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Analyzing the Factors Influencing the Implementation of Artificial Intelligence in the Iranian Banking Industry: Findings from a Qualitative Study

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Abstract

One of the significant challenges in the Iranian banking industry is identifying and analyzing the key factors for the successful implementation of artificial intelligence (AI). Without addressing these factors, banks may face issues such as increased security risks, reduced service efficiency, and user resistance to adopting new technologies. In this study, the most critical factors were first identified through a content analysis of previous research and a review of successful case studies, forming the basis for designing a semi-structured questionnaire to interview experts. Subsequently, in this qualitative study, data were collected through interviews with 18 specialists and managers from various fields, including information technology, human resources, marketing, and project management. The collected data were analyzed across five key dimensions: data security and governance, technology adoption and alignment, technology and data infrastructure, data analysis and prediction, and service and operational optimization. The results indicate that each of these dimensions, both independently and in interaction with other areas, plays a vital role in enhancing the productivity and effectiveness of banks in utilizing AI. These findings emphasize the necessity of strengthening security infrastructure, fostering a digital culture, and developing analytical tools to facilitate the digital transformation process in banking.

Keywords: Artificial Intelligence, Banking Industry, Successful Implementation, Technology Adoption.

1. Introduction

The emergence of artificial intelligence (AI) as one of the most prominent and rapidly evolving technologies has provided extensive opportunities to reduce human labor costs in collecting, analyzing, and utilizing information. By leveraging machine learning algorithms, AI can identify patterns and behaviors across various domains, offering optimal methods and solutions to achieve desired objectives (Castelli et al., 2016). This technological transformation has driven organizations, particularly banks, to adopt intelligent technologies to enhance accuracy and reliability in organizational processes by minimizing human errors and costs. The use of AI in banking not only enables precise and structured data analysis but also plays a pivotal role in delivering optimized financial services and managing associated risks (Khemka & Laha, 2020). These technologies have been transformative across multiple generations in the banking industry. From centralized banking and electronic service systems

such as ATMs and electronic portals to advanced AI systems capable of customer assessment and personalized recommendations, AI has served as a driving force in improving services and reducing temporal and spatial limitations in accessing banking services (De, 2020).

Furthermore, AI can leverage historical data and learning patterns to provide scenarios for predicting and identifying future opportunities and threats, enabling more accurate decision-making (Kaur et al., 2020). These features have made AI a vital tool for banks and other financial institutions, particularly in the complex and turbulent economic and political environment of Iran, which faces challenges such as sanctions. Therefore, before adopting and implementing AI technologies, it is essential to identify the requirements and barriers affecting their acceptance and alignment with the current structures of banks. This will help prevent challenges such as job stress, incompatibility with operational processes, and increased organizational costs (Dağ, 2019). In this regard, the lack of a comprehensive model to assess weaknesses and existing problems in this domain can hinder the adoption of advanced technologies in banks and reduce their effectiveness in service delivery and performance management. Consequently, numerous studies have emphasized the importance of a suitable foundation for the adoption and implementation of AI, highlighting that providing the necessary infrastructure and scientifically identifying and prioritizing factors influencing the use of these technologies in organizations can maximize organizational performance (Fourie & Bennett, 2019; Zain et al., 2020).

The literature on the implementation of artificial intelligence (AI) in the banking industry reveals a multifaceted and evolving landscape, where AI is positioned as a transformative force across operational, strategic, and customer-facing dimensions. Studies such as those by Umamaheswari et al. (2023) and Husain et al. (2022) emphasize AI's potential to enhance operational efficiency, reduce human error, and increase productivity (Husain et al., 2022; Umamaheswari & Valarmathi, 2023). Researchers like Doumpos et al. (2023), Berrada et al. (2022), and Tang et al. (2020) highlight AI's application in risk management, fraud detection, and credit assessment (Berrada et al., 2022; Doumpos et al., 2023; Tang & Tien, 2020), while others such as Verma et al. (2023) and Saluja et al. (2022) examine its role in addressing cybersecurity threats and identity fraud (Saluja, 2022; Verma & Chakarwarty, 2023). Customer interaction and satisfaction also receive significant attention, with studies by Lin et al. (2023), Jaiwant (2022), and Lee and Chen (2022) demonstrating how AI-driven personalization, anthropomorphic features, and intelligent interfaces improve user experience and engagement (Jaiwant, 2022; Lee & Chen, 2022; Lin & Lee, 2023). The human aspect, including trust and ethical considerations, is explored by Noreen et al. (2023), Northey et al. (2022), and Nguyen et al. (2023), pointing to the need for transparent and user-friendly AI systems to foster consumer confidence (Nguyen et al., 2023; Noreen et al., 2023; Northey et al., 2022). Scholars such as Dewasiri et al. (2023) and Mehta (2020) explore AI's strategic integration with other technologies like blockchain and big data, driving digital transformation. Moreover, cost reduction, competitive advantage, and structural changes in banking processes are recurring themes (Kaya et al., 2019; Roy & Thangaraj, 2021; Tripathi et al., 2022). Despite its benefits, the literature also underscores challenges such as data privacy, implementation costs, and the displacement of human roles (Carpenter, 2020; Crosman, 2018). Collectively, this body of research underscores that while AI promises substantial gains in efficiency, innovation, and customer satisfaction, its successful implementation in banking—especially in specific contexts like Iran—depends on addressing contextual challenges such as infrastructural readiness, regulatory frameworks, and socio-cultural acceptance.

Therefore, given the importance of implementing artificial intelligence (AI) in the Iranian banking industry and the role this technology can play in enhancing the performance and efficiency of this sector, it is essential to first establish the necessary foundations and readiness for its adoption and utilization. Otherwise, encountering various challenges and obstacles during the implementation process will be inevitable. These challenges may include issues such as incompatibility with organizational structures, increased implementation costs, and the need to adapt to existing processes. For this reason, before initiating implementation, it is crucial to take measures to prepare the necessary infrastructure and organizational readiness, including developing technology adoption strategies and aligning with operational processes. In this study, the most critical factors were first identified through a content analysis of previous research and a review of successful case studies,

2. Methods and Materials

This study adopts a qualitative research approach, utilizing semi-structured interviews based on a semi-open questionnaire. The data were collected through interviews with eighteen experts, whose details are presented in the table below. Thematic analysis was applied to classify and extract relevant themes from the interviews. After conducting the interviews, meaningful statements were extracted, and open coding was applied to identify key challenges. Subsequently, based on the literature review and thematic analysis approach, the factors were categorized into main and sub-themes. The study focuses on identifying the factors influencing the implementation and application of artificial intelligence (AI) in the Iranian banking industry from the perspective of experts. Following the interviews with experts, meaningful statements were extracted. Open coding was then applied to these statements to identify key challenges. In the subsequent step, based on the literature review and the thematic analysis approach, the factors were categorized into main themes and sub-themes.

The table below provides a detailed overview of the demographic and professional characteristics of the experts involved in the research. It includes information such as their specialization, years of experience, educational background, and current positions.

Table 1. Introduction and Description of the Characteristics and Features of the Research Experts

No.	Specialization	Years of Experience	Education Level	Position/Title
1	Information Technology Engineering	18	Ph.D.	IT Specialist
2	Human Resource Management	17	Master's Degree	Branch Manager
3	Marketing Management	24	Ph.D.	Research and Development Specialist
4	Project Management	13	Master's Degree	Project Management Specialist
5	Software Engineering	11	Master's Degree	Software Development Specialist
6	Human Resource Management	25	Ph.D.	Human Resources Specialist
7	Organizational Behavior Management	21	Master's Degree	Branch Manager
8	Network Engineering	20	Master's Degree	IT Specialist
9	Project Management	17	Master's Degree	Project Management Specialist
10	Marketing Management	22	Master's Degree	Marketing Specialist
11	Human Resource Management	16	Ph.D.	Human Resources Specialist
12	Software Engineering	13	Master's Degree	Software Development Specialist
13	Information Technology Management	15	Ph.D.	IT Specialist
14	Human Resource Management	16	Master's Degree	Human Resources Specialist
15	Information Technology Management	19	Ph.D.	IT Specialist
16	Organizational Behavior Management	26	Ph.D.	Human Resources Specialist
17	Human Resource Management	23	Master's Degree	Branch Manager
18	Information Technology Management	22	Master's Degree	IT Specialist

3. Findings and Results

In this section, the challenges were extracted using a thematic analysis approach based on the results of interviews with research experts. The process was carried out in the following stages:

Stage 1: Familiarization with the Data

The first step in any qualitative analysis is reading and re-reading the interview transcripts. After converting the audio recordings of the interviews into written text, the researcher carefully reviewed and examined all transcripts to gain a thorough understanding of the data. This familiarity was achieved through reading and taking notes on the meaningful statements extracted from the interviews. Before delving into specialized discussions, the researcher must thoroughly familiarize

themselves with all the data, handwritten notes related to the interviews, and any other informational sources used in the study. In this research, after reviewing and extracting concepts from interviews with 18 experts, the results are presented in the table below, with a portion provided as an example.

Table 2. Open Coding of Interviews; Researcher's Calculations, 2024

Expert Code	Meaningful Statements
A1	The use of AI in fraud detection and loan assessment has significantly increased.
A2	Integrating AI into banking systems comes with challenges.
A3	Successful AI implementation depends on balancing automation and human expertise.
A6	Not all processes can be fully automated; human presence is still necessary.
A5	AI is strong in big data analysis, but ethical and regulatory considerations must be addressed before widespread use.
A4	The future of banking lies in combining AI and human resources; AI handles repetitive tasks, freeing employees for more complex work.
A1	The speed of AI adoption in banks depends on their size, resources, and risk tolerance.
A3	AI success in banking is linked to improved efficiency, reduced costs, and enhanced customer experience.
A5	AI has revolutionized fraud detection and accelerated anomaly identification.
A5	Integrating AI into loan assessment is complex and requires fairness and transparency in decisions.
A6	AI has immense potential and is driving cultural change in banks.
A1	Some employees are concerned about job replacement by AI.
A8	Training and effective communication are critical for successful AI integration.
A2	There is a lot of hype around AI in banking, but it is still in development.
A3	AI can automate tasks, but human judgment is essential for complex financial decisions.
A4	The key is not just automation but enhancing human capabilities with AI.
A6	AI can measure loan risk for customers.
A1	AI-based chatbots are increasingly used for customer service.
A2	Regulations are adapting to the rapid development of AI in banking.
A3	Clear guidelines are needed for the responsible use of AI.
A7	Protecting data privacy and preventing algorithmic bias in data analysis are crucial.
A8	AI provides personalized insights and helps customers make complex decisions.
A1	Data security is critical when integrating AI into banking.
A4	Ensuring customer data privacy and security throughout the AI lifecycle is essential.
A5	Strong cybersecurity measures and governance frameworks are necessary for responsible AI adoption.
A6	Interest in using AI for banking compliance is growing.
A7	AI can automate transaction monitoring and reporting, freeing compliance officers for strategic tasks.
A8	Regulatory bodies must provide clear guidance on AI use in compliance.
A13	The human cost of AI implementation in banking should not be overlooked.
A13	The impact of AI on employee morale and job security must be examined.
A18	Banks should invest in employee retraining and provide clear career paths.
A11	The regulatory outlook for AI in banking is still evolving.
A12	Clear guidelines are needed on algorithmic bias, fairness, and accountability in AI-based decisions.
A14	The future of banking with AI lies not just in automation but in creating a more personalized and engaging customer experience.
A10	AI can suggest suitable financial products based on individual needs and provide real-time insights into spending habits.
A18	AI has immense potential to transform the banking industry.
A16	Developing measures to combat online financial crimes relies on AI.
A15	Secure systems to counter digital threats require a stronger focus on cybersecurity.
A15	Penetration testing tools are used to assess and measure system vulnerability to cyberattacks.
A11	Ensuring optimal AI performance in e-banking depends on proper algorithm implementation.
A14	The effectiveness of AI in e-banking requires precise algorithm execution.
A13	Proper implementation of AI algorithms improves customer experience and operational efficiency in banking.
A13	Fine-tuning machine learning algorithms is essential for optimizing fraud detection in e-banking.
A18	The organization uses various methods to collect employee performance data.
A11	A human resource management system is available for collecting and managing employee data.
A12	Mechanisms exist to identify employee skills and experiences, guiding training decisions.
A14	The company has established procedures to ensure responsible collection and use of employee performance data.
A10	A robust platform is needed for the full digitalization of banking services.
A18	Banks require a next-generation digital banking platform that enables automation and integration of all banking processes.

Stage 2: Generating Initial Codes (Extracting Concepts from Meaningful Statements)

In this stage, the data were organized systematically and meaningfully, breaking down large volumes of data into smaller, meaningful segments. Various coding methods were employed, with their selection based on the research perspective and the study's research questions. The generation of initial codes involved extracting preliminary concepts from meaningful written

statements. In this step, factors were identified using open coding, based on the concepts and data extracted in the previous stage. A portion of the open coding results is provided as an example in the table below.

Table 3. Open Coding of Interviews; Researcher's Calculations, 2024

Source	Meaningful Statements	Open Coding
A1	The use of AI in fraud detection and loan assessment has significantly increased.	Fraud detection, improved loan assessment
A2	Integrating AI into banking systems comes with challenges.	Challenges of AI integration
A3	Successful AI implementation depends on balancing automation and human expertise.	Balancing automation and human expertise
A6	Not all processes can be fully automated; human presence is still necessary.	Necessity of human presence in processes
A5	AI is strong in big data analysis, but ethical and regulatory considerations must be addressed before widespread use.	Big data analysis, ethical and regulatory considerations
A4	The future of banking lies in combining AI and human resources; AI handles repetitive tasks, freeing employees for more complex work.	Combining AI and human resources, automating repetitive tasks
A1	The speed of AI adoption in banks depends on their size, resources, and risk tolerance.	Speed of adoption, bank size, resources, and risk tolerance
A3	AI success in banking is linked to improved efficiency, reduced costs, and enhanced customer experience.	Improved efficiency, reduced costs, enhanced customer experience
A5	AI has revolutionized fraud detection and accelerated anomaly identification.	Fraud detection, accelerated anomaly identification
A5	Integrating AI into loan assessment is complex and requires fairness and transparency in decisions.	Complexity of loan assessment, fairness and transparency in decisions
A6	AI has immense potential and is driving cultural change in banks.	AI potential, cultural change in banks
A1	Some employees are concerned about job replacement by AI.	Employee concerns about job replacement
A8	Training and effective communication are critical for successful AI integration.	Importance of training and communication
A2	There is a lot of hype around AI in banking, but it is still in development.	Hype and development of AI in banking
A3	AI can automate tasks, but human judgment is essential for complex financial decisions.	Task automation, necessity of human judgment
A4	The key is not just automation but enhancing human capabilities with AI.	Enhancing human capabilities
A6	AI can measure loan risk for customers.	Measuring loan risk
A1	AI-based chatbots are increasingly used for customer service.	Use of chatbots for customer service
A2	Regulations are adapting to the rapid development of AI in banking.	Regulatory adaptation to AI development
A3	Clear guidelines are needed for the responsible use of AI.	Need for clear guidelines on responsible AI use
A7	Protecting data privacy and preventing algorithmic bias in data analysis are crucial.	Data privacy, preventing algorithmic bias
A8	AI provides personalized insights and helps customers make complex decisions.	Personalized insights, aiding customer decision-making
A1	Data security is critical when integrating AI into banking.	Importance of data security
A4	Ensuring customer data privacy and security throughout the AI lifecycle is essential.	Privacy and security in the AI lifecycle
A5	Strong cybersecurity measures and governance frameworks are necessary for responsible AI adoption.	Cybersecurity measures, governance frameworks
A6	Interest in using AI for banking compliance is growing.	AI use in banking compliance
A7	AI can automate transaction monitoring and reporting, freeing compliance officers for strategic tasks.	Automating monitoring and reporting, freeing compliance officers
A8	Regulatory bodies must provide clear guidance on AI use in compliance.	Need for regulatory guidance on AI in compliance
A13	The human cost of AI implementation in banking should not be overlooked.	Human cost of AI implementation
A13	The impact of AI on employee morale and job security must be examined.	Impact on employee morale and job security
A18	Banks should invest in employee retraining and provide clear career paths.	Investment in retraining, clear career paths
A11	The regulatory outlook for AI in banking is still evolving.	Evolving regulatory outlook
A12	Clear guidelines are needed on algorithmic bias, fairness, and accountability in AI-based decisions.	Need for guidelines on bias, fairness, and accountability
A14	The future of banking with AI lies not just in automation but in creating a more personalized and engaging customer experience.	Personalized and engaging customer experience
A10	AI can suggest suitable financial products based on individual needs and provide real-time insights into spending habits.	Suggesting financial products, real-time insights into spending habits

A18	AI has immense potential to transform the banking industry.	AI potential to transform banking
A16	Developing measures to combat online financial crimes relies on AI.	Combating online financial crimes
A15	Secure systems to counter digital threats require a stronger focus on cybersecurity.	Focus on cybersecurity for digital threats
A15	Penetration testing tools are used to assess and measure system vulnerability to cyberattacks.	Penetration testing for cybersecurity
A11	Ensuring optimal AI performance in e-banking depends on proper algorithm implementation.	Optimal AI performance, proper algorithm implementation
A14	The effectiveness of AI in e-banking requires precise algorithm execution.	Precise algorithm execution
A13	Proper implementation of AI algorithms improves customer experience and operational efficiency in banking.	Improved customer experience and operational efficiency
A13	Fine-tuning machine learning algorithms is essential for optimizing fraud detection in e-banking.	Fine-tuning machine learning algorithms
A18	The organization uses various methods to collect employee performance data.	Methods for collecting employee performance data
A11	A human resource management system is available for collecting and managing employee data.	HR management system for employee data
A12	Mechanisms exist to identify employee skills and experiences, guiding training decisions.	Identifying employee skills and experiences
A14	The company has established procedures to ensure responsible collection and use of employee performance data.	Responsible use of employee performance data
A10	A robust platform is needed for the full digitalization of banking services.	Need for a robust digitalization platform
A18	Banks require a next-generation digital banking platform that enables automation and integration of all banking processes.	Next-generation digital banking platform

Stage 3: Searching for Themes

A theme was defined as a pattern that captures significant or noteworthy meanings or insights related to the data or the research question. According to Braun and Clarke (2006), there are no fixed or definitive rules for determining what constitutes a theme; rather, its importance and relevance define it. In cases where the dataset was small, such as a limited focus group, significant overlap between the coding stage and the identification of initial themes was likely to occur.

In this stage, sub-themes, which encompassed one or more extracted concepts, were identified. Subsequently, main themes, which covered multiple sub-themes, were determined.

Table 4. Initial Themes

Row	Concept (Initial Code)	Sub-Themes
1	Secure and reliable data management for AI integration, development of mechanisms to ensure information security, designing mechanisms to prevent cyber fraud, existence of a comprehensive structure for identifying cyber threats, and mechanisms for assessing data quality in the system.	Data Security and Assurance
2	The level of explainability and acceptance of technology by employees, the compatibility of AI with banking processes, trust-building mechanisms for customer acceptance of technology, designing structures for cultural adaptation to AI implementation, and the digital integration of employee and customer interactions.	Technology Alignment and Adoption
3	Use of dedicated and customized databases, alignment of database structures with AI needs, suitable platforms for successful learning, designing processes tailored to machine learning needs, and a platform for maximizing the digitalization of banking services and processes.	Data and Technology Infrastructure
4	Mechanisms for analyzing customer sentiments and feedback, use of risk and market sensitivity analysis mechanisms, implementation of predictive algorithms based on neural networks, structures for market sensitivity analysis, and implementation of communication channels with customers for data collection.	Data Analysis and Prediction
5	Implementation of chatbots and voice assistants, providing infrastructure for calculating banking profits using AI, meeting the need for service direction in a technology-driven environment, and a suitable platform for offering electronic and digital financial services.	AI-Based Banking Services
6	Use of structures ensuring fast data transfer, creating platforms to ensure the successful performance of learning algorithms, compatibility of neural networks and support vector machines with the system, use of comprehensive and inclusive databases, and mechanisms for collecting employee performance data.	Speed and Effectiveness of Data Transfer

Stage 4: Reviewing Themes

In this stage, the sub-themes developed earlier were carefully examined for their relevance and alignment with the research objectives. The initial themes identified in previous stages were refined and significantly expanded. By merging sub-themes and broadening their conceptual scope, the main themes of the research were derived. During this process, it was analyzed whether the resulting themes reflected clear and meaningful insights into the subject matter. Subsequently, data related to each theme were collected and organized in a structured manner.

Further, by reviewing the information associated with each theme, the extent to which the data supported the themes was evaluated. The results of these analyses are presented in detail in Table 5, illustrating how the data related to each theme were identified and categorized within the research sample.

Table 5. Themes at the End of Stage Four

Concept (Initial Code)	Sub-Themes	Main Theme
Secure data management for AI integration, development of mechanisms to ensure information security, designing mechanisms to prevent cyber fraud, identifying cyber threats, and assessing data quality in the system.	Data Security and Assurance	Data Security and Governance
Structures ensuring trust and security, mechanisms for assessing and reducing cyber risks.	Cybersecurity Governance	
The level of technology explainability by employees, customer acceptance of technology, alignment with banking processes, cultural adaptation for successful implementation, and building digital trust between employees and customers.	AI Acceptance and Explainability	Technology Adoption and Alignment
Designing structures for cultural adaptation to AI implementation, encouraging technology acceptance among employees and customers.	Training and Cultural Adaptation	
Use of dedicated and customized databases, alignment of database structures with AI needs, storage of data required for analysis, and integration and standardization of system data.	Data Management and Storage	Technology and Data Infrastructure
Providing suitable platforms for learning and processing, maximizing the digitalization of banking services and processes, infrastructure for calculating banking profits, and AI-based data analysis platforms.	Learning and Processing Infrastructure	
Analyzing customer feedback and opinions, collecting data from communication channels, analyzing customer data, and implementing communication channels for data collection.	Customer Sentiment and Feedback Analysis	Data Analysis and Prediction
Implementing risk analysis for performance evaluation, risk analysis mechanisms, and market sensitivity analysis structures.	Risk and Market Sensitivity Analysis	
Predictive algorithms based on neural networks, compatibility of neural networks with the system, and proper implementation of AI-based predictive models.	AI-Based Prediction	
Offering electronic financial services, digitalizing processes, implementing chatbots and voice assistants, and providing platforms for calculating banking profits using AI.	AI-Driven Banking Services	Service and Operational Optimization
Ensuring data transfer speed, optimizing learning algorithms, using appropriate databases, and mechanisms for collecting employee performance data to enhance process effectiveness.	Service Efficiency and Speed	

At this stage, the research focused on analyzing and refining the sub-themes, expanding them to achieve the research objectives. Through the consolidation and refinement of these themes, a meaningful and cohesive structure of main themes emerged, representing the unique insights of the study. Additionally, all data related to each theme were meticulously collected and reviewed to ensure consistency and adequate support for the extracted themes. This process established a valid and coherent conceptual framework for addressing the research objectives.

In Table 5, the themes and initial codes extracted in the fourth stage of the research, focusing on the implementation of artificial intelligence in the Iranian banking industry, are presented in detail. These themes were categorized into four main groups: Data Security and Governance, Technology Adoption and Alignment, Technology and Data Infrastructure, and Service and Operational Optimization.

- Under Data Security and Governance, topics such as data security management and cybersecurity assurance were addressed.
- The Technology Adoption and Alignment theme explored the acceptance of technology by employees and customers, as well as cultural adaptation and the explainability of AI.
- Technology and Data Infrastructure included the provision of necessary infrastructure for data learning and analysis.
- In the Service and Operational Optimization theme, process optimization and the speed and effectiveness of services were emphasized.

Figure 1. Factors Influencing the Successful Implementation of Artificial Intelligence in the Iranian Banking Industry

4. Discussion and Conclusion

The analysis and interpretation of factors influencing the successful implementation of artificial intelligence (AI) in the Iranian banking industry, based on previous research findings and the data presented, can help us to identify key challenges and opportunities in this field. This analysis specifically focuses on four fundamental pillars, each playing a critical role in the successful implementation of AI. These pillars include data security and governance, technology adoption and alignment, technology and data infrastructure, and data analysis and prediction, each contributing to advancements in this domain with its unique perspective and priorities. Additionally, a fifth pillar, service and operational optimization, has been examined, which significantly enhances the efficiency and effectiveness of banking systems through AI.

Data Security and Governance: In this area, the primary factors include secure data management to align with AI systems, the development of security mechanisms, and combating cyber fraud. Data security and cyber threat management, as emphasized by Verma et al. (2023), are among the most critical challenges in AI-based banking and are essential for protecting sensitive banking information (Verma & Chakarwarty, 2023). Sawwalakhe et al. (2023) also confirmed this and suggested that banks should employ stronger analytical mechanisms to counter cyber threats (Sawwalakhe et al., 2023).

Technology Adoption and Alignment: This pillar encompasses the acceptance of AI technology by employees and customers, cultural adaptation around this technology, its explainability, and building digital trust among stakeholders. Noreen et al. (2023) emphasized the importance of fostering trust among customers and employees, indicating that increased awareness and trust lead to higher acceptance of new technologies. Other studies, such as Dewasiri et al. (2023), have highlighted the need for cultural adaptation and employee training to reduce potential resistance to technology adoption and ensure seamless integration of banking processes with modern technologies (Dewasiri et al., 2023).

Technology and Data Infrastructure: Developing robust infrastructure for data storage and management, creating integrated databases, and designing AI-based analytical infrastructure are critical factors for the successful implementation of AI. According to Sawwalakhe et al. (2023) and Nguyen et al. (2023), data analysis infrastructure and digitalization of services enable banks to meet their technology-driven needs more effectively and enhance system efficiency (Nguyen et al., 2023; Sawwalakhe et al., 2023). These studies also emphasized the importance of data integration and improving processing capabilities, which have been confirmed in numerous prior studies.

Data Analysis and Prediction: Another critical factor is the implementation of predictive algorithms based on neural networks and market risk and sensitivity analysis, which play a vital role in improving banking strategies. Gültekin et al. (2020) and Dağ et al. (2019) demonstrated that analyzing large banking datasets and identifying hidden financial patterns are significant applications of AI that can enhance strategic decision-making in banks (Dağ, 2019; Gültekin et al., 2020). Additionally, optimizing learning algorithms and collecting customer feedback to improve service effectiveness and speed are other key aspects of this pillar.

Service and Operational Optimization: This pillar emphasizes improving the efficiency and speed of banking services through AI. Factors such as service effectiveness and speed, along with AI-based banking services, play a crucial role in enhancing banking system efficiency and meeting customer needs. Northey et al. (2022) showed that innovative technologies like chatbots and voice assistants enable faster customer responses and increase satisfaction. Furthermore, the use of AI in learning algorithms and employee performance analysis enhances decision-making speed and responsiveness in banking systems (Northey et al., 2022). Tripathi et al. (2022) also demonstrated that digitalization and competition in banking services have led organizations to achieve greater productivity and efficiency, with studies like Saluja et al. (2022) confirming these results (Tripathi et al., 2022).

In summary, the examined pillars—data security and governance, technology adoption and alignment, technology and data infrastructure, data analysis and prediction, and service and operational optimization—each play a vital role in the successful implementation of AI in Iranian banking. Recent research, including studies by Carpenter (2020) and Berrada et al. (2022), indicates that AI can enhance customer experience, security, and operational efficiency (Berrada et al., 2022; Carpenter, 2020). To better leverage opportunities and mitigate challenges, banks should focus on integrating security technologies, data analysis, and infrastructure strengthening to succeed in their digital transformation journey.

Based on the analysis results, eight practical recommendations are proposed to improve the implementation of artificial intelligence (AI) in the Iranian banking industry. These recommendations can help banks better utilize AI technologies, minimize challenges, and enhance efficiency and security:

1. **Developing and Implementing Comprehensive Security Policies**: Given the importance of data security in banking, it is recommended that banks establish comprehensive security policies for managing and protecting sensitive data and combating cyber threats. The use of advanced encryption technologies and continuous monitoring are essential measures in this regard.
2. **Promoting Digital Culture and Employee Training**: To increase the acceptance of AI technologies, banks should organize regular training programs for employees and promote a digital culture. Cultural adaptation and training help employees adapt more easily to technological changes and build greater trust in new technologies.
3. **Enhancing Technology Infrastructure and Strengthening Data Centers**: To improve data processing efficiency and speed, it is recommended that banks focus on upgrading and developing their technology infrastructure. Strengthening data centers, adopting cloud storage technologies, and implementing advanced data analysis systems can address the technology-driven needs of banks.
4. **Developing Advanced Analytical Systems and Customer Behavior Prediction**: Implementing advanced machine learning algorithms and big data analytics can help banks to identify customer behavior patterns and deliver better services. These analyses can enhance marketing strategies and strategic decision-making in banks.
5. **Establishing Customer Feedback Monitoring Systems**: Creating systems that collect and analyze customer feedback continuously can improve banking services. It is recommended that banks use intelligent methods to analyze this feedback to better identify customer needs and enhance their satisfaction levels.

6. **Utilizing AI Technologies to Combat Fraud and Cybercrime**: The use of fraud detection algorithms and AI systems to identify and prevent cybercrime is crucial for banks. These technologies can automatically detect suspicious activities and improve the security of banking systems.
7. **Integrating Data in Large Banks**: To gain better insights and enhance data analysis capabilities, banks should integrate data from various sources. Creating comprehensive and harmonized databases enables banks to conduct more thorough analyses and optimize their performance.
8. **Advancing Digital Services and Using Chatbots and Voice Assistants**: It is recommended that banks adopt AI-based chatbots and voice assistants to increase customer service efficiency and response speed. These tools can assist in providing faster information and support to customers, and improve their user experience.

These recommendations can help banks leverage AI capabilities to improve efficiency and security, respond more effectively to customer needs, and strengthen their position in the competitive banking market.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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