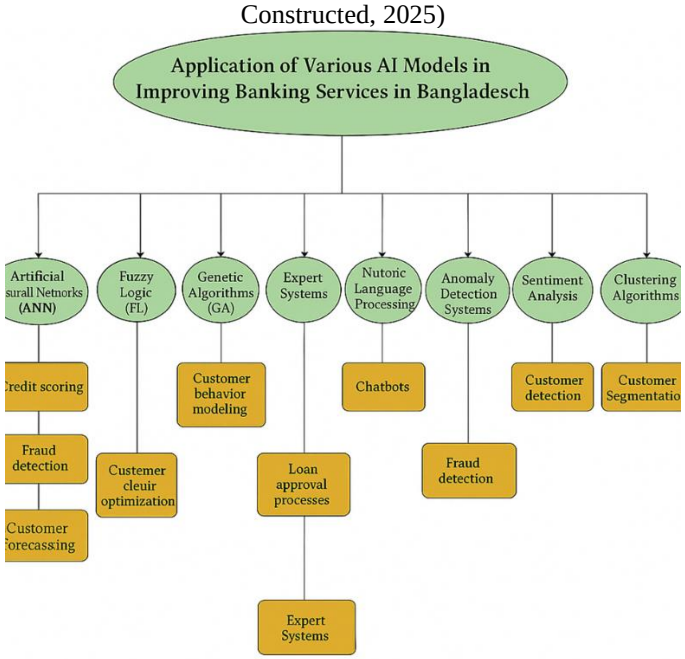
Socio-Economic Implications

The banking industry's use of AI is consistent with Bangladesh's overarching objectives of financial inclusion and digital transformation. AI has the potential to significantly increase economic participation, reach unbanked people, and provide branchless and mobile-based financial services. Additionally, lowering corruption through open and data-driven decision-making processes may enhance governance. With a focus on readiness assessment, model selection based on particular banking needs, and outcome evaluation using key performance indicators like accuracy, reliability, cost-effectiveness, and customer satisfaction, the conceptual framework put forth in this study provides an organized route for the adoption of AI.

V. Flowchart Of Conceptual Framework

The paper also proposes a conceptual framework that banking sectors can follow to examine readiness, elect appropriate AI models, and assess performance metrics such as accuracy, reliability, and cost-effectiveness.

Figure no 1. Application of Various AI Models Improving Banking Services in Bangladesh (Author Constructed, 2025)



VI. Conclusion

According to this report, AI and ML may effectively improve financial services in Bangladesh by improving client happiness, security, and efficiency. However, understanding these possible requirements outweighs obstacles like ignorance, insufficient awareness, poor infrastructure, and gaps in legislation. Every player in this industry, including financial institutions, researchers, and regulators, can use the suggested conceptual framework and themes from the study as a guide. This study's synthesis has several facets. This report offers guidance to the banking industry on implementing AI tools to enhance operations. This analysis gives policymakers a foundation for developing AI strategies and legislation that will help the Fintech sector to flourish sustainably. For the researchers, it suggests the identification of gaps and future research directions, especially in localized AI applications for developing economies in Bangladesh. The world is changing rapidly with the revolution of fintech applications. We cannot imagine a single image of our daily life without AI and ML help. They make our lives more accessible easier, better and comfortable than before. Even, AI is spreading towards our untouched lives of imagination. They are also giving pragmatic solutions for us in this unimaginable world. So, it is time to be more careful about the use of AI and ML for a better future. We must be aware of using this scheme for suitable and useful purposes. There should be not a single activity that creates harm for us and society. In the banking sector, AI and ML can also be used as means of negativity. Corrupt persons or other individuals or institutions can make negative use of AI and ML. So, we must restrict the negative impacts of AI and ML in the banking sectors of Bangladesh. Thus, we can reduce the corruption and illegality in our financial system. These types of activities need more provision and monitoring from the government and all stakeholders. Again, the government needs more efficient schoolers, technology and employees to tackle these types of activities. This supervision is more crucial to a country like Bangladesh.

According to the study, many elements are necessary for the successful use of AI in the banking service of Bangladesh.

First among them are

1. technological readiness, sufficient system integration and digital infrastructure.
2. the organizational culture's readiness to teach employees and embrace innovation.
3. assistance with the regulations
4. explicit legal structures and rules pertaining to data protection.
5. Customer Trust
6. Increasing trust in services powered by AI.

Future Research Directions

Future studies should look at localized AI applications that are suited to the socioeconomic environment of Bangladesh, including NLP systems in Bengali, risk modeling for the unorganized sector, or AI for microfinance. Furthermore, evaluations of the effects of AI integration in financial services on employment, ethics, and long-term sustainability continue to be important areas of research.

Declarations

This study had no grant from any funding agencies.

Conflicts of Interest

The authors have no conflict of interest.

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