

# Artificial Intelligence in the Banking Industry: A Comprehensive Analysis of the current Landscape and Future Transformations

<sup>1</sup>Satgian Singh Khalsa A/L Harjit Singh, <sup>2</sup>Noor Azma Ismail & <sup>3</sup>Abdulaziz Al-Nahari

<sup>1,2</sup>School of Information Technology, UNITAR International University, Malaysia,

<sup>3</sup>Information Technology Department, The University of Technology and Applied Science, Nizwa, Oman

Email: <sup>1</sup>sa7gian@gmail.com, <sup>3</sup>abdulaziz.alnahari@utas.edu.om

Corresponding Author Email: <sup>2</sup>azma1706@unitar.my

**To Link this Article:** <http://dx.doi.org/10.6007/IJARBSS/v14-i10/23126> DOI:10.6007/IJARBSS/v14-i10/23126

**Published Date:** 25 October 2024

## Abstract

This research paper investigates the implementation and development of Artificial Intelligence (AI) within the banking industry, a sector undergoing significant transformation due to the rapid adoption of this technology. The study aims to provide a comprehensive analysis of how AI is reshaping key areas such as customer experience, operational productivity, risk management, fraud detection, and regulatory compliance. By examining current practices and exploring future trends, including regulatory and ethical considerations, the research highlights both the opportunities and challenges associated with integrating AI into banking. The paper also addresses the critical role of governance frameworks in managing AI's impact and offers insights for decision-makers on effectively navigating this evolving landscape. The objective is to present a nuanced understanding of AI's transformative potential in banking and its implications for stakeholders, including customers, regulators, and industry leaders, while projecting the future trajectory of AI-driven innovations in the sector.

**Keywords:** Artificial Intelligence (AI), Banking Industry, Customer Experience.

## Introduction

The adoption of Artificial Intelligence (AI) has accelerated during the Covid-19 pandemic. According to a PWC study, 52% of companies fast-tracked their AI plans during this period, with 86% predicting AI would become a "mainstream technology" in 2021 (PWC, 2020). This trend, driven by the pandemic, is expected to continue well into the 2020s (Themudo, 2021). The banking industry, in particular, has seen significant investment in AI as financial institutions strive to meet evolving customer expectations and address security challenges.

Despite the potential for AI in banking, various obstacles remain, including limited consumer awareness. While past research has broadly addressed this issue, there is a need for more focused studies on AI technological proficiency (Noreen et al., 2020). This research investigates AI knowledge in the banking sector, specifically excluding basic technological use like the internet and computer literacy. Data was collected from five Asian countries, exceeding previous study sample sizes.

The research explores AI's impact on customer experience in banking, examining areas like personalized services, chatbots, and overall satisfaction. Additionally, it addresses AI's role in risk management, fraud detection, and regulatory compliance, while considering future challenges such as ethical concerns and workforce impacts. Focusing on the Malaysian banking sector, this paper examines AI adoption as of Q4 2023 and anticipates changes over the next decade. It aims to provide insights into AI implementation and help stakeholders make informed decisions about its future role in banking.

### **Literature Review**

The literature review aims to explore the evolution and current state of Artificial Intelligence (AI) in the banking sector, along with its projected future developments. By analyzing key concepts and trends from existing research, this review contextualizes AI's role in banking and its potential impact on the industry. AI, in its most basic form, refers to machine-based intelligence where machines are programmed to perform tasks that typically require human cognition, such as problem-solving, learning, and physical actions.

#### *Artificial Intelligence (AI) in the Malaysian Finance Industry*

In recent years, AI has gained increasing attention in Malaysia, with numerous studies highlighting its potential across various sectors, particularly finance. On a national scale, AI has been shown to enhance economic forecasting, such as predicting GDP, where neural network models outperform traditional methods. Malaysia's National Industrial Revolution 4.0 (4IR) Policy projects a 30% increase in output by 2030, attributing much of this growth to AI advancements (Sanusi et al., 2020; Cheong, 2022).

Within the finance industry, AI is transforming digital financial services by improving risk detection, addressing information asymmetry, and enhancing customer support through chatbots and cybersecurity tools. In the Malaysian banking sector, AI helps reduce operational costs, mitigate risks, and detect fraud while improving customer satisfaction. AI-driven innovations, such as digital smart contracts, are being proposed to replace traditional paper contracts, ensuring more secure and credible transactions. Furthermore, AI is being utilized to predict customer loyalty, especially within Islamic banking, providing valuable insights to enhance customer retention (Mhlanga, 2020; Kochhar et al., 2019; Rahman et al., 2021).

The rise of FinTech, integrated with AI, is reshaping both conventional and Islamic finance in Malaysia, bringing greater transparency and efficiency. Over 300 FinTech startups have emerged in Southeast Asia, offering solutions in payments, lending, and wealth management (Zain et al., 2020; Ali et al., 2019). AI and machine learning are particularly useful in treasury management and loan approval processes by improving cash flow predictions and decision-making. Additionally, AI-enabled mobile banking has gained popularity, especially among millennials, with factors like service quality, trust, and attitude towards AI influencing

customer loyalty, particularly in Islamic nations (Owusu Kwateng et al., 2019; Suhartanto et al., 2022).

In Malaysia's Islamic finance sector, AI plays a crucial role in Shariah-compliant investments, such as stock selection and algorithmic trading. AI applications in this area improve decision-making, with neural networks proving especially accurate in predicting Sukuk issuance ratings (Gazali et al., 2020). While the adoption of AI in Islamic finance is growing, there is still room for improvement, particularly in enhancing technology use in Zakat institutions, where mobile platforms could increase outreach and engagement (Salleh & Chowdhury, 2020).

AI is also increasingly used to combat money laundering in Malaysia, a persistent issue within the financial sector. AI provides comprehensive solutions for detecting suspicious transactions, significantly improving the accuracy of investigations and reducing false positives (Kute et al., 2021). These advancements highlight the growing importance of AI in enhancing the integrity and efficiency of Malaysia's financial industry.

#### *AI Applications Areas in Banking Sector*

AI has a wide range of applications in banking and finance, including cybersecurity, fraud detection, customer experience enhancement, chatbots, risk management, loan and credit decisions, regulatory compliance, and process automation. These technologies are transforming the financial industry by improving operational efficiency and accuracy.

Historically, traditional IT systems in banking were limited to automating repetitive tasks with fixed functionalities. However, AI has revolutionized these systems, enabling them to learn and adapt independently. AI systems can now observe, analyze, and make decisions without human input, continuously improving their performance through autonomous learning (Rodrigues et al., 2022).

Three major factors have driven recent advancements in AI. First, the rise in global data generation, largely due to increased internet usage, has provided a solid foundation for AI decision-making. Second, advancements in computer processing power have accelerated AI algorithm efficiency. Third, reduced data storage costs and improved data mining capabilities have made AI more accessible and effective across various industries (Patel et al., 2022).

In the banking sector, AI is vital in areas like asset management, customer service, and fraud prevention. AI-driven financial services offer speed and precision, significantly improving risk management and customer engagement. Additionally, AI's ability to process large datasets enables banks to forecast market trends and adapt to the competitive financial landscape (Silva, 2021; Doumpos et al., 2022).

#### *Key Areas of AI in Banking*

The integration of AI into the banking sector has introduced significant cost-saving measures, primarily through the reduction of paperwork and operational expenses. AI technologies allow banks to access managerial and customer information without the need for traditional paper-based processes, which is projected to save USD 416 billion by 2023 (Millenniumci, 2022). Chatbots, a key AI tool, enhances customer service by providing automated responses to common inquiries, efficiently resolving issues without human intervention while gathering valuable data for future use (Mogaji et al., 2021; Huang & Lee, 2022).

AI also plays a crucial role in improving customer experience in banking. With the rise of digital financial services, banks can analyze and predict customer behaviors using machine learning algorithms to offer personalized services such as customized financial plans. This aligns with customer expectations for quick, personalized responses, as shown in studies linking AI-driven customer interactions to increased satisfaction (Lin & Lee, 2023). Furthermore, AI's sentiment analysis capabilities allow banks to forecast customer emotions through data from emails, social media, and surveys, helping institutions tailor content and services to individual preferences (Mogaji et al., 2021; Verma, 2022).

In addition to enhancing customer experience, AI is vital in fraud detection and automation within banking. Automated systems, such as AI-powered currency counters, reduce errors and streamline operations, leading to increased business efficiency. AI-driven fraud detection systems use complex algorithms to monitor transactions and behaviors, reducing fraud risks by identifying suspicious activities that might go unnoticed by human oversight (Verma, 2022; Rahman et al., 2022). These advancements have made banking operations more secure and efficient, contributing to the broader adoption of AI technologies across the industry.

#### *Potential Risks of AI/ML Integration in Financial Services*

The integration of Artificial Intelligence and Machine Learning (AI/ML) into financial service providers (FSPs) has raised concerns about potential risks to financial stability, especially if these models are not properly calibrated. Risks such as discriminatory treatment, diminished operational resilience, and increased vulnerability to financial shocks may arise from improper AI/ML usage. However, current AI/ML adoption is still relatively cautious, with FSPs implementing safeguards, such as monitoring systems for identity verification and limiting AI/ML applications to specific portfolios (Millenniumci, 2022). These early stages of AI adoption indicate that most financial institutions are proceeding with care to avoid destabilizing outcomes.

Customer awareness and attitudes toward AI significantly impact the adoption of AI-based banking services. Studies show that the perceived usefulness of AI, combined with knowledge of AI technologies, influences customers' willingness to adopt digital banking solutions (Inegbedion et al., 2020). Research conducted in Thailand involving 400 banking customers revealed that trust, social norms, and perceived usefulness are key factors in the adoption of AI (Noonpakdee, 2020). Furthermore, as AI-based technologies become more integrated into banking services, customer awareness and trust in these technologies continue to grow, contributing to higher adoption rates.

Attitudes and subjective norms also play a significant role in shaping AI adoption in banking. According to the Theory of Planned Behavior (TPB), a positive attitude towards AI, combined with the influence of social groups, enhances the likelihood of customers adopting AI-based services (Kaakeh et al., 2019). For instance, the COVID-19 pandemic accelerated the need for remote banking solutions, with AI-driven services gaining popularity due to social distancing measures (Aziz & Afaq, 2018). These factors highlight the social and psychological influences that drive customer acceptance of AI in financial services.

Perceived risk remains a critical factor in AI adoption. In Malaysia, where AI banking services are still in the early stages, customer trust is essential to reduce perceived risk (Thaker et al., 2019). As AI-based services improve in terms of transaction security and accuracy, customer trust increases, further boosting adoption rates. Studies also show that the perceived usefulness of AI—its ability to enhance performance and improve transaction efficiency—positively impacts customer acceptance of these services (Amin et al., 2014). Knowledge of AI technology is thus a crucial determinant in shaping customer intentions to adopt AI banking solutions (Zolait et al., 2009).

### *Regulatory Oversight and Legislation for Financial Services in Malaysia*

The regulatory framework for financial services in Malaysia is governed by Bank Negara Malaysia (BNM), which oversees the sector and regulates FinTech within Islamic finance. Key legislation includes the Central Bank of Malaysia Act 2009 (CBMA), the Anti-Money Laundering, Anti-Terrorism Financing and Proceeds of Unlawful Activities Act 2001 (AMLATF), and the Islamic Financial Services Act 2013 (IFSA). To promote innovation, BNM introduced the Financial Technology (FinTech) Regulatory Sandbox Framework, enabling financial institutions and FinTech companies to test new technologies in controlled environments under the Financial Services Act (FSA) and IFSA.

BNM also regularly issues guidelines aimed at enhancing security measures for digital financial services. The Minimum Guidelines on the Provisions of Internet Banking Services set the standard for licensed institutions in Malaysia, while the Anti-Money Laundering and Counter Financing of Terrorism (AML/CFT) policy for digital currencies outlines measures for transparency and control in FinTech transactions. While digital currencies are not yet recognized as legal tender, the AMLATF's provisions remain applicable to FinTech activities, particularly in Islamic finance, to ensure compliance with reporting and regulatory requirements.

Additional legislation, such as the Personal Data Protection Act (PDPA) 2010, Digital Signature Act (DSA) 1997, and Computer Crimes Act (CCA) 1997, provide a robust legal framework for protecting personal data, regulating digital signatures, and addressing cyber-related offenses. These laws establish clear standards and penalties for non-compliance, ensuring the integrity and security of digital transactions in Malaysia's financial industry (Kok & Siripipatthanakul, 2023).

### **Methodology**

This study adopts a mixed-methods research design, combining both qualitative and quantitative methods to provide a comprehensive exploration of AI's current landscape in the banking industry and its potential future impacts. The integration of qualitative and quantitative techniques ensures that the study captures a broad spectrum of insights, ranging from in-depth subjective perceptions to measurable data.

#### *Quantitative Approach*

The quantitative component of this research involved the collection and analysis of numerical data through surveys. A structured online survey was developed to gather quantitative information on AI adoption, implementation, and its impact within the banking sector. The survey included closed-ended questions designed to elicit measurable responses, which

facilitated statistical analysis of the current state of AI. The respondents represented various segments of the banking industry, including bank employees and customers.

### *Qualitative Approach*

A qualitative approach was also employed, which involved conducting a one-on-one interview with the Head of Infrastructure at a local bank. The interview questions were developed based on insights gained from an initial online literature review and surveys. This approach allowed for in-depth exploration of AI's integration into banking infrastructure, focusing on security issues and operational challenges. Additionally, qualitative content analysis was employed, which enabled the study to systematically analyze textual data and identify patterns related to AI in banking (Jaipong et al., 2023).

### *Data Collection*

Data collection involved sourcing information from multiple channels, including academic research, news articles, and industry-specific reviews. Research papers, online databases such as Google Scholar, and industry news related to AI implementation in banking—both locally in Malaysia and globally—were utilized. Additionally, discussions with colleagues in the banking industry helped in understanding both employees' and customers' perspectives on AI technology. The study targeted two main groups: bank employees and customers. This allowed for an analysis of both internal (employee) and external (customer) views on AI integration, addressing the dual focus of operational efficiencies and customer experience.

### *Survey Design and Implementation*

An online survey was created using a stratified sampling technique to ensure a balanced representation from various segments of the banking industry. The survey incorporated seven demographic factors, including age, gender, education level, and work experience. The survey contained 26 items across 8 sections, designed to capture respondent perceptions on awareness, perceived usefulness, perceived risks, subjective norms, and knowledge regarding artificial intelligence. Additionally, the survey measured attitudes towards AI and the intention to adopt AI in banking.

A total of 42 responses were collected, forming the primary dataset for the quantitative analysis. Each section of the survey was carefully validated for reliability before conducting the final analysis, ensuring that the data collected was both accurate and relevant.

## **Finding and Discussion**

### *Interview with the Head of Infrastructure of a Local Bank*

An interview with the Head of Infrastructure at a local bank provided valuable insights into the evolving role of AI in the banking sector. The interviewee noted that AI is increasingly crucial for maintaining competitiveness, enhancing customer service, and improving operational efficiency, with applications in fraud detection, chatbot-driven customer support, and risk assessment. While emphasizing the need for in-house AI development to ensure data security, the interviewee acknowledged that third-party providers could be utilized with appropriate safeguards. Regarding the future of physical bank branches, the interview highlighted a shift in customer behavior toward online banking; however, branches are likely to remain operational, with a focus on customer-centric services. Additionally, trends such as personalized banking services and AI's expanding influence in wealth management and mortgage underwriting were discussed.

**Survey Analysis Using SPSS**

A survey was conducted to explore AI adoption and customer preferences in banking, with 42 respondents participating. Below are the key findings from the demographic and statistical analysis:

**Demographic Analysis**

The majority of respondents were aged 25-44, accounting for 90.4% of the sample. The gender distribution revealed a higher percentage of female respondents (59.5%) compared to males (40.5%). Most respondents held a degree (71.4%), while 19% had a master's degree, and 9.5% held a diploma. The most common range of work experience was 5-10 years (42.9%), followed by 10-15 years (28.6%). The results are summarized in Table 1.

Table 1  
Summarize of the Demographic Data

Survey Questions	Options	Respondent	Percentages (%)
Age	18 – 24	1	2.4
	25 – 34	19	45.2
	35 – 44	19	45.2
	45 – 54	3	7.1
Gender	Male	17	40.5
	Female	25	59.5
Education	Diploma	4	9.5
	Degree	30	71.4
	Master	8	19
Working Experience	1 – 5 years	6	14.3
	5 – 10 years	18	42.9
	10 – 15 years	12	28.6
	More than 15 years	6	14.3

**AI Adoption in Banking**

The survey explored the current use of AI in banking operations. Most respondents (42.9%) reported limited experimentation with AI, while 23.8% reported moderate use across various functions. The results are summarized in Table 2.

Table 2  
Extent of AI Utilization in Current Banking Operation

		Frequency	Percent
Valid	Not using AI at all	5	11.9
	Limited experimentation with AI	18	42.9
	Some AI implementation in specific areas	9	21.4
	Moderate use of AI across various functions	10	23.8
	Total	42	100.0

**AI Tools Utilized in Banking Service Experience**

The study identified the most commonly used AI tools in banking services among consumers. The results reveal that Mobile Banking Apps dominate, with 54.8% of respondents utilizing

this AI tool. In contrast, Chatbots and Virtual Assistants are used by 26.2% of consumers, approximately half the usage rate of mobile banking apps. This suggests a significant reliance on mobile banking applications for various financial transactions and services, while chatbots serve as supplementary tools for customer interaction and support.

Additionally, Automated Bill Payments account for 9.5%, indicating that consumers are increasingly adopting automation for routine financial tasks. Personal Finance Apps, designed to assist users in managing their finances and tracking expenses, represent 7.1% of the responses, showcasing a growing interest in tools that promote financial literacy and management. Notably, 2.4% of participants reported not using any AI tools in their banking experience. The results are summarized in Table 3.

Table 3

*AI Tools Utilized in Banking Service Experience*

	Frequency	Percent
Valid Doesn't use AI	1	2.4
Automated Bill Payments	4	9.5
Chatbots and Virtual Assistants	11	26.2
Mobile Banking App	23	54.8
Personal Finance Apps that help to manage money & track expenses	3	7.1
Total	42	100.0

**Customer Interaction with Banks**

When asked about their preferred channel for managing their bank accounts, 85.7% of respondents indicated the mobile app as their favorite platform. The results are summarized in Table 4. In cases where something goes wrong with their bank accounts, 66.7% of respondents preferred phone calls to resolve issues, while 19% opted for chatbots. Physical visits to bank branches accounted for only 11.9% of the responses. Table 5 shows preferred channels for contacting bank regarding account issues.

Table 4

*Preferred Channels for Account Management*

	Frequency	Percent
Valid App	36	85.7
Phone call	1	2.4
Website	5	11.9
Total	42	100.0



Table 5

*Preferred Channels for Contacting Bank Regarding Account Issues*

		Frequency	Percent
Valid	Chatbot	8	19.0
	Email	1	2.4
	Going to the branch	5	11.9
	Phone call	28	66.7
	Total	42	100.0

**Customer Preferences in Banking**

Security emerged as the most valued characteristic in banking (73.8%), with client support being the second most valued feature (14.3%). This result underscores the importance of robust security measures, particularly in light of frequent news about financial scams. Table 6 shows customer preferences on the most valued characteristics in banking institutions.

Table 6

*Customer Preferences on the Most Valued Characteristics in Banking Institutions*

		Frequency	Percent
Valid	App features	3	7.1
	Card Design	1	2.4
	Client support	6	14.3
	Interest rate	1	2.4
	Security	31	73.8
	Total	42	100.0

**Future AI Integration**

Respondents were optimistic about the future of AI in banking, with 78.6% predicting significant advancements in AI over the next 5-10 years. Most respondents also indicated a preference for applying for loans via mobile apps (59.5%) in the future, compared to physical branches (26.2%). Table 7 shows summary of respondents' perspectives on the evolution of AI technology in the banking industry over the next 5 – 10 years.

Table 7

*Respondents' Perspectives on the Evolution of AI Technology in the Banking Industry Over the Next 5-10 Years*

		Frequency	Percent
Valid	Not at all	1	2.4
	Yes, but with limitation	8	19.0
	Yes, very likely	33	78.6
	Total	42	100.0

### AI Ethics and Regulation

In terms of ethical and regulatory considerations, 52.4% of respondents believed that organizations moderately consider these aspects when implementing AI in banking operations, while 31% felt that these considerations were extensive. Data privacy and security were the main concerns regarding AI integration (57.1%), followed by algorithm bias and fairness (19%). Table 8 shows the varied opinion among respondents on ethical and regulatory aspects that need to be considered by organization in implementing AI in banking operations.

Table 8

*Respondents' Perspectives on the Ethical and Regulatory Aspects That Need to be Considered by Organization in Implementing AI in Banking Operations*

		Frequency	Percent
Valid	Considered extensively	13	31.0
	Considered moderately	22	52.4
	Considered to a minimal extent	6	14.3
	Not considered at all	1	2.4
	Total	42	100.0

### Statistical Analysis

#### *AI Usage in Banking Operations and Age Group*

A one-way ANOVA was conducted to determine if there were significant differences in AI usage in banking operations between different age groups. The results indicated no statistically significant difference ( $F(3, 38) = 0.249, p = 0.861$ ). This suggests that AI usage in banking operations does not significantly vary across age groups. The results are summarized in Table 9.

Table 9

*AI Usage in Banking Operations and Age Group*

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	.777	3	.259	.249	.861
Within Groups	39.509	38	1.040		
Total	40.286	41			

**Future of AI in Banking and Education Level**

A one-way ANOVA was used to analyze whether respondents' education level influenced their perception of AI's future in banking. The results showed a significant difference ( $F(2, 39) = 18.393, p < 0.001$ ). Post-hoc Tukey tests revealed that diploma holders were significantly less optimistic about AI's future compared to degree and master's degree holders. The results are summarized in Table 10.

Table 10

*Future of AI in Banking and Education Level*

(I) Education level	(J) Education level	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
Diploma	Degree	1.150*	.190	<.001	.69	1.61
	Masters	.150	.142	.545	-.20	.50
Degree	Diploma	-1.150*	.190	<.001	-1.61	-.69
	Masters	-1.000*	.218	<.001	-1.53	-.47
Masters	Degree	1.000*	.218	<.001	.47	1.53
	Diploma	-.150	.142	.545	-.50	.20

\*. The mean difference is significant at the 0.05 level.

**Perception of Organizational Consideration of Ethical and Regulatory Aspects in AI Implementation in Banking Operations by Work Experience**

A one-way ANOVA was conducted to compare the effects of different levels of working experience on ethical and regulatory considerations. The analysis revealed a statistically significant difference between the groups ( $F(3, 38) = 3.680, p = 0.020$ ). This indicates that employees' working experience influences their ethical and regulatory considerations.

To further explore these differences, Tukey's HSD test for multiple comparisons was applied. The results showed a significant difference between employees with 10 to 15 years of experience and those with 5 to 10 years ( $p = 0.042, 95\% \text{ C.I.} = [-1.37, -0.02]$ ). This suggests

that as employees gain more experience, their ethical and regulatory considerations evolve, particularly after a decade of service. However, no statistically significant differences were observed among the other experience groups, implying that shifts in ethical consideration may not occur uniformly across all experience levels. The results are summarized in Table 11.

Table 11

*Perception of Organizational Consideration of Ethical and Regulatory Aspects in AI Implementation in Banking Operations by Work Experience*

		Mean			95% Confidence Interval	
(I) Working_experience	(J) Working_experience	Difference (I-J)	Std. Error	Sig.	Lower Bound	Upper Bound
1-5 years	10-15 years	.611	.319	.238	-.24	1.47
	5-10 years	-.083	.338	.995	-.99	.82
	More than 15 years	-.167	.390	.973	-1.22	.88
10-15 years	1-5 years	-.611	.319	.238	-1.47	.24
	5-10 years	-.694*	.252	.042	-1.37	-.02
	More than 15 years	-.778	.319	.086	-1.63	.08
5-10 years	1-5 years	.083	.338	.995	-.82	.99
	10-15 years	.694*	.252	.042	.02	1.37
	More than 15 years	-.083	.338	.995	-.99	.82
More than 15 years	1-5 years	.167	.390	.973	-.88	1.22
	10-15 years	.778	.319	.086	-.08	1.63
	5-10 years	.083	.338	.995	-.82	.99

\*. The mean difference is significant at the 0.05 level.

**Conclusion and Recommendations**

The study’s conclusion highlights the significant findings regarding AI’s transformative role in banking, particularly its contributions to customer experience, fraud detection, risk management, and operational efficiency. These outcomes underscore AI's potential to streamline processes and enhance customer engagement while raising considerations around data privacy, regulatory compliance, and skill shortages.

Based on these findings, several recommendations emerge. Firstly, banking institutions should strengthen regulatory frameworks that prioritize transparency and ethical use of AI, addressing privacy concerns and bias in decision-making. Additionally, targeted investment in AI education and workforce development is essential to bridge the skills gap, ensuring a prepared workforce for the future of AI-driven banking. Lastly, further research focusing on the practical applications of AI, such as natural language processing and advanced analytics, is recommended to provide dynamic insights into AI’s evolving impact on the sector.

This structured approach offers stakeholders a clear path forward, grounded in the study's key insights and well-considered recommendations, to maximize AI's benefits while addressing its challenges in the banking industry.

### Acknowledgement

The authors thank UNITAR International University for the publication of this research.

### References

- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50, 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Amin, H., Rahman, A. R. A., & Razak, D. A. (2014). Consumer acceptance of Islamic home financing. *International Journal of Housing Market and Analysis*, 7(3), 307–332. <https://doi.org/10.1108/IJHMA-10-2013-0053>
- Aziz, S., & Afaq, Z. (2018). Adoption of Islamic banking in Pakistan: An empirical investigation. *Cogent Business & Management*, 5, 1548050. <https://doi.org/10.1080/23311975.2018.1548050>
- Beck, L., & Ajzen, I. (1991). Predicting dishonest actions using the theory of planned behavior. *Journal of Research in Personality*, 25, 285–301. [https://doi.org/10.1016/0092-6566\(91\)90032-I](https://doi.org/10.1016/0092-6566(91)90032-I)
- Doumpos, M., Zopounidis, C., Gounopoulos, D., Platanakis, E., & Zhang, W. (2022). Operational research and artificial intelligence methods in banking. *European Journal of Operational Research*, 306, 1–16. <https://doi.org/10.1016/j.ejor.2022.04.028>
- Garg, P., Gupta, B., Chauhan, A. K., Sivarajah, U., Gupta, S., & Modgil, S. (2021). Measuring the perceived benefits of implementing blockchain technology in the banking sector. *Technological Forecasting and Social Change*, 163, 120407. <https://doi.org/10.1016/j.techfore.2020.120407>
- Huang, S. Y., & Lee, C.-J. (2022). Predicting continuance intention to fintech chatbots. *Computers in Human Behavior*, 129, 107027. <https://doi.org/10.1016/j.chb.2021.107027>
- Inegbedion, H., Inegbedion, E. E., Osifo, S. J., Eze, S. C., Ayeni, A., & Akintimehin, O. (2020). Exposure to and usage of e-banking channels: Implications for bank customers' awareness and attitude to e-banking in Nigeria. *Journal of Science and Technology Policy Management*, 11(1), 133–148. <https://doi.org/10.1108/JSTPM-09-2019-0078>
- Iranmanesh, S. H., Hamid, M., Bastan, M., Hamed Shakouri, G., & Nasiri, M. M. (2019). Customer churn prediction using artificial neural network: An analytical CRM application. In *Proceedings of the International Conference on Industrial Engineering and Operations Management* (pp. 23–26). Pilsen, Czech Republic.
- Juwaheer, T. D., Pudaruth, S., & Ramdin, P. (2012). Factors influencing the adoption of internet banking: A case study of commercial banks in Mauritius. *World Journal of Science, Technology and Sustainable Development*, 9(3), 204–234. <https://doi.org/10.1108/20425941211291374>
- Kaakeh, A., Hassan, M. K., & Almazor, S. F. V. H. (2019). Factors affecting customers' attitude towards Islamic banking in UAE. *International Journal of Emerging Markets*, 14(4), 668–688. <https://doi.org/10.1108/IJEM-09-2018-0305>
- Kaya, O. (2019). *Deutsche Bank Research*. Retrieved from <https://www.db.com/research>
- Kok, S. L., & Siripipatthanakul, S. (2023). *Artificial intelligence (AI) adoption: The case of the Malaysian financial industry* (pp. 7-8).

- Lin, R.-R., & Lee, J.-C. (2023). The supports provided by artificial intelligence to continuous usage intention of mobile banking: Evidence from China. *Aslib Journal of Information Management*. Advance online publication. <https://doi.org/10.1108/AJIM-08-2022-0271>
- Maja, M. M., & Letaba, P. (2022). Towards a data-driven technology roadmap for the bank of the future: Exploring big data analytics to support technology roadmapping. *Social Sciences & Humanities Open*, 6, 100270. <https://doi.org/10.1016/j.ssaho.2022.100270>
- Millennium Consultants. (2022). Benefits of artificial intelligence in the banking sector. Retrieved from <https://www.millenniumci.com/benefits-of-artificial-intelligence-in-the-banking-sector>
- Mogaji, E., & Nguyen, N. P. (2022). Managers' understanding of artificial intelligence in relation to marketing financial services: Insights from a cross-country study. *International Journal of Bank Marketing*, 40, 1272–1298. <https://doi.org/10.1108/IJBM-03-2021-0145>
- Mogaji, E., Balakrishnan, J., Nwoba, A. C., & Nguyen, N. P. (2021). Emerging-market consumers' interactions with banking chatbots. *Telematics and Informatics*, 65, 101711. <https://doi.org/10.1016/j.tele.2021.101711>
- Noonpakdee, W. (2020). The adoption of artificial intelligence for financial investment service. In *Proceedings of the 2020 22nd International Conference on Advanced Communication Technology (ICACT)* (pp. 396–400). IEEE.
- Noreen, U., Shafique, A., Ahmed, Z., & Ashfaq, M. (2023). Banking 4.0: Artificial intelligence (AI) in the banking industry & consumer's perspective. *Sustainability*, 15(4), 3682. <https://doi.org/10.3390/su15043682>
- Patel, R., Migliavacca, M., & Oriani, M. (2022). Blockchain in banking and finance: Is the best yet to come? A bibliometric review. *Research in International Business and Finance*, 62, 101718. <https://doi.org/10.1016/j.ribaf.2022.101718>
- Pitchay, A. B. A., Thaker, M. A. B. M. T., Azhar, Z., Mydin, A. A., & Thaker, H. B. M. T. (2019). Factors persuading individuals' behavioral intention to opt for Islamic bank services: Malaysian depositors' perspective. *Journal of Islamic Marketing*, 11(1), 234–250. <https://doi.org/10.1108/JIMA-10-2017-0111>
- Rahman, M., Ming, T. H., Baigh, T. A., & Sarker, M. (2022). Adoption of artificial intelligence in banking services: An empirical analysis. *International Journal of Emerging Markets*. Advance online publication. <https://doi.org/10.1108/IJOEM-04-2022-0337>
- Rodrigues, A. R. D., Ferreira, F. A., Teixeira, F. J., & Zopounidis, C. (2022). Artificial intelligence, digital transformation and cybersecurity in the banking sector: A multi-stakeholder cognition-driven framework. *Research in International Business and Finance*, 60, 101616. <https://doi.org/10.1016/j.ribaf.2022.101616>
- Roseline, J. F., Naidu, G., Pandi, V. S., alias Rajasree, S. A., & Mageswari, N. (2022). Autonomous credit card fraud detection using a machine learning approach. *Computers & Electrical Engineering*, 102, 108132. <https://doi.org/10.1016/j.compeleceng.2022.108132>
- Safari, K., Bisimwa, A., & Armel, M. B. (2020). Attitudes and intentions toward internet banking in an underdeveloped financial sector. *PSU Research Review*, 6(1), 39–58. <https://doi.org/10.1108/PRR-02-2020-0006>
- Silva, R. d. (2021). Calls for behavioural biometrics as bank fraud soars. *Biometric Technology Today*, 2021, 7–9. <https://doi.org/10.1016/j.btt.2021.05.002>

- Themudo, J. M. (2021). *The impact of artificial intelligence in banking*. Retrieved from <https://run.unl.pt/handle/10362/140142>
- Urumsah, D. (2015). Factors influencing consumers to use e-services in Indonesian airline companies. In *E-services adoption: Processes by firms in developing nations* (Vol. 23B, pp. 5–254). Emerald Group Publishing Limited.
- Verma, J. (2022). Application of machine learning for fraud detection—A decision support system in the insurance sector. In *Big Data Analytics in the Insurance Market* (pp. 251–262). Emerald Publishing Limited.
- Zolait, A. H. S., Mattila, M., & Sulaiman, A. (2009). The effect of user's informational-based readiness on innovation acceptance. *International Journal of Bank Marketing*, 27(1), 76–100. <https://doi.org/10.1108/02652320910932960>