Future of Work and Digital Management Journal

Article type:
Original Research

Article history:
Received 10 June 2026
Revised 28 July 2026
Accepted 02 September 2026
Initial Publish 23 September 2026
Published online 01 July 2027

Mehdi. Taleb[1], Mohammadreza. Sanaei[1*], Alireza. Aminkhaki[2]

1 Department of IT Management, Qa.C., Islamic Azad University, Qazvin, iran
2 Department of Economic, Qa.C., Islamic Azad University, Qazvin, iran

Corresponding author email address:
mr.sanaei@iau.ac.ir

How to cite this article:
Taleb, M., Sanaei, M., & Aminkhaki, A. (2027). Futures Studies of Artificial Intelligence–Based Banking Services in the Payment Industry: Iranian Private Banks. *Future of Work and Digital Management Journal,* *5*(4), 1-18. https://doi.org/10.61838/fwdmj.339

Futures Studies of Artificial Intelligence–Based Banking Services in the Payment Industry: Iranian Private Banks

ABSTRACT

The present study aimed to conduct a futures study of artificial intelligence–based banking services in the payment industry of Iranian private banks. The study employed an exploratory mixed-methods approach (qualitative–quantitative). In the qualitative phase, data were collected through meta-synthesis and a systematic review of studies published in international scientific databases and were analyzed using open, axial, and selective coding. Structural analysis was also conducted using MICMAC software to examine the relationships among the variables. The results showed that the variables of "strategic leadership and support," "organizational digital maturity," "technological innovation," and "interorganizational synergy" were located in the linkage cluster and played key roles in the dynamics of the banking system. Subsequently, using Scenario Wizard software, four plausible future scenarios were developed: "Coordinated Smart Ecosystem," "Technological Advancement amid Distrust," "Structural Loss of Opportunities," and "Digital Crisis." The final findings indicated that achieving a desirable future for intelligence-driven banking in Iran requires effective digital leadership, adaptive policymaking, secure infrastructure, and targeted investment in digital trust and technological innovation. Otherwise, the likelihood of a digital crisis and the erosion of banks' competitive advantage will increase. Finally, the development of a national digital trust standard, enhancement of strategic leadership, establishment of interbank and bank–fintech collaboration networks, and implementation of technology-monitoring systems were proposed as strategic measures.

Keywords: futures studies, artificial intelligence, digital banking, structural analysis, MICMAC, Scenario Wizard, payment industry.

Introduction

The rapid diffusion of artificial intelligence (AI) across financial services has transformed the competitive, operational, and strategic foundations of contemporary banking. AI technologies are increasingly embedded in customer service, credit assessment, fraud detection, risk management, payment processing, personalization, compliance, and strategic decision-making, thereby reshaping both the internal architecture of banks and the nature of their interactions with customers and other actors in the financial ecosystem. This transformation is especially visible in the payment industry, where transaction volumes, real-time service expectations, cybersecurity threats, data intensity, and competitive pressures from fintech firms have accelerated the need for intelligent, automated, and adaptive banking infrastructures. Recent developments indicate that AI is no longer viewed merely as a supplementary technological tool; rather, it has become a strategic capability capable of redefining banking business models, service delivery mechanisms, and the structure of digital payment ecosystems [1, 2].

Digital transformation in banking reflects a broader organizational shift in which technologies, capabilities, processes, and strategic priorities are reconfigured to create value in increasingly digital environments. Earlier research on digital business

transformation emphasized that technological change alone is insufficient unless organizations develop the internal capabilities required to integrate digital technologies into their strategies and operating models [3]. In financial services, this capability perspective is particularly important because banks operate in highly regulated, information-intensive, and trust-dependent environments. Accordingly, successful digital transformation requires not only investment in technological infrastructure, but also organizational readiness, managerial commitment, data governance, workforce competencies, process redesign, and the capacity to respond rapidly to environmental changes. These requirements have become more pronounced with the expansion of AI, because AI adoption introduces new dependencies on data quality, algorithmic governance, technological expertise, cybersecurity, and organizational learning [4, 5].

The payment industry constitutes one of the most dynamic areas of banking transformation. Digital payments have evolved from relatively simple electronic transaction mechanisms into complex ecosystems involving banks, fintech firms, payment service providers, technology companies, regulators, merchants, and customers. These ecosystems increasingly rely on AI to process high-volume data, detect transaction anomalies, optimize customer experiences, support real-time decision-making, and automate operational processes. In this context, AI can increase the speed and accuracy of payment services, reduce operating costs, improve scalability, and enable financial institutions to design more personalized and responsive services [6]. The integration of AI into payment infrastructures also enables banks to move from reactive service models toward predictive and anticipatory models in which customer needs, transaction risks, and market patterns can be identified before they result in operational problems or lost opportunities.

One of the most important contributions of AI to banking is its potential to improve operational efficiency while simultaneously enhancing service quality. AI-based systems can automate repetitive activities, facilitate rapid processing of complex information, reduce human error, improve resource allocation, and support more accurate managerial decisions. At the customer interface, intelligent systems can provide personalized recommendations, automated assistance, rapid responses, and context-sensitive services. These capabilities can significantly improve perceived responsiveness and convenience, particularly in digital banking environments where customer expectations are shaped by experiences with technology-intensive industries outside traditional financial services [7]. Customer-centric digital transformation therefore depends increasingly on the ability of banks to convert customer data into actionable insights and to use intelligent systems to create individualized service experiences [8].

At the same time, the growing role of fintech firms has intensified competitive pressure and altered the institutional structure of financial markets. Fintech development has introduced new forms of competition, collaboration, and platform-based service delivery, compelling traditional banks to reconsider established business models and innovation processes. A systematic review of fintech research demonstrated that the expansion of technology-driven financial services has created both disruptive pressures and opportunities for cooperation within the financial services industry [9]. In payment services in particular, fintech firms can often introduce products more rapidly, use flexible digital architectures, and respond more effectively to niche customer needs than traditional banks. Consequently, banks must not only adopt new technologies but also develop interorganizational relationships, innovation networks, and collaborative arrangements that allow them to combine institutional trust and financial expertise with technological agility.

AI can further intensify this transformation by facilitating new forms of financial innovation. In emerging banking systems, the use of AI has been associated with the creation of innovative products, enhanced analytical capabilities, automated

decision-making, and more flexible delivery channels [10]. These developments suggest that AI adoption should be considered within a broader innovation ecosystem rather than as an isolated technological intervention. The strategic value of AI depends on interactions among technological infrastructure, organizational capabilities, regulatory conditions, market competition, customer behavior, institutional collaboration, and leadership. Therefore, the future of AI-based banking cannot be adequately understood by examining individual technologies alone; it requires a systemic perspective that considers the interdependence of multiple drivers.

Security and trust represent particularly critical dimensions of AI-enabled payment transformation. Payment systems process sensitive financial and personal information and are continuously exposed to fraud, identity theft, cyberattacks, unauthorized access, and increasingly sophisticated forms of digital manipulation. Machine learning and other AI techniques have demonstrated considerable potential for detecting abnormal transaction patterns and improving fraud detection capabilities [11]. Through continuous analysis of large volumes of transaction data, intelligent systems can identify suspicious activities more rapidly and adapt detection mechanisms as fraud patterns change. However, the expansion of automated monitoring and algorithmic decision-making also raises important questions regarding transparency, accountability, privacy, data protection, and the possibility of biased or erroneous decisions.

These concerns are especially important because customer adoption of digital banking services is closely related to perceived security and trust. Even technically advanced payment services may fail to achieve widespread adoption if customers perceive them as insecure, opaque, or unreliable. Research on AI and payment industry transformation has therefore emphasized that technological progress must be accompanied by robust cybersecurity mechanisms and deliberate efforts to strengthen customer trust [12]. Digital trust can be understood as a multidimensional condition involving confidence in the security, reliability, transparency, integrity, and institutional accountability of digital services. In AI-based banking, trust is influenced not only by cybersecurity performance but also by the perceived fairness and explainability of automated systems. Consequently, trust and security are not merely technical considerations; they are strategic determinants of the sustainability of digital banking ecosystems.

The governance and ethical implications of AI further complicate the trajectory of banking transformation. As AI systems assume greater responsibility for decisions affecting credit, payments, risk classification, customer profiling, and service access, banks must establish governance mechanisms capable of ensuring accountability, fairness, explainability, privacy, and regulatory compliance. Ethical challenges may arise from biased training data, opaque algorithms, unequal treatment, excessive surveillance, or unclear responsibility for automated decisions. Effective AI governance therefore requires coordination among technological, legal, managerial, and ethical mechanisms [13]. For banking institutions, this implies that the long-term value of AI cannot be measured only in terms of efficiency or profitability; it must also be evaluated according to institutional legitimacy, customer protection, compliance, and social acceptance.

Regulation is consequently becoming a central component of AI-enabled financial transformation. Overly restrictive regulation may inhibit experimentation and reduce the speed of technological innovation, whereas insufficient regulation may expose financial institutions and customers to unacceptable risks. This creates a need for adaptive and intelligent regulatory frameworks capable of balancing innovation with security, accountability, and systemic stability. Such frameworks are particularly important in payment systems because disruptions, fraud, or loss of trust can have consequences beyond

individual banks and may affect the stability of the wider financial ecosystem. Future-oriented banking strategies must therefore integrate technological development with anticipatory policymaking and regulatory capacity.

The evolution of future banking ecosystems also highlights the importance of interorganizational integration and platform-based collaboration. Emerging banking environments are increasingly characterized by the convergence of banking institutions, fintech platforms, payment networks, data providers, technology firms, and public regulators. Research on future banking ecosystems suggests that AI integration will reinforce these interdependencies by enabling more sophisticated forms of data sharing, automation, prediction, and ecosystem coordination [14]. However, the benefits of such integration depend on interoperability, data governance, cybersecurity standards, institutional trust, and strategic alignment. Banks that remain technologically isolated may therefore struggle to achieve the economies of scale, learning effects, and innovation capabilities associated with ecosystem participation.

Strategic leadership represents another essential determinant of successful AI adoption. Digital transformation often requires substantial organizational change, including the redesign of processes, reassignment of responsibilities, development of new competencies, modification of organizational culture, and acceptance of greater technological experimentation. Without strong leadership support, AI initiatives may remain fragmented, technically oriented, or disconnected from broader institutional objectives. Strategic leaders play an important role in setting priorities, mobilizing resources, establishing a digital vision, supporting innovation, managing resistance, and coordinating technological transformation across organizational units. The importance of such leadership becomes even greater in highly uncertain environments, where banks must make long-term investments despite ambiguity regarding technological development, regulation, market behavior, and customer expectations.

These challenges are especially relevant in developing economies, where the adoption of AI may occur under conditions of uneven digital maturity, constrained investment capacity, institutional uncertainty, and infrastructure limitations. Research has shown that AI capabilities can support digital banking transformation in developing economies, but the effectiveness of this transformation depends strongly on institutional conditions and the availability of complementary organizational capabilities [5]. Similarly, studies of AI adoption in banking have identified technological infrastructure, employee capabilities, organizational readiness, regulatory support, security concerns, and managerial commitment as recurring factors affecting implementation [4]. These findings suggest that national and institutional context plays a decisive role in shaping the pathway through which AI generates value.

The Iranian banking system presents a particularly important context for examining these issues. Iranian banks have expanded electronic and digital banking services considerably, and payment infrastructures occupy a central position in everyday financial transactions. At the same time, banks operate under specific technological, economic, regulatory, and institutional conditions that distinguish their transformation trajectory from that of many advanced financial systems. Research on digital transformation and AI readiness in Iranian banking has indicated that differences in organizational preparedness, technological capabilities, human resources, and managerial support influence the capacity of banks to adopt intelligent technologies effectively [15]. Therefore, the future development of AI-based banking services in Iran requires attention not merely to international technological trends but also to domestic institutional and organizational capacities.

Recent Iranian research has also highlighted the potential contribution of AI to improving banking service quality. AI-enabled personalization, intelligent customer service, faster processing, and improved decision-making can enhance service

performance, although these benefits depend on reliable infrastructure and effective implementation [16]. From a strategic perspective, the central challenge is therefore not whether AI can contribute to banking performance, but under what combinations of organizational, technological, regulatory, and environmental conditions these contributions can be realized sustainably. The answer to this question is particularly important for private banks, which often face greater competitive pressure to differentiate services, adopt emerging technologies, and respond rapidly to changing customer expectations.

Studies focused specifically on the Iranian payment industry further indicate the need for a futures-oriented approach. Research on AI-based banking services in Iran has emphasized that the trajectory of technological transformation depends on the interaction of multiple drivers rather than on a single determinant [17]. These drivers include technological innovation, organizational digital maturity, policy and regulation, customer trust, strategic leadership, economic conditions, interorganizational cooperation, and the capacity to monitor emerging technologies. Because these variables interact dynamically, conventional linear forecasting methods may not adequately capture the complexity of future developments. A more appropriate approach involves identifying structural relationships among key variables and exploring alternative configurations of uncertain but highly influential factors.

Futures studies provide a suitable methodological framework for addressing such complexity because they do not attempt simply to predict a single predetermined future. Instead, they identify drivers of change, critical uncertainties, systemic interactions, and multiple plausible future trajectories. In volatile technological environments, scenario development allows decision-makers to examine how different combinations of strategic, technological, and institutional conditions may shape alternative outcomes. This perspective is particularly relevant to AI because the pace and direction of technological development are difficult to forecast and are strongly mediated by governance, trust, investment, organizational readiness, and user acceptance. Global analyses of payment transformation likewise suggest that AI-powered banking will increasingly depend on the ability of financial institutions to integrate intelligent automation, data-driven services, security, ecosystem collaboration, and strategic adaptability [1].

A futures-oriented perspective can also help distinguish between variables that function primarily as drivers and those that operate as outcomes or dependent factors. Structural analysis techniques such as MICMAC are useful in this respect because they assess the influence and dependence of variables within a system. Highly influential variables may serve as leverage points for strategic intervention, while linkage variables may represent unstable and sensitive components whose changes propagate through the broader system. Identifying these relationships is essential for managers and policymakers seeking to prioritize scarce resources and design resilient transformation strategies. For example, investment in AI infrastructure may have limited impact if digital leadership remains weak, regulatory coordination is inadequate, or customer trust deteriorates.

The need for such systemic analysis becomes even more apparent when considering that the future of AI-based banking involves both substantial opportunities and significant risks. AI can facilitate innovation, operational efficiency, personalization, fraud detection, and improved decision-making [7, 11]. At the same time, insufficient governance, cybersecurity weaknesses, low digital trust, organizational resistance, or regulatory uncertainty can reduce these benefits and generate new vulnerabilities [12, 13]. Digital transformation may therefore lead to markedly different outcomes depending on the interaction among leadership, maturity, innovation, trust, collaboration, and environmental stability. A banking system characterized by strong strategic leadership and high digital trust may move toward coordinated intelligent

ecosystems, whereas weak leadership and declining trust may produce fragmented transformation, missed opportunities, or systemic digital crisis.

Moreover, the competitive implications of AI adoption are likely to intensify as banking ecosystems evolve. Banks that develop advanced digital capabilities may use AI to differentiate services, improve customer retention, reduce transaction costs, strengthen fraud prevention, and create new revenue models, while institutions that fail to adapt may lose market share to more agile banks and fintech competitors [2, 9]. This competitive dynamic underscores the importance of technological entrepreneurship and organizational innovation. Yet innovation should not be interpreted narrowly as the acquisition of new software or algorithms. It also involves organizational learning, experimentation, partnership development, data capabilities, leadership, and strategic responsiveness [10].

Accordingly, the strategic challenge facing Iranian private banks is multidimensional. They must simultaneously increase their digital maturity, strengthen AI capabilities, maintain customer trust, improve cybersecurity, respond to fintech competition, comply with regulatory requirements, and invest in organizational capabilities that support sustained transformation. Customer-centricity must also remain central because the ultimate value of AI-enabled banking depends on whether customers experience services as useful, reliable, secure, accessible, and responsive [8]. These requirements cannot be managed effectively through short-term technological planning alone. They require a forward-looking framework capable of identifying critical drivers, assessing systemic interdependencies, and constructing plausible scenarios that support proactive strategic decision-making.

Despite the growing body of research on AI adoption, digital banking, fintech, customer experience, security, and organizational transformation, several gaps remain. Much of the literature examines individual applications or determinants in isolation, while fewer studies integrate organizational, technological, regulatory, economic, and trust-related dimensions within a unified futures framework. Furthermore, the specific context of Iranian private banks and the payment industry remains comparatively underexplored, particularly from a structural and scenario-based perspective. Existing studies provide valuable insights into readiness, service quality, and AI-based banking development in Iran [15-17], but a comprehensive examination of the mutual influence of key drivers and the alternative futures generated by critical uncertainties is still needed. Addressing this gap can contribute both theoretically, by integrating AI banking transformation with futures studies and structural analysis, and practically, by helping managers and policymakers identify strategic leverage points and prepare for multiple possible trajectories.

Therefore, the aim of this study is to conduct a futures-oriented analysis of artificial intelligence–based banking services in the payment industry of Iranian private banks by identifying and structurally analyzing the key driving factors and developing plausible future scenarios.

Methodology

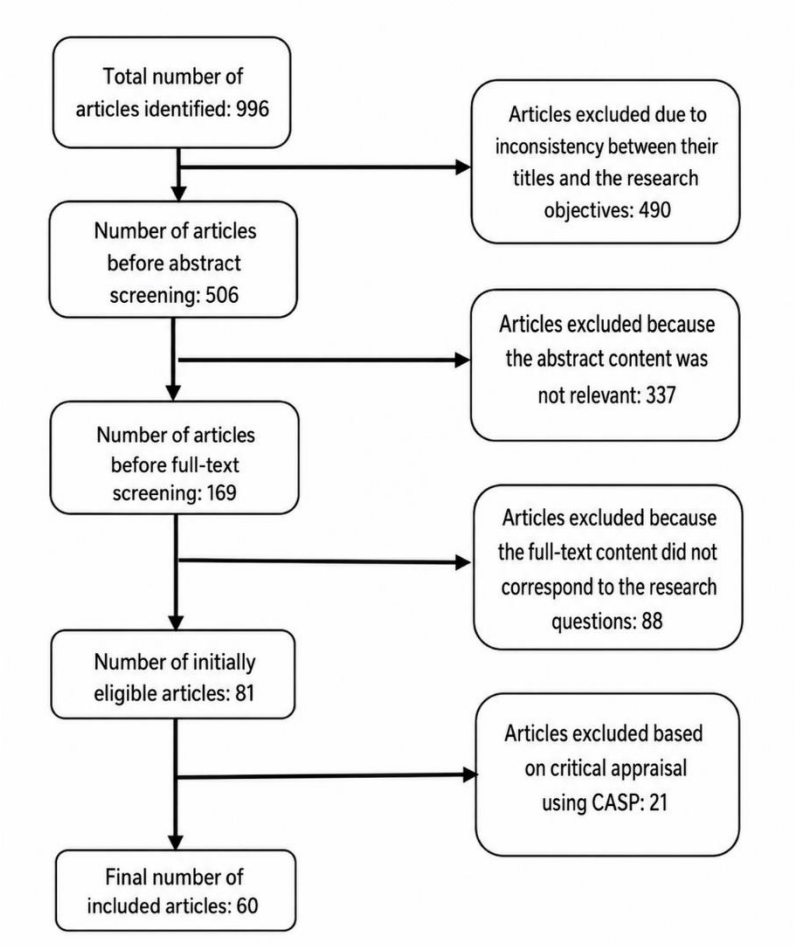
First, the existing articles and studies were reviewed in chronological order. Subsequently, a synthesis was conducted to examine the tools used and the trends followed in applying these tools in order to generate ideas for designing a hybrid model. In another synthesis, the data and problem-solving approaches were examined with respect to the three challenges discussed in the significance and necessity section. Finally, the outcomes of these three analytical dimensions were integrated to identify the existing research gap. It should be noted that the studies reviewed covered the preceding 15 years.

Nevertheless, the primary emphasis was placed on studies published during the preceding five years, particularly those published in 2020. Furthermore, all reviewed articles were obtained from reputable international journals and conferences. Subsequently, the factors were identified through a three-stage coding process, and the intended model was ultimately extracted using grounded theory.

In this study, data were collected through two methods: library research and field investigation. Library research was used to collect information related to the theoretical foundations and research background within the thematic scope of the study and to extract the initial components. Initially, valid, reliable, and relevant documents published within an appropriate time frame were identified. For this purpose, articles, books, and reputable domestic and international websites were reviewed. The criteria used for the qualitative assessment of whether articles should be included or excluded consisted of credible English-language sources published from 2010 onward and the presence of the keywords *artificial intelligence* and *payment* in the titles of the articles. It should be noted that, in recent years, various constructs, including the payment industry, have received considerable scholarly attention. The article extraction procedure is presented below.

Figure 1

Article Extraction Process



The third step of the meta-synthesis involved the analysis and synthesis of qualitative findings. At this stage, the extracted codes were transformed into concepts, and the concepts were subsequently grouped into categories. The classification of these codes was based on the degree of similarity among them. In the next step, the extracted concepts and categories were

incorporated into the interview process. At this stage, to collect the required data, interviews were conducted with academic experts, instructors, and researchers in the fields of leadership and communications, particularly in virtual environments. Participants were selected using theoretical sampling.

In this study, a code was first assigned to each identified factor. Subsequently, the codes were grouped into common concepts based on their semantic meaning, thereby forming the study concepts. In the next step, the factors represented as codes in the preceding stage were categorized. This procedure corresponds to axial coding (the second stage) and selective coding (the third stage) in grounded theory methodology. In axial coding, the relationships among categories are identified, whereas in selective coding, these relationships are conceptualized and reported at a higher level of abstraction. Table 1 presents the demographic characteristics of the expert panel members. Following the establishment of the organizational expert committee, the questionnaires required for collecting the research data were designed.

Table 1

Demographic Characteristics of the Expert Panel Members

Expert	Group	Educational Qualification
1	Organizational experts	PhD
2	Organizational experts	Master's degree
3	Organizational experts	Master's degree
4	Organizational experts	PhD
5	Organizational experts	PhD
6	Organizational experts	Master's degree
7	Organizational experts	Master's degree
8	Organizational experts	PhD
9	Academic experts	PhD in Information Technology Management
10	Academic experts	PhD in Artificial Intelligence
11	Academic experts	PhD in Information Technology Policy
12	Academic experts	PhD in Artificial Intelligence
13	Academic experts	PhD in Artificial Intelligence
14	Academic experts	PhD in Artificial Intelligence
15	Academic experts	PhD in Artificial Intelligence

Findings and Results

To contextualize, adapt, and screen the drivers of artificial intelligence adoption in the payment industry, the preliminary theoretical framework comprising the components extracted from the research literature was distributed among organizational experts in the form of a questionnaire. The purpose was to develop a flexible framework for these components that could address many of the shortcomings associated with insufficient precision and clarity. At this stage, 12 principal concepts were extracted to establish the final theoretical framework.

Table 2

Components of Artificial Intelligence–Based Banking Services

Definition and Description	Main Concept
Fundamental transformation of banking processes, products, and structures through the application of emerging technologies.	1. Digital transformation in financial services
The extent of an organization's capability to adopt and effectively utilize new technologies.	2. Organizational digital maturity and readiness
The existence of supportive and regulatory frameworks for guiding financial innovations.	3. Smart policymaking and regulation
Increased competitive pressure resulting from the entry of fintech firms and digital innovations.	4. Technological competition in the financial market
The effects of macroeconomic and political variables on the development of banking technologies.	5. Economic stability in the macro-environment
The degree of customer and institutional trust in the security of data and digital transactions.	6. Digital trust and cybersecurity
Development of innovative products and services based on emerging financial technologies.	7. Technological innovation and entrepreneurship
Application of data and artificial intelligence analytics in key decision-making processes.	8. Data-driven decision-making

The role of managers in directing and facilitating organizational digital transformation.	9. Strategic leadership and support
Expansion of diversified and personalized products within the digital banking system.	10. Diversity of electronic financial services
Collaboration among banks, fintech firms, and governmental institutions for joint development.	11. Interorganizational synergy and collaboration
Continuous monitoring of global trends and adaptation of policies to future changes.	12. Futures studies and technology monitoring

The paradigmatic model for the futures study of artificial intelligence–based banking services provides a systematic framework for explaining how digital transformation occurs in the Iranian banking industry. Within this model, causal conditions such as technological competition, financial innovation, and global artificial intelligence trends function as driving forces of change. The central phenomenon of the model is "digital transformation of artificial intelligence–based financial services," which develops within contextual conditions such as organizational readiness, digital culture, and workforce skills. Simultaneously, intervening conditions such as smart policymaking, governmental support, economic conditions, and digital trust can facilitate or constrain the implementation of transformation. In response to these conditions, strategies such as developing digital leadership, adopting data-driven decision-making, enhancing interorganizational collaboration, and strengthening innovation centers are implemented. The ultimate outcomes of this process include the emergence of a smart banking ecosystem, increased competitiveness and customer trust, and improved efficiency and economic sustainability within the national banking system.

Table 3

Paradigmatic Model

Model Component	Description and Related Categories
Causal conditions	Factors that create the need for digital transformation in the banking industry: • Technological competition in the financial market • Technological innovation and entrepreneurship • Global artificial intelligence trends • Need for diversity in digital financial services
Central phenomenon	Digital transformation in artificial intelligence–based financial services. This phenomenon constitutes the core of the theory and aims to redesign banking structures and processes around intelligent technologies.
Contextual conditions	Environments and contexts within which digital transformation occurs: • Organizational digital infrastructure and readiness • Digital organizational culture and workforce skills • Customers' level of technological literacy • Technology support and training systems
Intervening conditions	Facilitating or inhibiting factors affecting implementation of the phenomenon: • Smart policymaking and regulation • Governmental support and banking regulations • Macroeconomic conditions and sanctions • Cybersecurity infrastructure and digital trust
Strategies and actions	Organizational and banking responses to the above conditions for achieving digital transformation: • Development of digital leadership and managerial support • Data-driven decision-making • Establishment of collaboration and synergy among institutions and fintech firms • Strengthening innovation units, accelerators, and technology observatories
Consequences	Outcomes and achievements resulting from successful implementation of digital transformation: • Increased competitiveness of banks in the financial market • Improved customer experience and trust • Economic sustainability and cost reduction • Improved transparency and decision-making efficiency • Development of a smart and future-oriented banking ecosystem

For each variable:

- **Influence** = Row total (the total influence exerted by that variable on the other variables)
- **Dependence** = Column total (the extent to which that variable is influenced by the other variables)

Table 4

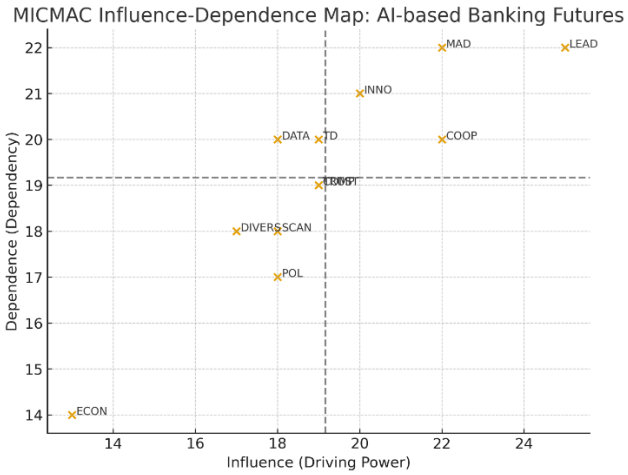
Summary of MICMAC Results: Numerical Values and Classification

Variable	Influence	Dependence	MICMAC Cluster
Digital Transformation (TD)	19	20	Dependent
Digital Maturity and Readiness (MAD)	24	24	Linkage
Policymaking and Regulation (POL)	17	18	Autonomous
Technological Competition (COMP)	20	17	Autonomous
Economic Stability/Sanctions (ECON)	12	12	Autonomous
Digital Trust and Security (TRUST)	22	20	Autonomous
Innovation (INNO)	23	24	Linkage
Data-Driven Decision-Making (DATA)	21	21	Dependent
Strategic Leadership and Support (LEAD)	28	26	Linkage

Service Diversity (DIVERS)	17	18	Autonomous
Synergy and Collaboration (COOP)	25	24	Linkage
Technology Monitoring and Futures Studies (SCAN)	19	19	Autonomous

Figure 2

MICMAC Influence–Dependence Diagram

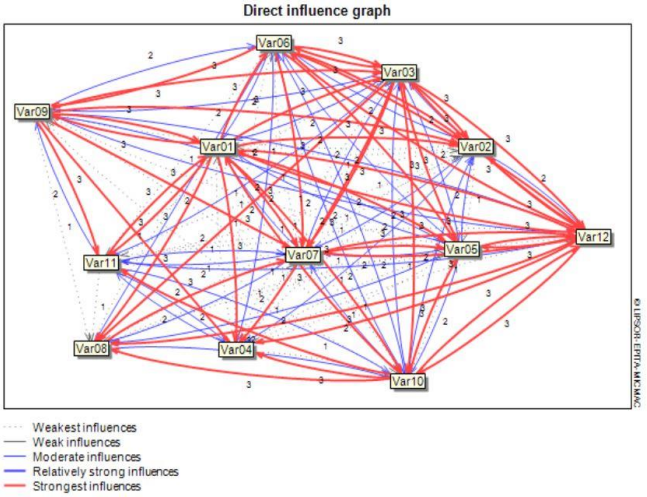


- Linkage variables such as digital maturity, innovation, leadership, and synergy have sensitive and reciprocal roles: they both exert influence and depend on other variables. Accordingly, they represent critical points within the system, where changes can rapidly propagate throughout the network.
- Dependent variables, such as digital transformation and data-driven decision-making, primarily represent outcomes and are affected to a greater extent by other variables in the system.
- Several variables, including policymaking, technological competition, trust, and service diversity, were classified within the autonomous cluster. This indicates that they do not necessarily constitute the core of the network independently, although they may operate relatively autonomously or be affected by specific influences.

Selection of Critical Axes for Scenario Development

Figure 3

Direct Influence Graph



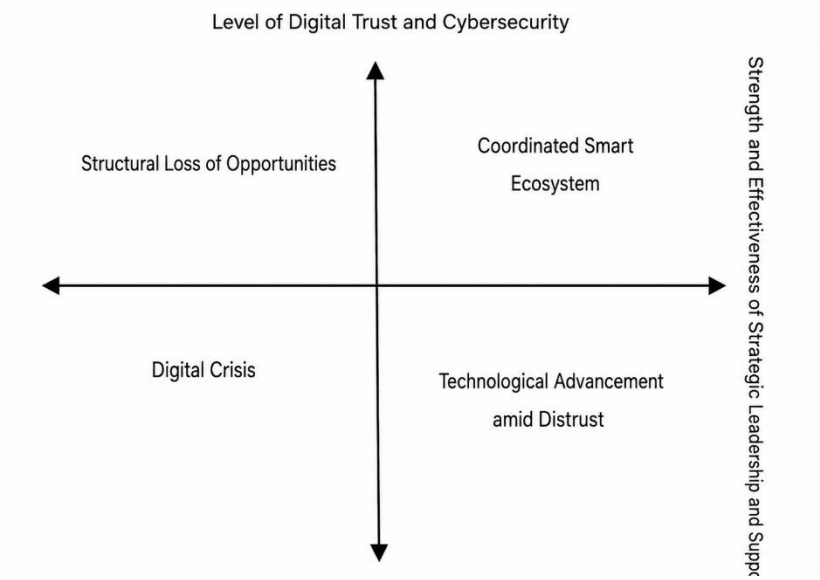
In scenario analysis and Scenario Wizard, two “critical uncertainties” are typically selected as the axes with the greatest capacity to differentiate among alternative scenarios. Based on the MICMAC analysis and the practical significance of the variables, the following two axes were selected, with high and low levels specified for each:

- **Horizontal axis (X):** Strength and effectiveness of strategic leadership and support (LEAD) — **Levels:** Strong / Weak
- **Vertical axis (Y):** Level of digital trust and cybersecurity (TRUST) — **Levels:** High / Low

The rationale for this selection is that leadership is one of the strongest linkage variables and can determine the direction of policies and investments. Digital trust and security constitute key prerequisites for the adoption of digital services; depending on their level, customer-related outcomes may differ substantially.

Figure 4

Scenario Axes



Based on combinations of the high and low levels of the two principal axes, four possible future states for the artificial intelligence–based banking industry were developed.

Table 5

Future Scenario States

Strategic Leadership	High Level of Digital Trust	Low Level of Digital Trust
Strong strategic leadership	Scenario A: Coordinated Smart Ecosystem	Scenario B: Technological Advancement amid Distrust
Weak strategic leadership	Scenario C: Structural Loss of Opportunities	Scenario D: Digital Crisis

Discussion and Conclusion

The present study aimed to provide a futures-oriented analysis of artificial intelligence–based banking services in the payment industry of Iranian private banks by identifying the principal drivers of transformation, examining their structural relationships, and developing plausible future scenarios. The findings identified 12 major components shaping the development of AI-based banking services: digital transformation in financial services, organizational digital maturity and readiness, smart policymaking and regulation, technological competition in the financial market, economic stability in the macro-environment, digital trust and cybersecurity, technological innovation and entrepreneurship, data-driven decision-making, strategic leadership and support, diversity of electronic financial services, interorganizational synergy and

collaboration, and futures studies and technology monitoring. The paradigmatic model further indicated that these components operate through causal, contextual, intervening, strategic, and consequential mechanisms. MICMAC analysis showed that digital maturity and readiness, innovation, strategic leadership and support, and interorganizational synergy and collaboration were linkage variables, whereas digital transformation and data-driven decision-making were classified as dependent variables. The subsequent scenario analysis, based on the critical dimensions of strategic leadership and digital trust, generated four plausible futures: the Coordinated Smart Ecosystem, Technological Advancement amid Distrust, Structural Loss of Opportunities, and Digital Crisis.

The identification of digital transformation as the central phenomenon of the model suggests that the future of banking services cannot be reduced to the adoption of isolated AI applications. Rather, AI-driven banking transformation involves the reconstruction of organizational processes, service architectures, decision systems, customer interfaces, and interorganizational relationships. This interpretation is consistent with the argument that digital transformation requires an alignment between technological resources and organizational capabilities rather than the mere acquisition of new technologies [3]. Similarly, research on AI-driven banking ecosystems indicates that AI creates transformative value when it becomes embedded in broader organizational and ecosystem-level structures [2]. Therefore, the present findings support a systemic interpretation of AI adoption in which digital transformation emerges from interactions among technological readiness, leadership, trust, regulation, innovation, and institutional collaboration.

The classification of organizational digital maturity and readiness as a linkage variable is especially important. Its relatively high influence and dependence indicate that digital maturity both shapes other dimensions of transformation and is itself affected by them. In practical terms, banks with advanced infrastructure, skilled human resources, interoperable systems, and digitally oriented processes are more capable of implementing AI-based solutions, yet their level of maturity may also depend on leadership support, regulatory conditions, innovation capabilities, and investment priorities. This finding is closely aligned with research on Iranian banking systems showing that digital readiness is a key determinant of successful AI adoption and that differences in infrastructure, competencies, and organizational preparedness affect the speed and quality of digital transformation [15]. Similar conclusions have been reported in studies of developing economies, where AI capabilities generate meaningful transformation only when complementary organizational resources and digital competencies are sufficiently developed [5]. Consequently, digital maturity should be regarded as both an enabling condition and a dynamic outcome of transformation.

Strategic leadership and support emerged as the most influential linkage variable, with the highest influence score among the studied factors. This result indicates that managerial direction and strategic commitment are central to the future trajectory of AI-enabled banking. Strategic leadership can determine whether digital investment is fragmented or coherent, whether organizational resistance is effectively managed, whether AI projects are aligned with business objectives, and whether sufficient resources are allocated to innovation, cybersecurity, data governance, and employee capabilities. This interpretation is consistent with the broader literature showing that digital transformation depends substantially on strategic alignment, organizational capabilities, and leadership commitment [3, 4]. In AI-intensive banking environments, managerial support is particularly important because technological implementation often requires significant changes in decision structures, organizational routines, risk management practices, and workforce competencies. The present findings therefore

suggest that leadership is not simply one contextual variable among many; it functions as a key leverage point through which multiple other components of the system can be influenced.

Technological innovation was also located in the linkage cluster, indicating a reciprocal and highly sensitive role within the banking system. Innovation can directly enhance service diversity, process automation, personalization, fraud detection, predictive analytics, and customer responsiveness, while its development is simultaneously contingent on leadership, digital maturity, market competition, regulatory flexibility, and institutional cooperation. This result supports previous evidence that AI can stimulate financial innovation by enabling new products, service models, and decision mechanisms within emerging banking systems [10]. It is also compatible with studies emphasizing that AI-based financial transformation depends on continuous innovation rather than one-time technological adoption [6]. The implication is that innovation should be institutionalized through structures such as innovation units, accelerators, technology observatories, and cross-sector partnerships rather than treated as an occasional technological project.

Interorganizational synergy and collaboration constituted another major linkage factor. This finding reflects the increasingly ecosystem-based character of contemporary banking and payment services. Banks no longer operate as isolated institutions; their services depend on interaction with fintech companies, payment service providers, regulators, technology firms, data infrastructures, and other financial institutions. The importance of collaboration is consistent with research showing that fintech growth has transformed the competitive structure of financial services while simultaneously creating opportunities for partnership and complementary innovation [9]. Research on future banking ecosystems has similarly highlighted the increasing integration of banks, technology firms, and digital platforms within AI-enabled payment environments [14]. The present results therefore indicate that the capacity to develop collaborative networks may become a major source of resilience and competitiveness for Iranian private banks.

The dependent status of digital transformation and data-driven decision-making is another meaningful finding. Although both are strategically important, their classification suggests that they are primarily generated through the interaction of other drivers rather than functioning as independent initiating forces. In other words, a bank may aspire to digital transformation or data-driven management, but such outcomes are difficult to realize without digital maturity, technological innovation, leadership support, trust, effective governance, and appropriate regulatory conditions. Previous research supports this interpretation by showing that AI adoption improves analytical capabilities and decision-making only when data, infrastructure, competencies, and organizational integration are available [4, 7]. Thus, the results challenge simplistic approaches that equate the implementation of analytics or AI tools with genuine data-driven transformation.

Digital trust and cybersecurity, despite being classified in the autonomous cluster in the MICMAC analysis, emerged as one of the two critical uncertainties used to construct the future scenarios. This apparent distinction is theoretically important. A variable may not occupy the structural center of a network in terms of mutual influence and dependence but may nevertheless have substantial strategic significance because of its ability to differentiate future outcomes. Digital trust is indispensable in financial services because customers must believe that transactions, personal information, algorithms, and digital platforms are secure and reliable. Prior research has demonstrated that security and trust are central determinants of the acceptance and sustainability of AI-enabled payment systems [12]. AI-based fraud detection can strengthen this trust by identifying abnormal transaction patterns and improving the capacity of payment systems to respond to cyber threats [11].

However, security failures, opaque automated decisions, or misuse of data may rapidly undermine confidence even when technological capabilities are advanced.

The role of trust is also connected to the broader ethical and governance challenges of AI. As banking systems rely increasingly on automated decisions, issues such as algorithmic transparency, accountability, bias, privacy, and explainability become integral to institutional legitimacy. Previous research has emphasized that responsible AI governance must extend beyond technical performance and include ethical and regulatory safeguards [13]. This is particularly relevant to the payment industry because failures can affect not only individual transactions but also perceptions of systemic reliability. Accordingly, the present study's emphasis on digital trust as a critical uncertainty confirms that technological capability without corresponding institutional trust may not generate sustainable transformation.

The first and most desirable scenario, the Coordinated Smart Ecosystem, combines strong strategic leadership with a high level of digital trust and cybersecurity. Under this scenario, banks are able to coordinate investments, develop intelligent services, collaborate with fintech companies, strengthen data-driven decision-making, and maintain customer confidence. This scenario is consistent with global expectations that future payment ecosystems will increasingly combine AI-enabled automation, data analytics, personalization, collaborative platforms, and secure digital infrastructures [1]. It is also aligned with research indicating that AI-driven banking ecosystems can substantially improve efficiency, service innovation, and responsiveness when organizational and technological capabilities are effectively integrated [2]. In this future, leadership and trust reinforce each other: effective management facilitates investment in secure systems, while strong trust increases customer acceptance and provides institutional legitimacy for continued technological innovation.

The second scenario, Technological Advancement amid Distrust, combines strong leadership with low digital trust. In this situation, banks may have the strategic capacity to invest in AI and digital infrastructure, but weak customer confidence, cybersecurity concerns, privacy risks, or opaque automated processes constrain the realization of technological benefits. Such a scenario is plausible because innovation and adoption are not synonymous. Financial institutions may possess advanced technologies without achieving corresponding customer acceptance. Research emphasizing customer-centric banking transformation has shown that AI creates value only when customers perceive digital services as useful, reliable, and responsive [8]. Similarly, improvements in operational efficiency do not necessarily translate into improved service experiences unless security and trust concerns are adequately addressed [7]. Therefore, this scenario demonstrates that leadership alone cannot guarantee successful transformation when confidence in the digital environment remains weak.

The Structural Loss of Opportunities scenario combines weak strategic leadership with relatively high digital trust. In such circumstances, customers may be prepared to use digital services and the technological environment may be sufficiently secure, yet banks fail to convert this favorable context into innovation and competitive advantage because of inadequate strategic direction, slow decision-making, fragmented investment, or organizational inertia. This scenario is especially relevant where existing digital infrastructure is available but institutions lack the managerial capacity to exploit it effectively. The finding corresponds with evidence from Iranian banking research showing that organizational readiness and service improvement are strongly conditioned by managerial and institutional capabilities [15, 16]. It also supports the view that AI capability must be embedded in coherent strategic transformation rather than implemented as disconnected technological initiatives [5].

The fourth scenario, Digital Crisis, represents the most unfavorable configuration, combining weak leadership with low digital trust and cybersecurity. Under these conditions, fragmented technology adoption, inadequate governance, poor strategic coordination, cybersecurity vulnerabilities, customer distrust, and weak innovation capacity may reinforce one another. The likely consequences include declining competitiveness, inefficient investment, limited adoption of AI-based services, increased vulnerability to fraud, and erosion of customer confidence. This scenario illustrates the systemic nature of digital transformation failure: when leadership and trust simultaneously deteriorate, technological investments may not only fail to produce value but may generate new organizational and reputational risks. The possibility of such a future is consistent with studies warning that AI adoption in banking is accompanied by significant technical, organizational, ethical, and security challenges [6, 13].

The findings regarding policymaking, regulation, macroeconomic stability, competition, service diversity, and technology monitoring also contribute to understanding the broader transformation environment. Although these factors were classified as autonomous variables in the structural analysis, they remain strategically relevant because they shape the conditions under which other drivers operate. Smart regulation can facilitate experimentation while controlling risk, technological competition can stimulate innovation, service diversity can strengthen customer value, and technology monitoring can help banks respond to emerging trends. In the Iranian context, these dimensions are particularly important because banks operate under economic, regulatory, and technological constraints that may alter the direction and speed of transformation. Research focused specifically on the Iranian payment industry similarly emphasizes the need to consider multiple interacting technological and institutional drivers when examining the future of AI-based banking services [17].

Overall, the results indicate that the future of AI-based banking services in Iranian private banks should be understood as an interconnected system rather than a linear technological development process. Strategic leadership, digital maturity, innovation, collaboration, cybersecurity, trust, regulation, and economic conditions jointly determine whether AI generates meaningful transformation. This systemic interpretation is consistent with the broader literature on AI adoption, digital banking, fintech development, customer-centric transformation, and emerging financial ecosystems [4, 9, 10, 14]. The central contribution of the present study is therefore the identification of strategic leverage points and the demonstration that alternative futures depend on the interaction of organizational capability and institutional trust. The findings suggest that the desirable future of intelligent banking is not produced automatically by technological progress; rather, it must be actively constructed through coordinated leadership, secure infrastructures, collaborative innovation, adaptive governance, and sustained investment in digital capabilities.

The present study has several limitations that should be considered when interpreting its findings. First, the identification and classification of the principal drivers were partly dependent on the available literature and expert judgments, which may introduce interpretive subjectivity despite the use of systematic coding and structured analytical procedures. Second, the expert panel was relatively limited in size and consisted primarily of organizational and academic specialists; therefore, the perspectives of customers, fintech entrepreneurs, regulators, cybersecurity professionals, and other stakeholders may not have been represented to the same extent. Third, MICMAC analysis focuses on structural influence and dependence and does not necessarily capture the full temporal complexity, nonlinear interactions, or sudden disruptions that may characterize technological change. Fourth, the scenario framework was constructed around two critical uncertainties, which necessarily simplifies a much more complex environment involving economic, regulatory, social, geopolitical, and technological variables.

Finally, because the study focused on Iranian private banks and the payment industry, caution should be exercised when transferring the conclusions directly to public banks, other financial institutions, or banking systems operating under substantially different institutional conditions.

Future studies are recommended to expand the stakeholder base by incorporating customers, fintech executives, regulators, policymakers, cybersecurity experts, data scientists, and technology providers into the analytical process. Longitudinal research could also examine how the identified drivers and their structural positions change over time as AI technologies, regulations, and customer expectations evolve. Researchers may combine structural analysis with methods such as Delphi, cross-impact balance analysis, system dynamics, agent-based modeling, or quantitative scenario simulation to test the stability and consequences of alternative futures more rigorously. Comparative studies between private and public banks, between Iranian banks and banks in other emerging economies, or between different segments of the financial services sector could further clarify the role of institutional context. Future research could also examine specific AI applications separately, including fraud detection, conversational banking, credit scoring, personalized financial services, predictive risk management, and automated payment monitoring, in order to determine whether different applications are governed by different combinations of strategic drivers and uncertainties.

Bank managers and policymakers should prioritize the development of strategic digital leadership and treat AI transformation as an organization-wide strategic program rather than a collection of isolated technology projects. Private banks should establish formal AI governance structures, strengthen cybersecurity infrastructure, develop transparent data-management policies, and systematically measure customer trust in digital services. Investment in employee capabilities should accompany investments in technology so that managers and staff can interpret AI outputs, manage associated risks, and incorporate intelligent systems into decision-making processes. Banks should also create sustained collaboration mechanisms with fintech firms, universities, technology companies, regulators, and other financial institutions to accelerate innovation and reduce duplicated investments. Establishing technology observatories and futures-monitoring units can assist banks in identifying emerging technologies and regulatory changes before they become disruptive. Finally, the development of national or sector-wide standards for digital trust, cybersecurity, algorithmic accountability, interoperability, and responsible AI could provide the institutional foundation necessary for moving the Iranian banking system toward a coordinated, secure, and competitive smart banking ecosystem.

Acknowledgments

We would like to express our appreciation and gratitude to all those who cooperated in carrying out this study.

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants. Written consent was obtained from all participants in the study.

Transparency of Data

In accordance with the principles of transparency and open research, we declare that all data and materials used in this study are available upon request.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

References

[1] Capgemini, "World payments report 2025: The future of AI-powered banking and payment systems," Capgemini Research Institute, 2025. [Online]. Available: https://www.capgemini.com

[2] P. Anderson, J. Miller, and T. Roberts, "AI-driven transformation in digital banking ecosystems," *Journal of Banking Innovation*, vol. 15, no. 1, pp. 25-42, 2024, doi: 10.1016/j.jbi.2024.01.004.

[3] A. Nadeem, B. Abedin, N. Cerpa, and E. Chew, "Digital transformation & digital business strategy in electronic commerce-the role of organizational capabilities," *Journal of Theoretical and Applied Electronic Commerce Research*, vol. 13, no. 2, pp. i-viii, 2018, doi: 10.4067/S0718-18762018000200101.

[4] R. Kumar, V. Sharma, and P. Singh, "Artificial intelligence adoption in banking and financial services: Trends and challenges," *Journal of Enterprise Information Management*, vol. 34, no. 6, pp. 1812-1834, 2021, doi: 10.1108/JEIM-01-2021-0034.

[5] A. Mirashk, "Artificial intelligence capabilities and digital banking transformation in developing economies," *Journal of Emerging Financial Technologies*, vol. 6, no. 2, pp. 91-109, 2024.

[6] M. Ahmadi, S. Hosseini, and A. Karimi, "Artificial intelligence adoption in banking systems: Opportunities and challenges in digital payment ecosystems," *Journal of Financial Technology Management*, vol. 8, no. 2, pp. 44-61, 2022.

[7] M. Almalki, F. Alrashidi, and S. Almutairi, "Artificial intelligence applications in banking services: Customer experience and operational efficiency," *International Journal of Financial Studies*, vol. 10, no. 4, pp. 1-18, 2022, doi: 10.3390/ijfs10040087.

[8] Y. Limani, F. Hoxha, and A. Berisha, "Artificial intelligence and customer-centric banking transformation," *International Journal of Finance & Banking Studies*, vol. 11, no. 3, pp. 77-91, 2022, doi: 10.20525/ijfbs.v11i3.1942.

[9] E. Z. Milian, M. M. Spinola, and M. M. de Carvalho, "Fintechs and the financial services industry: A systematic literature review," *Electronic Commerce Research and Applications*, vol. 34, p. 100833, 2019, doi: 10.1016/j.elerap.2019.100833.

[10] P. Choudhury, S. Banerjee, and R. Dutta, "Artificial intelligence and financial innovation in emerging banking systems," *International Journal of Bank Marketing*, vol. 40, no. 5, pp. 1033-1052, 2022, doi: 10.1108/IJBM-03-2022-0141.

[11] S. Kokari, R. Ahmed, and K. Patel, "AI-enabled fraud detection in payment systems: A machine learning perspective," *Computers & Security*, vol. 118, p. 102746, 2022, doi: 10.1016/j.cose.2022.102746.

[12] A. Bhatti, R. Khan, and M. Hussain, "Artificial intelligence and payment industry transformation: Security and customer trust perspectives," *Journal of Digital Banking*, vol. 7, no. 1, pp. 66-82, 2023, doi: 10.1057/s41264-023-00192-8.

[13] H. Knoch, T. Weber, and M. Klein, "AI governance and ethical challenges in banking systems," *Business Ethics and Digital Transformation Review*, vol. 14, no. 2, pp. 88-104, 2022, doi: 10.1007/s12599-022-00731-5.

[14] R. Giulia, F. Marco, and B. Lorenzo, "Future banking ecosystems and artificial intelligence integration in digital payments," *Technological Forecasting and Social Change*, vol. 189, pp. 122-138, 2023, doi: 10.1016/j.techfore.2023.122138.

[15] M. Yarmohammadi Gerenchi, R. Tavakoli, and A. Shafiei, "Digital transformation and AI readiness in Iranian banking systems," *Quarterly Journal of Information Technology Management*, vol. 15, no. 4, pp. 75-96, 2023.

[16] S. Rahimi Kalur, A. Mohammadi, and H. Ebrahimi, "The role of artificial intelligence in improving banking service quality in Iran," *Journal of Iranian Financial Innovation*, vol. 9, no. 1, pp. 11-29, 2024.

[17] H. Molaei, "Future studies of AI-based banking services in Iran's payment industry," *Iranian Journal of Digital Banking Research*, vol. 5, no. 1, pp. 33-57, 2024.