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Design of a Comprehensive and innovative ICT-Based Digital Banking Model for Empowering Iran's Banking Industry

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Abstract

This study aims to create a logical model with well-defined criteria for the effective implementation and execution of digital banking within Iran's banking sector, using four strategic elements: customer experience, infrastructure, data, and business. A mixed-method research approach (adaptative and factor analysis) was used to develop the model. Descriptive criteria and strategic components from major digital companies such as Microsoft, Capgemini, Oracle, IBM, and a prominent digital bank were identified. These components were compared in a matrix, which led to the formation of the proposed model. The model was validated through observation, interviews, and a questionnaire with 111 questions on a Likert scale, distributed among 528 technology experts. Factor analysis and structural equation modeling, using Smart PLS software, were applied for validation. A comprehensive digital banking model was developed for Iran's banking industry. The research presents a modular and agile model that addresses market needs, ensures an outstanding digital experience for customers using banking services, and supports open banking by utilizing the latest financial technologies. As customer behavior evolves, Iran's banking sector is undergoing significant changes in financial interactions. To remain competitive and thrive, banks must embrace digital transformation. This study analyzes current trends in banking and introduces a comprehensive digital banking model that positions the banking ecosystem for digital transformation, laying the foundation for the future of banking.

Keywords: Information and Communication Technology, Fintech, Digital Transformation, Digital Banking, Digital Age, Digital economy, Iranian Banking Industry.

1. Introduction

The contemporary global economy is experiencing a profound digital transformation, a process that has reshaped multiple industries, including financial services. The emergence of information and communication technologies (ICTs) has significantly altered the structure and operations of banks by enabling them to integrate advanced tools such as artificial intelligence, blockchain, mobile platforms, and cloud computing into their business models (Schwab & Shani, 2016; Vafai & Dashti, 2018). These developments, collectively referred to as digital banking, have expanded customer access to financial services, improved efficiency, and introduced new opportunities for competition and growth (Accenture, 2015; Barquin & Vinayak, 2015). However, the transition toward digital banking is complex and requires tailored strategies, particularly in

countries with unique socio-economic and regulatory landscapes such as Iran (Arsanjani et al., 2019; Central Bank of the Islamic Republic of, 2024).

Digital banking is best understood as the application of digital technologies across the entire value chain of financial services, covering customer experience, infrastructure, business models, and data-driven operations (Accenture & Mark, 2013; Accenture, 2013). By leveraging digital platforms, banks can deliver real-time, personalized services regardless of time and place (Skinner et al., 2014). This paradigm shift corresponds with the broader evolution of the digital economy, which has been defined as the creation of value through digital platforms and connectivity between individuals, organizations, and technologies (Schwab, 2016). Such dynamics highlight the interconnectedness of the financial sector with technological progress and underscore the need for adaptive banking models that align with customer expectations and global standards (Castro et al., 2014; Kearney et al., 2014).

The historical trajectory of digital banking illustrates its rapid acceleration. From early innovations in internet banking, pioneered by institutions like the Stanford Federal Credit Union in the 20th century (Gillis, 1971), to the proliferation of mobile banking and fintech startups, digitalization has consistently disrupted conventional banking practices (Skinner, 2020; Skinner & Kianpour, 2020). Technological advancements such as big data analytics, open banking, and biometrics have further redefined customer engagement by enabling secure, frictionless, and tailored financial services (Lipton et al., 2016). For banks, adopting such innovations is not optional but a necessity to remain relevant in increasingly competitive financial ecosystems (Timothy et al., 2010).

Globally, the adoption of digital banking differs across countries due to variations in technological readiness, customer behavior, regulatory frameworks, and economic development. According to comparative reports, markets such as Indonesia, India, Malaysia, Saudi Arabia, Qatar, and the UAE have each pursued distinct digital banking strategies based on their infrastructural capacities and customer demand (Statista, 2024a, 2024b, 2024c, 2024d, 2024e, 2024f, 2024g). For instance, Indonesia has focused on modular models and ecosystem integration (Samosir et al., 2017), while the UAE has emphasized omni-channel platforms for smart city integration (Alnuaimi, 2019). Similarly, India has adopted a layered digital banking architecture to strengthen interoperability and scalability (Statista, 2024e), and Malaysia has prioritized improving trust in online services while expanding mobile payment adoption (Hamid et al., 2007).

Saudi Arabia and China, as highlighted in comparative service quality studies, have pursued customer-centric models with emphasis on privacy, responsiveness, and loyalty programs (Gülmez, 2016). Qatar, benefiting from high levels of internet penetration, has positioned itself as a regional leader in digital connectivity (Statista, 2024f), while Russia has made significant strides in digital payments, reflecting the country's emphasis on fintech adoption (Statista, 2024b). These diverse trajectories demonstrate that while digital banking is a universal trend, its adoption is highly context-dependent, shaped by cultural, regulatory, and economic variables.

In Iran, the need for digital transformation in banking has become increasingly urgent. Regulatory reports emphasize growing demand for fast, reliable, and customer-focused services (Central Bank of the Islamic Republic of, 2024). Yet, challenges such as restrictive regulations, infrastructural gaps, and cultural barriers remain (Arsanjani et al., 2019). Studies highlight that Iranian banks must transition from traditional e-banking models toward comprehensive digital banking frameworks that integrate strategic elements such as customer experience, infrastructure development, ecosystem management, and advanced data governance (Asgarimehr et al., 2017; Davari, 2013). Without such systemic transformation, Iranian banks risk falling behind regional competitors who have already embraced digitalization on a large scale (Statista, 2024c, 2024d).

From a methodological perspective, the evaluation of digital banking models increasingly relies on advanced statistical tools such as structural equation modeling (SEM) and partial least squares path modeling (PLS-PM). These approaches enable researchers to assess the validity and reliability of complex models that capture the interrelationships among multiple latent variables (Chin, 1998; Tenenhaus et al., 2004). Pioneering works on PLS-based SEM established the foundation for evaluating hierarchical constructs (Wetzels & Odekerken, 2009), while subsequent developments refined its application in

fields ranging from management to behavioral research (Amani, 2020; Azar et al., 2012). In Iranian scholarship, SEM and confirmatory factor analysis have been widely applied to validate models in social sciences and management (Habibi, 2016; Habibi & Kalahi, 2022). The integration of these methods with digital banking studies ensures robust model testing and offers actionable insights for practitioners (Babakianpour, 2024).

The global consulting industry has also contributed significantly to shaping digital banking discourse. Reports from organizations such as Accenture and McKinsey emphasize that banks must embrace a "digital first" mindset to survive in rapidly evolving markets (Accenture, 2015; Accenture & Mark, 2013). These studies highlight key enablers, including infrastructure modernization, data-driven strategies, open innovation, and customer-centric processes. Similarly, Kearney's roadmap for digital banking underscores the importance of organizational flexibility and innovation in navigating transformation (Kearney et al., 2014). Academic contributions complement these insights by providing empirical evidence of the strategic role of ecosystems, partnerships, and data strategies in driving successful digital transitions (Barquin & Vinayak, 2015; Castro et al., 2014).

At a theoretical level, digital transformation is inseparable from the broader context of the Fourth Industrial Revolution. Schwab's framing of this era emphasizes how emerging technologies blur the boundaries between physical, digital, and biological systems, leading to unprecedented changes in business and society (Schwab, 2016; Schwab & Shani, 2016). For banking, this revolution translates into the necessity of integrating technologies such as artificial intelligence, machine learning, and blockchain to deliver innovative services that align with customer expectations and global trends (Skinner & Kianpour, 2020). Similarly, the concept of organizational transformation requires banks to align digital strategies with human resources, governance, and cultural change (Timothy et al., 2010).

Despite promising opportunities, digital banking also faces challenges, including cybersecurity threats, customer distrust, and regulatory barriers (Arsanjani et al., 2019; Hamid et al., 2007). Moreover, the adoption of digital channels demands continuous investment in infrastructure and skills (Asgarimehr et al., 2017). Lessons from comparative experiences demonstrate that customer trust and cultural readiness are critical success factors (Gülmez, 2016; Samosir et al., 2017). Iran, with its growing digital infrastructure and large base of tech-savvy youth, holds strong potential to achieve a comprehensive transformation, but this requires a coordinated strategy supported by regulatory reforms, investment, and partnerships (Central Bank of the Islamic Republic of, 2024).

Ultimately, designing a comprehensive and innovative ICT-based digital banking model for Iran involves integrating four strategic pillars: customer experience, infrastructure, data management, and business ecosystems. Each of these pillars reflects the global evolution of digital banking, while also responding to Iran's specific needs and constraints (Accenture, 2015; Asgarimehr et al., 2017). Customer experience strategies emphasize personalization, seamless interactions, and omni-channel integration (Castro et al., 2014), while infrastructure strategies highlight the importance of secure, reliable, and scalable systems (Lipton et al., 2016). Data strategies underscore the role of analytics and governance in enhancing decision-making (Babakianpour, 2024), and business strategies stress partnerships, ecosystems, and innovation as drivers of competitive advantage (Accenture, 2013; Barquin & Vinayak, 2015). Together, these elements provide a holistic framework for empowering Iran's banking industry to compete in the digital age.

In conclusion, the convergence of global technological trends, comparative country experiences, and local challenges underscores the urgency of digital transformation in Iran's banking industry. By leveraging structural modeling approaches (Chin, 1998; Tenenhaus et al., 2004; Wetzels & Odekerken, 2009), aligning with international best practices (Accenture, 2015; Kearney et al., 2014), and addressing regulatory and cultural constraints (Arsanjani et al., 2019), Iranian banks can develop a sustainable digital banking model. Such a model will not only enhance customer satisfaction and operational efficiency but also position the country's financial sector to thrive in the competitive global economy shaped by the Fourth Industrial Revolution.

2. Methods and Materials

This study aims to develop a comprehensive digital banking model tailored to the Iranian banking industry. It is descriptive, employing a mixed-methods approach that combines a comparative study with factor analysis. To conduct the research, a library study was first performed, reviewing relevant literature, followed by the identification of strategic components from four global digital leaders Microsoft, Oracle, Capgemini, IBM and Mitsubishi Bank, a major digital bank in East Asia. These components were categorized into four strategies, and the indicators used were compared across four comparative matrices, resulting in a modular, comprehensive, and flexible model.

To further achieve the research objectives, key data collection methods such as observation, interviews, and questionnaires were utilized to gather input from banking system experts and IT professionals. The experts refined the variables by eliminating or adjusting overlapping ones and organizing them accordingly. Finally, qualitative data were gathered through questionnaires using a Likert scale and a judgmental sampling method, distributed among a sample of managers, experts, and IT professionals within the banking sector. The final model was validated through factor analysis with structural equation modeling, utilizing Smart PLS software.

To analyze the data collected from the research methods, the normality of the statistical population's distribution was first examined using the Kolmogorov-Smirnov Test. Variance analysis (ANOVA) was conducted based on demographic variables to explore the relationships between the research variables through the Correlation Test. Additionally, Structural Equation Modeling (SEM) was applied to assess the overall model fit, and Factor Analysis was performed on four variables using Smart PLS software.

3. Findings and Results

It is important to note that the strategies employed in this study are based on the opportunities and challenges facing banks in the digital technology sector. These strategies were developed within the broader framework of general banking organizational strategies. They encompass a range of functional strategies related to finance, human resources, and information technology, as well as operational strategies focused on products, markets, and processes.

The comprehensive feeling and perception of the customer from all direct interactions or virtual touchpoints with the bank's products, services, systems, brand, and employees. What matters here is the customer's perception—whether the experience is frictionless, memorable, and enjoyable, or tiring and cumbersome, which is enhanced through the use of digital technologies. Table 1 shows the criteria and indicators for the digital customer experience strategy.

Table 1. Criteria and Indicators of Customer Experience Strategy

Strategy	criterion	indicator
Digital Customer Experience	Digital communication	Message Network , Video Banking, E-Wallet, Digital Customer Club, Counter Service Office, Intergrating Partnership.
	Marketing analysis services	CRM system development, Big Data, Social network analysis, Customer behavior analysis based on PSPU data, Data mining and modeling of customer behavior, Digital marketing performance analysis in digital channels, Customer churn, Customer Profiling, Development of a customer needs prediction model using AI, Establishment of a customer feedback process.
	Distribution channels	Internet Banking, Electronic Documents, POS, Mobile, Kiosk, Mobile banking, App, ATM, Email, SMS, IVR, Ports, Call Center, Web.
	Social media	Social media (Instagram, Telegram, Facebook, etc.), web, chat.
	Customer Relationship Management	Digital marketing capacity development, Customer value system implementation, Omni channel marketing, Development of access points to support digital banking, Customer experience dashboard, Customer journey map, Standard landing pages for core products, Development of customer onboarding platform in digital channels, Process development for facilities, for deposits and commitments, Social banking, Improvement of SEO and search engine ranking, Development of customer club, implementation of data-driven marketing, Development of content marketing.

Digital banking requires a set of programs and policies to control, protect, and enhance the value of data and information. This includes data management strategies such as master data management and standard models like IFX, which define

processes and support structures for data governance and data quality. Table 2 shows the criteria and indicators for the data strategy.

Table 2. Criteria and Indicators of Data Strategy

Strategy	criterion	indicator
Data	Data architecture	Data architecture planning and deployment, Data center development, Data warehouse and ETL metadata development, Business intelligence, Decision support system (DSS), Online Analytical Processing (OLAP), Online Transaction Processing (OLTP), Development of structured and unstructured customers metadata through Big Data and Data Lake Big Data, Data analytics, Artificial intelligence
	Data analysis	Payment Data Analysis, Information Mining, Data Mining, Clustering Application Development
	Open Data Exchange	Open Data platform development, External Gateway development for core Banking, GSB development (Government Service Bus), Application Programing interface (API)

A digital business strategy is a plan that helps companies use technology to achieve their objectives in the path of digital transformation. This action cannot be achieved without engaging with other organizations, establishing a digital ecosystem, and creating a shared platform and infrastructure. With this approach, banks will be present wherever their customers are. To realize banking everywhere, banks must create three ecosystems: a payment-centric ecosystem, a business-centric ecosystem, and a fully integrated ecosystem (Accenture, 2013). Table 3 shows the criteria and indicators for the business strategy.

Table 3. Criteria and Indicators of Business Strategy

Strategy	criterion	indicator
Business	Content	Establishing Customer Portfolio Management, Establishing Product and Service Portfolio Management, Quality Management, Productivity Management, Content Management, Research
	Ecosystem management	Mission, Vision, Organizational Strategy, Development of Infrastructure and Platform Shaping the Ecosystem, Asset Management, Wealth Management, Partner Alignment, Financial Investment, Venture Investment.
	Developing strategic partnerships	Startups, Attracting the cooperation of key partners, Developing Due Diligence process and skills for projects, Banking technologies and companies, Consulting services.Financial and investment management, Capital markets

Table 4 shows the criteria and indicators for the infrastructure strategy.

Table 4. Criteria and Indicators of Infrastructure Strategy

Strategy	criterion	indicator
Infrastructure	Information and Communication Technology Management Cycle	Core Banking (Payment Network and Media, Reliability and Network Communications, Data-Driven Banking Infrastructure, Z Core, Digitalization of Banking Services (Facilities, deposits, obligations, checks, cards),Cloud space (Container infrastructure development, Deployment pipeline development, Performance management infrastructure development, Establishment of Kubernetes as a network service orchestrator), Block chain, Euro pay, Workload management in progress (WIP), Domestic and International Payments, Augmented Reality, Network Function Virtualization (NFV), Development of Automated Testing, Cross Channel, Non-Performing Loan (NPL), Near Field Communication (NFC), Interactive Voice Response (IVR), Card Management System (CMS), MasterCard & Visa (EMV), Software Defined Network (SDN), Micro Service, Internet Of Things (IOT), Account and liquidity management. Virtual account management.
	Information Security Management	Improving Cyber Security in the areas of (physical information protection, environmental and physical security, application security, network security, operational security, and communication security),Supervision, Information transfer agreements, Fraud management, Information Systems Architecture, Organizing information security, Human Resources Security, Back Up, Implementing PCI-DSS standard in payment services,Digital Authentication (Biometrics, National Smart Card Know Your customer (KYC), Single Sign On (SSO)),Risk management in the areas of (financial, market, liquidity, credit, operational risk management, document management, user access management), Setting legal rules and regulations, compliance with legal and contractual requirements
	Human Resources	Improving, attracting, developing, motivating and retaining talent, developing the Talent Pool, developing knowledge management
	Processes	Establishing a platform for participation and investment, Establishing a user experience design process, Establishing Design Thinking, Establishing a product management processs (Establishing the SCRUM concept in product development & Establishing the MVP concept in product development (Minimum Viable Product), Workflow management, Process reengineering, Labor Value Stream Modeling
	Digital Leadership	Creating a digital governance infrastructure, Establishing an agile innovation system with an OKR approach, Developing transformational team organization (ART), Organizing change management (CMO), Establishing a project management office (PMO), Developing the effectiveness of transformation management (TMO).

It is also important to mention that each bank has three sections: Back Office, Middle Office, and Front Office. In the presented model, each of the above-mentioned four strategies, with their criteria and indicators, is positioned as service-oriented modules within the three sections: Front Office, Middle Office, and Back Office, and is presented as a reference model for digital banking for the benefit of the Iranian banking industry.

The proposed model is modular and comprehensive developed using the OKR strategic planning method with an Agile approach for modeling (Figure 1).

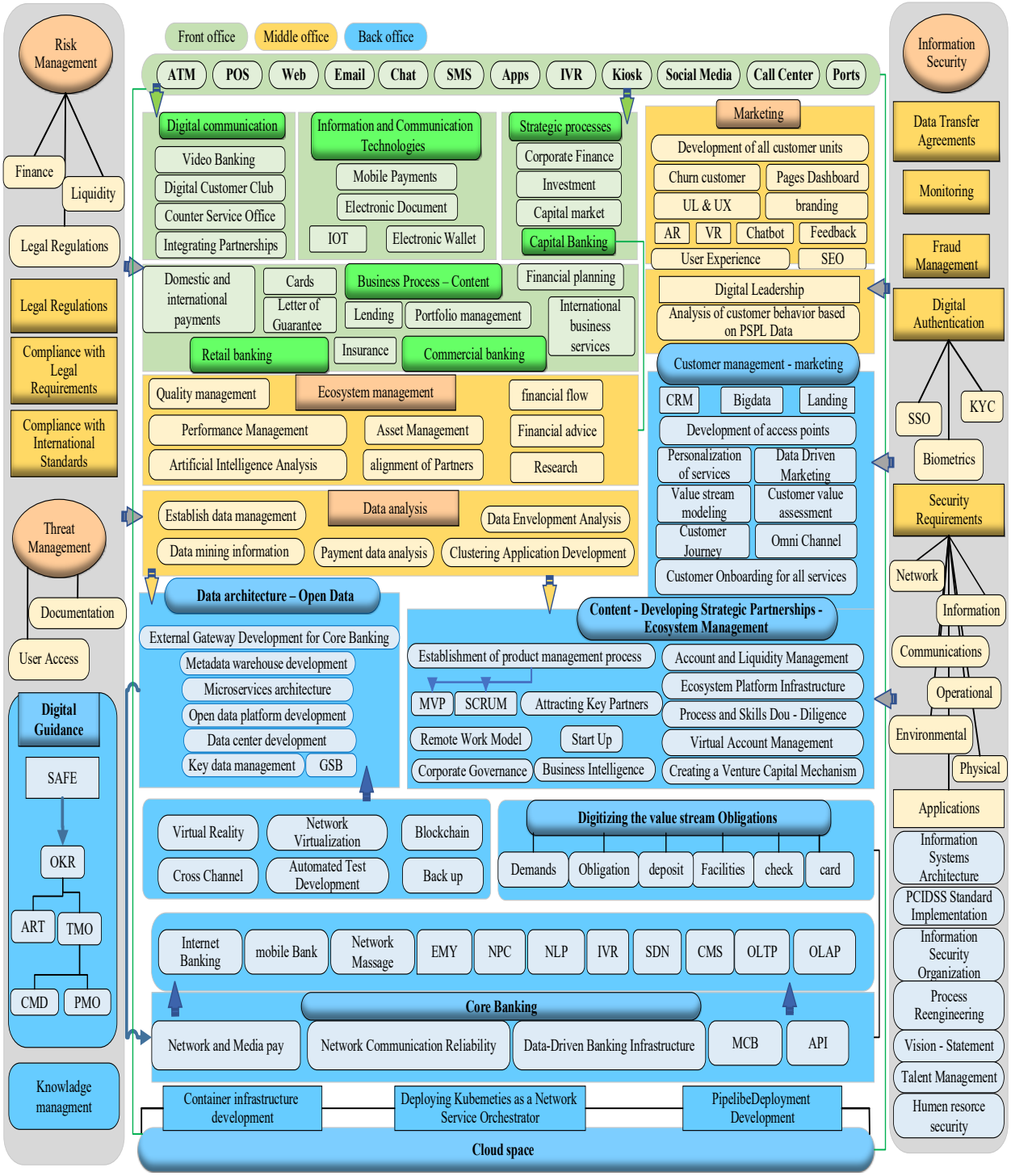

Figure 1. Comprehensive Model of Digital Banking

The results of the normality test are presented in Table 5. According to the results, since the significance values for all cases were below the error level of 0.05, the data distribution was not normal, and the null hypothesis was rejected. As a result, Smart PLS software was used for subsequent data analysis.

Table 5. Results of the data normality test (research variables)

Strategy	Criterion	Question number	Average	Standard deviation	Variance
Digital Customer Experience	Digital communications	1-5	3.2621	0.52858	0.279
	Distribution channels (delivery)	16-20	3.3174	0.4711	0.222
	Social media	21-24	3.1316	0.56247	0.316
	Customer Relationship Management	25-37	3.2407	0.4936	0.244
Infrastructure	Information and Communication Technology Management Cycle	38-61	3.2819	0.50785	0.258
	Information Security Management	62-74	3.4368	0.47149	0.222
	Human Resources	75-77	3.5051	0.54172	0.293
	Processes	78-85	3.2642	0.61211	0.375
	Digital Leadership	86-89	3.3741	0.61566	0.379
Data	Data architecture	90-94	3.4871	0.57327	0.329
	Data analysis	95-97	3.5177	0.57543	0.331
	Open Data Exchange	98-100	3.3586	0.57807	0.334
Business	Content	10-103	3.5164	0.56586	0.320
	Ecosystem management	104-107	3.3182	0.54197	0.294
	Developing strategic partnerships	108-111	3.1506	0.55769	0.311

To evaluate discriminant validity in Smart PLS, the cross-factor analysis method was employed. Each research question was analyzed individually using the Partial Least Squares technique. Convergent validity was assessed using Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE), with the results displayed in Table 6.

Table 6. Validity and reliability assessment

Criterion	Factor loadings (general model)	Average Variance Extraction (AVE)	Composite validity (CR)	Cronbach's alpha
Digital communications	0.687	0.433912	0.791739	0.670579
Marketing analysis services	0.857	0.447033	0.888721	0.859805
Distribution channels (delivery)	0.608	0.468566	0.776068	0.615932
Social media	0.735	0.655734	0.842039	0.611007
Customer Relationship Management	0.927	0.721984	0.838543	0.889523
Information and Communication Technology Management Cycle	0.956	0.444039	0.94913	0.943104
Information Security Management	0.869	0.478411	0.922377	0.908609
Human Resources	0.759	0.681674	0.865133	0.766329
Processes	0.813	0.603659	0.923765	0.905026
Digital Leadership	0.801	0.66382	0.887071	0.828833
Data architecture	0.944	0.683048	0.915025	0.883779
Data analysis	0.896	0.696514	0.873122	0.782041
Open Data Exchange	0.840	0.664266	0.854372	0.744553
Content	0.788	0.720506	0.885395	0.805778
Ecosystem management	0.906	0.579837	0.846433	0.757831
Developing strategic partnerships	0.760	0.510857	0.80463	0.678149

As shown in Table 6, all coefficients for validity measurement exceed 0.5, indicating strong correlations between the observed variables and their corresponding latent variables. In the reliability measurement, all coefficients are above 0.7, confirming convergent validity. The Composite Reliability (CR) value was also greater than the Average Variance Extracted (AVE).

Additionally, to assess the structural fit of the model, t-values were used as significance coefficients. Table 7 and Figure 2 show that the t-values for all variables in this study are greater than 2.57, which means that at a 99% confidence level, the relationships are statistically significant and correct.

Table 7. Table of significance criteria Z coefficients or t-values

Criterion	Significance criterion Z coefficients or t-values	Result
Digital communications	19,230	Acceptance
Marketing analysis services	48,107	Acceptance
Distribution channels (delivery)	15,758	Acceptance
Social media	35,783	Acceptance
Customer Relationship Management	91,130	Acceptance
Information and Communication Technology Management Cycle	163,852	Acceptance
Information Security Management	59,902	Acceptance
Human Resources	26,447	Acceptance
Processes	37,417	Acceptance
Digital Leadership	33,143	Acceptance
Data architecture	128,954	Acceptance
Data analysis	77,009	Acceptance
Open Data Exchange	50,778	Acceptance
Content	31,117	Acceptance
Ecosystem management	85,828	Acceptance
Developing strategic partnerships	31,686	Acceptance

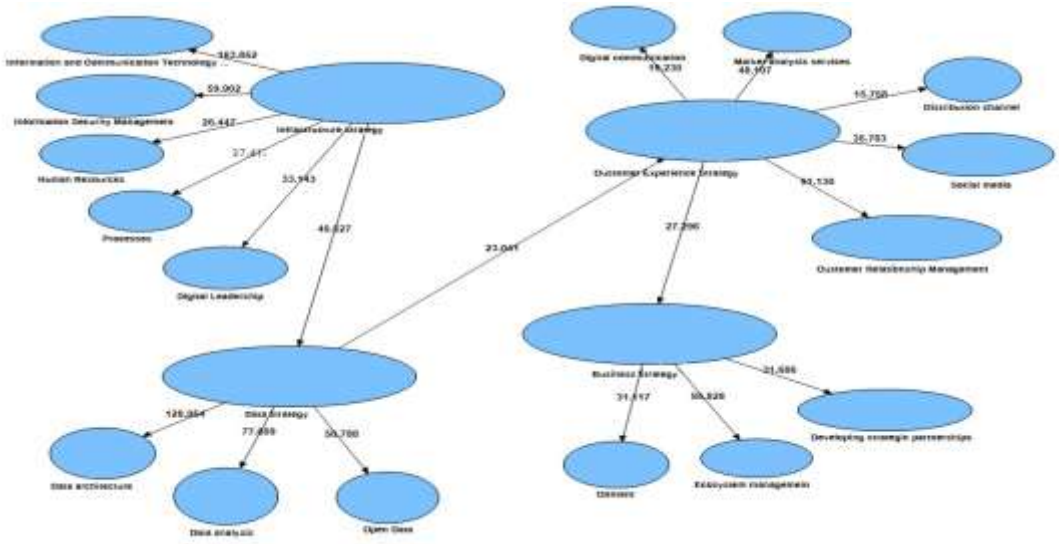

Figure 2. Measuring the significance of Z coefficients or t-values

In this study, the relationship between latent and observed variables was measured using factor loadings and path coefficients. The results of the analysis are presented in Table 8. The findings indicate that all factor loadings are within a highly favorable range. Furthermore, all path coefficients between latent variables are positive and less than one, indicating a direct and positive relationship.

Table 8. Factor loadings (general model)

Criterion	Factor loadings (general model)
Digital communications	0.687
Marketing analysis services	0.857
Distribution channels (delivery)	0.608
Social media	0.735
Customer Relationship Management	0.927
Information and Communication Technology Management Cycle	0.956
Information Security Management	0.869
Human Resources	0.759
Processes	0.813
Digital Leadership	0.801
Data architecture	0.944
Data analysis	0.896
Open Data Exchange	0.840
Content	0.788
Ecosystem management	0.906
Developing strategic partnerships	0.760

As presented in Table 9 and Figure 3, the highest R^2 value for the endogenous variables in the model is for the Information and Communication Technology (ICT) management cycle variable (0.956), while the lowest R^2 value is for the distribution channels variable (0.608). The R^2 values for the other endogenous variables also support the structural fit of the model.

Table 9: R2 or R squares criterion

Criterion	R2 criterion	Result
Digital communications	0.687	medium
Marketing analysis services	0.857	strong
Distribution channels (delivery)	0.608	medium
Social media	0.736	medium
Customer Relationship Management	0.927	strong
Information and Communication Technology Management Cycle	0.956	strong
Information Security Management	0.869	strong
Human Resources	0.759	medium
Processes	0.813	medium
Digital Leadership	0.881	medium
Data architecture	0.944	strong
Data analysis	0.896	strong
Open Data Exchange	0.840	strong
Content	0.788	medium
Ecosystem management	0.906	strong
Developing strategic Partnerships	0.760	Medium

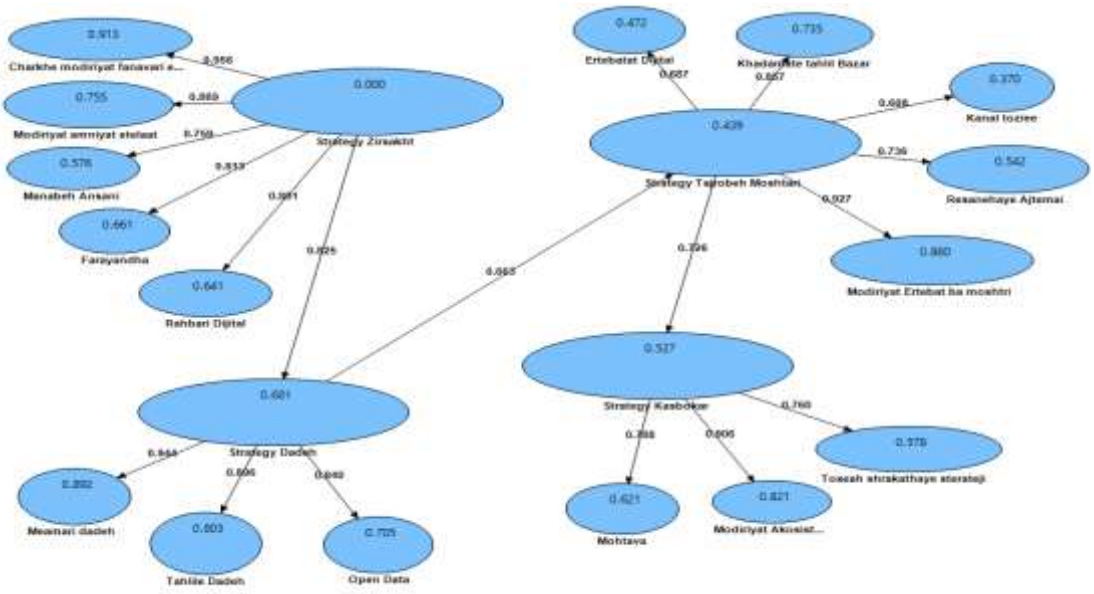

Figure 3. Measuring the R2 or R squares criterion.

Table 10 and Figure 4 determine the predictive power of the model. This table shows that the highest Q^2 value for the endogenous variables is for the data architecture variable (0.5949), while the lowest Q^2 value is for the customer experience variable (0.1286). The values for the other endogenous variables further confirm the model's structural fit.

Table 10: Q2 Criterion (Stone-Geisser Criterion)

Criterion	Q2 Criterion (Stone-Geisser Criterion)	Result
Digital communications	0.199951	medium
Marketing analysis services	0.316057	medium
Distribution channels (delivery)	0.169472	medium
Social media	0.252214	medium
Customer Relationship Management	0.373034	strong
Information and Communication Technology Management Cycle	0.402043	strong
Information Security Management	0.356994	strong
Human Resources	0.390000	strong
Processes	0.395777	strong
Digital Leadership	0.423157	strong
Data architecture	0.594886	strong
Data analysis	0.566011	strong
Open Data Exchange	0.44298	strong
Content	0.335685	strong
Ecosystem management	0.358072	strong
Developing strategic partnerships	0.262773	medium
Customer experience strategy	0.128642	medium
Infrastructure strategy	0.371133	strong
Data strategy	0.376418	strong
Business strategy	0.205458	medium

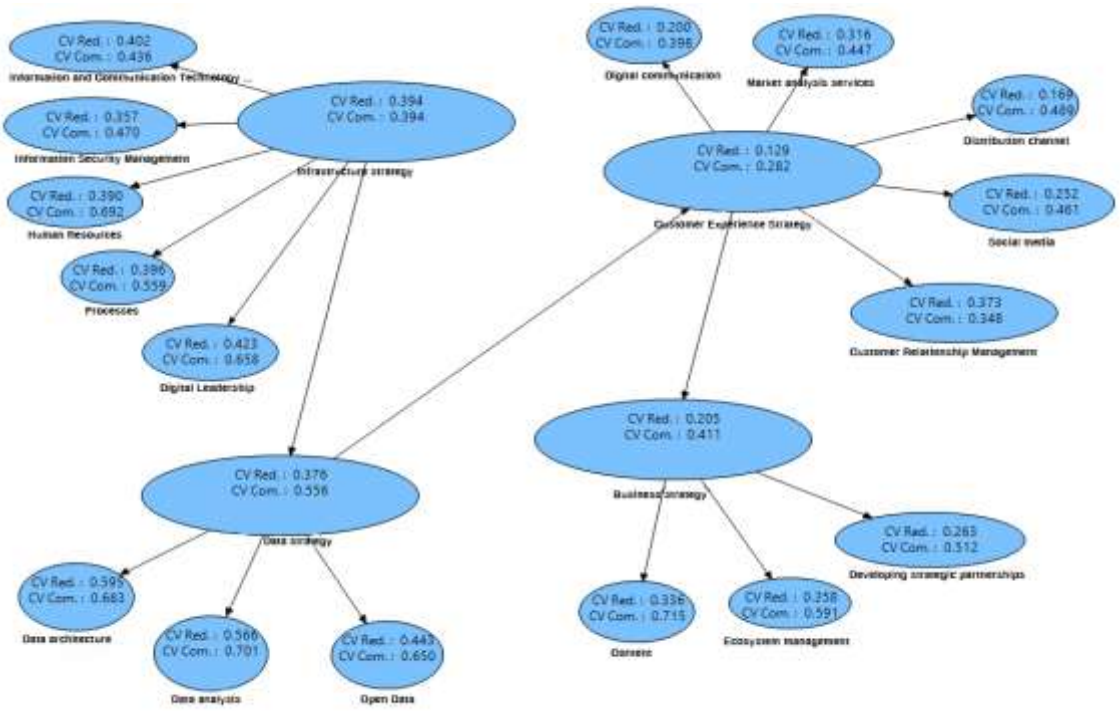

Figure 4. Measuring the R2 or R squares criterion.

Overall, the results demonstrate that the relationships between the constructs are accurate, and the model has a good fit. The overall model fit criterion (GOF) was calculated to be 0.593 in this research. Considering that values of 0.10, 0.25, and 0.36 represent weak, medium, and strong GOF, respectively, a value of 0.593 indicates a strong overall model fit.

4. Discussion and Conclusion

The findings of this research revealed that the proposed ICT-based digital banking model, structured around four strategic components—customer experience, infrastructure, data, and business—demonstrated strong validity and reliability. The results from structural equation modeling (SEM) using SmartPLS indicated high factor loadings across observed variables, with path coefficients confirming the positive and significant relationships among constructs. The model exhibited a strong overall fit, as demonstrated by the global goodness-of-fit index (GOF = 0.593), far exceeding the recommended threshold for a robust model (Tenenhaus et al., 2004). This outcome highlights that the strategic integration of customer experience, data governance, infrastructure modernization, and business ecosystems is not only feasible but also highly effective for the transformation of Iran's banking industry.

The results showed that customer experience strategies—including digital communications, distribution channels, social media engagement, and customer relationship management—achieved significant factor loadings, underscoring their critical role in digital transformation. This finding is consistent with global reports emphasizing customer-centricity as the cornerstone of digital banking (Barquin & Vinayak, 2015; Castro et al., 2014). In particular, the significance of CRM and omni-channel strategies aligns with evidence from the UAE, where omni-channel platforms were designed to create seamless and integrated customer experiences (Alnuaimi, 2019). Similarly, customer satisfaction and loyalty in online banking environments, as demonstrated in China and Saudi Arabia, were shown to depend heavily on factors such as privacy, responsiveness, and perceived value (Gülmez, 2016), supporting the strong customer experience coefficients observed in this study.

The infrastructure strategy also displayed high explanatory power, with ICT management cycles and information security management emerging as dominant contributors. This is reflective of the global trend that regards digital infrastructure as the backbone of banking transformation (Accenture, 2015; Accenture, 2013). The emphasis on cybersecurity and information

systems architecture resonates with earlier findings from Malaysia and Thailand, where distrust in internet banking was primarily attributed to security concerns (Hamid et al., 2007). Iran's banking sector, as highlighted in Central Bank reports, has also recognized the critical importance of cybersecurity in facilitating digital adoption (Central Bank of the Islamic Republic of, 2024). These findings reinforce the necessity of strong technological and security foundations in any attempt to implement a digital banking ecosystem.

Regarding the data strategy, the results demonstrated that data architecture, analytics, and open data exchange had some of the highest factor loadings, underscoring the centrality of data-driven decision-making in modern banking. This is consistent with earlier works that highlight big data, artificial intelligence, and advanced analytics as essential tools for customer profiling and financial innovation (Lipton et al., 2016; Skinner & Kianpour, 2020). Moreover, empirical studies have emphasized the role of robust data governance structures in building trust and ensuring scalability of financial platforms (Babakianpour, 2024; Habibi & Kalahi, 2022). International comparisons, particularly in India and Indonesia, confirm that layered data strategies and modular digital banking models drive growth and innovation (Samosir et al., 2017; Statista, 2024d, 2024e). Thus, the strong performance of the data component in this study validates its inclusion as a core pillar of Iran's digital banking framework.

The business strategy component, which included content management, ecosystem development, and strategic partnerships, also achieved high explanatory value. This reflects the global recognition of ecosystem-based models as central to digital banking. The importance of partnerships with fintechs and startups has been highlighted in global consulting reports (Accenture, 2015; Kearney et al., 2014), as well as in studies of East Asia, where fintech ecosystems have significantly reshaped consumer expectations (Barquin & Vinayak, 2015). In Iran, previous studies revealed that limitations in partnerships and ecosystem development have hindered the progress of e-banking (Arsanjani et al., 2019), thereby justifying the inclusion of ecosystem strategies in this model.

The results of this study are closely aligned with the broader literature on digital banking transformation. First, the emphasis on customer experience resonates with findings that position customers as the focal point of banking transformation strategies (Castro et al., 2014). Reports by McKinsey and Accenture have consistently argued that customer-centric models enhance loyalty and ensure long-term competitiveness (Accenture, 2015). Similarly, this study found that digital communications, distribution channels, and CRM were among the most significant contributors to digital banking success in Iran.

Second, infrastructure emerged as a critical enabler of transformation. Studies on the Fourth Industrial Revolution have emphasized the need for robust ICT infrastructures, cloud computing, and secure networks as prerequisites for digital success (Schwab & Shani, 2016; Vafai & Dashti, 2018). This aligns with our finding that ICT management cycles and information security management were key factors in the model. Moreover, these findings support earlier warnings that without adequate infrastructure, digital transformation efforts risk fragmentation and inefficiency (Timothy et al., 2010).

Third, the high loadings on data architecture and analytics are consistent with prior research highlighting the transformative role of big data and artificial intelligence in financial services (Lipton et al., 2016; Skinner, 2020). The use of advanced analytics for customer profiling and predictive modeling has been identified as a hallmark of successful global digital banks (Accenture, 2013). This study's results confirm that Iran's banking industry must prioritize investment in data strategies if it seeks to keep pace with global peers.

Fourth, the business ecosystem strategy is validated by both academic and consulting literature. The emergence of ecosystem-based platforms, particularly in Asia, demonstrates how partnerships with fintechs and technology firms can expand service portfolios and drive innovation (Barquin & Vinayak, 2015; Samosir et al., 2017). Reports by A.T. Kearney and Accenture further argue that ecosystem management is essential for fostering innovation and competitiveness (Accenture, 2015; Kearney et al., 2014). The findings of this study reinforce these claims by demonstrating the significance of partnerships and content strategies within Iran's banking sector.

Finally, the methodological rigor of this study, achieved through SEM and PLS modeling, also aligns with global best practices. Early works in this field established PLS as a robust method for testing complex models (Chin, 1998; Wetzels &

Odekerken, 2009). The use of discriminant and convergent validity testing in this study echoes the methodological standards advocated by previous scholars (Amani, 2020; Azar et al., 2012; Habibi, 2016). The strong GOF index obtained further validates the robustness of the model and its applicability in the Iranian context.

By integrating these findings with prior literature, this study contributes to both theoretical and practical understandings of digital banking transformation. Theoretically, it demonstrates that a holistic framework incorporating customer experience, infrastructure, data, and business ecosystems provides a comprehensive approach to digital banking. This confirms earlier conceptualizations of digital transformation as a multidimensional process (Schwab, 2016). Practically, the study provides Iranian banks with a validated model that can guide their transition toward digital maturity. The emphasis on strategic partnerships, data-driven decision-making, and customer-centric processes reflects global best practices while addressing the unique challenges faced in Iran (Arsanjani et al., 2019).

Despite its contributions, this study is not without limitations. First, while the model was validated with data from banking and IT experts within Iran, the generalizability of the findings to other sectors or countries may be limited. The regulatory, cultural, and technological environment of Iran is distinct, and models that are effective here may not fully apply elsewhere. Second, the cross-sectional nature of the data limits the ability to capture dynamic changes in customer behavior and technological adoption over time. Third, although SEM with PLS provided robust insights, the reliance on self-reported measures from experts may introduce bias, particularly regarding perceptions of strategic priorities. Finally, rapid technological advancements mean that components critical today may become outdated in the near future, limiting the long-term applicability of the model.

Future studies could extend this work by conducting longitudinal analyses to capture the dynamic evolution of digital banking adoption. Comparative cross-country studies would also be valuable, particularly across nations with similar regulatory and cultural environments, to test the adaptability of the model. Additionally, integrating customer-level data, such as satisfaction surveys and behavioral analytics, could enrich the model by reflecting the direct perspectives of users rather than relying solely on expert opinions. Methodologically, future research could also experiment with hybrid models that integrate SEM with machine learning approaches to better capture nonlinear relationships among constructs. Finally, future studies should examine emerging technologies such as blockchain, central bank digital currencies (CBDCs), and generative AI to explore how these may further reshape the digital banking landscape.

For practitioners, the results highlight the urgent need to adopt a balanced approach to digital transformation. Banks should invest simultaneously in customer experience, infrastructure, data governance, and business ecosystem strategies to achieve sustainable digital growth. Training and upskilling human resources are critical to ensure that staff can effectively operate within digital systems. Moreover, partnerships with fintechs, technology firms, and regulators should be prioritized to create a supportive ecosystem for innovation. Banks must also pay close attention to customer trust by enhancing security protocols and promoting transparent communication about data usage. Finally, adopting agile governance models will allow institutions to remain flexible in the face of rapid technological and market changes.

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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