Validation of the Service Innovation Model in the Agricultural Bank

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ABSTRACT

This study was conducted with the aim of validating the service innovation model in the Agricultural Bank. In terms of purpose, the present research is applied; in terms of method, it is quantitative; and regarding the nature of the data, it is descriptive–survey. The statistical population consisted of all managers and employees of the Agricultural Bank in the northwestern provinces of the country (East Azerbaijan, West Azerbaijan, Ardabil, and Kurdistan), totaling 1,682 individuals. The sample size was estimated at 313 using Cochran's formula, and the participants were selected through stratified random sampling. The data collection instrument was a researcher-made questionnaire. Research data were analyzed using structural equation modeling with PLS3 and SPSS software. The results indicate that, at a 99% confidence level, there is a positive and significant relationship among the antecedents, components, indicators, and outcomes of service innovation in the Agricultural Bank. Moreover, all indicators demonstrated high explanatory power, and the findings showed that antecedents of professional development, through their influence on developmental components, play a decisive role in shaping professional development outcomes for faculty members. These findings suggest that the proposed service innovation model in the Agricultural Bank possesses appropriate statistical and scientific validity and can be utilized as a practical framework for strategic decision-making by managers and policymakers.

Keywords: innovation, service innovation, Agricultural Bank.

Introduction

Service innovation has become a defining strategic capability for organizations navigating an increasingly volatile and technologically intensive global environment. As competitive pressures, customer expectations, and digital transformation accelerate, firms across sectors have been compelled to rethink how they design, deliver, and continuously improve services in order to sustain performance and differentiation. The banking industry, in particular, faces mounting demands for rapid responsiveness, data-driven personalization, and seamless omnichannel experiences, making service innovation an essential driver of long-term viability. Scholars argue that the rise of intelligent technologies—ranging from artificial intelligence (AI) to advanced analytics—not only creates new opportunities for service enhancement but also imposes profound challenges regarding capability development, organizational redesign, and customer value creation (1). These pressures are especially salient in

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contexts characterized by competitive fragmentation and regulatory complexity, where innovation must be simultaneously incremental and transformative in nature (2).

Recent contributions emphasize that service innovation capability is no longer confined to the development of new service features; rather, it encompasses a dynamic system of interrelated competencies involving digital technologies, customer co-creation, organizational adaptability, and network collaboration (3). The collaborative view of continuous service innovation highlights that organizations must orchestrate multiple internal and external actors to sustain innovation cycles, particularly within industries where service quality and reliability are inseparable from complex infrastructural and technological systems (3). In the banking sector, digital transformation strategies such as mobile banking, automated branch systems, cloud-based processes, and intelligent financial advisory services illustrate this systemic nature of service innovation, reflecting the convergence of operational, experiential, and relational innovations (4).

The evolution of innovation management has also been influenced by the profound shift toward AI-powered systems, which are reshaping how organizations sense opportunities, process information, and develop innovation strategies (5). With AI-enabled innovation frameworks increasingly used to enhance decision-making, automate routine processes, and personalize customer journeys, the capability to integrate these technologies has become central to modern service ecosystems (1). This transformation is not limited to highly digitalized industries; even traditional sectors such as banking are experiencing expansive digitalization, generating new pathways for process innovation, experience innovation, and business model innovation (6). Research shows that innovative service transition strategies—particularly those aligned with strategic agility and technological readiness—can significantly elevate organizational performance by improving cost efficiency, service quality, and customer satisfaction (6).

In emerging economies, banking institutions are increasingly recognized as catalysts for economic modernization and financial inclusion through innovative service provision (7). Financial transformation in micro, small, and medium enterprises (MSMEs), for instance, relies on banking systems capable of offering technologically advanced yet accessible services, which underscores the strategic role of banks in driving innovation-led growth at the societal level (7). Additionally, customer experience has become a critical dimension of service innovation, with studies demonstrating that innovative roadside assistance services, digital financial platforms, and smart tourism ecosystems significantly influence perceived value, satisfaction, and loyalty (8, 9). In the retail sector, smart unmanned stores illustrate how experiential relationship quality and service innovation coalesce to shape consumers' shopping experience, highlighting the need for similar customer-centered innovation models in banking (10).

Service innovation has also been reexamined through the lenses of sustainability, resilience, and ethical responsibility. As organizations face fluctuating environmental, market, and societal conditions, research shows that resilience and adaptability—supported by innovation—play a major role in improving business outcomes (11). Sustainability-oriented innovation, including circular business model innovation, is increasingly central to the strategic agenda of firms as they respond to regulatory, customer, and environmental pressures (12). In banking, where customer trust, regulatory compliance, and operational risk management are fundamental, sustainability-driven service innovation models can provide competitive advantages by aligning organizational practices with stakeholder expectations (13).

Moreover, digitalization has democratized innovation, enabling users, citizens, and customers to participate directly in designing and improving services. Patient-driven service innovation in healthcare, for instance, has

demonstrated how ecosystems can reorient toward user needs through participatory mechanisms (14). In parallel, urban innovation and development research shows that environmental and social factors play a significant role in shaping innovation trajectories, suggesting that contextual conditions must be integrated into service innovation models (15). In banking, customer co-creation and collaborative value creation have become essential tools for developing services that are meaningful, differentiated, and aligned with customer expectations (16). These collaborative processes allow organizations to design innovative models that focus on customer experience, experiential quality, and value co-creation across touchpoints.

In technologically dynamic sectors, competitive advantage is strongly tied to an organization's ability to integrate intellectual capital, big data analytics, and digital capabilities into its innovation system (17). The interplay of digital transformation and innovation capability suggests that banks must not only develop technology infrastructures but also cultivate human, structural, and relational capital to fully leverage innovation potential. Companies with mature data analytics capabilities can identify customer needs, predict market trends, and optimize operations, thereby facilitating more effective service innovation strategies (17). Scholars studying banking during crisis contexts—such as the pandemic—have shown that technology-enabled service quality dramatically shapes consumer satisfaction, perceptions of value, and loyalty in digital banking environments (18). These findings emphasize the importance of service innovation models that are adaptive, technology-integrated, and customer-centered.

Another emerging domain in service innovation research concerns innovation capability under competitive and environmental dynamism. Dynamic service innovation capabilities have been shown to significantly affect firm performance, particularly when moderated by environmental uncertainty and mediated by innovation-driven competitive advantage (19). This highlights the need for banking institutions—especially those operating in environments characterized by regulatory uncertainty, shifting customer expectations, and rapid technological disruption—to cultivate dynamic capabilities that enable continuous service evolution. Complementing this view, studies on process and recycling innovation reveal that firms adopting green innovations not only improve sustainability outcomes but also enhance operational performance, underscoring the importance of environmentally oriented innovation strategies (20).

Furthermore, psychological and behavioral factors within organizations influence employees' capacity to contribute to service innovation. Research reveals that employees' well-being, leadership style, and workplace environment can significantly affect their ability to engage in innovative behaviors (21). Ethical leadership and sleep quality, for example, have been associated with higher levels of employee service innovation behavior, highlighting the human dimension of innovation capability. These insights indicate that human capital must be considered an integral component of service innovation models, particularly in service-intensive sectors such as banking (21).

In Iran, the study of service innovation in the banking industry has gained considerable attention due to the banking sector's critical role in economic development, digital transformation, and customer service enhancement. For instance, research in Melli Bank identified the key factors affecting service innovation and offered a conceptual model for navigating innovation challenges in regional banking contexts (22). Similarly, investigations in Gardeshgari Bank have produced models that integrate cultural, technological, and structural determinants of service innovation using advanced modeling techniques (23). Studies using integrated fuzzy DEMATEL and dynamic capabilities approaches have contributed additional methodological tools for understanding service innovation in Iranian electronic banking systems (24). Complementing these perspectives, research on innovation for blind customers in Iranian banking has highlighted the inclusiveness dimension of service innovation and the

need for accessible and human-centered design (25). These diverse studies collectively demonstrate the increasing strategic importance of service innovation in Iranian banking.

In addition, country-specific research in the Iranian tourism and hospitality sectors has proposed models emphasizing post-pandemic innovation in service delivery, customer engagement, and ecosystem collaboration, offering insights applicable to financial service environments where customer experience and digital interaction are rapidly evolving (26). Studies on banking ambidextrous innovation stress the dual necessity of balancing exploratory and exploitative innovation capabilities in highly competitive environments, particularly for banks expanding their digital transformation strategies (2). These contributions illustrate the multidimensional nature of service innovation in Iran and the necessity of developing validated, context-specific models adapted to the banking system's cultural, technological, and strategic characteristics.

A growing body of global literature also emphasizes the significance of strategic digital transformation in driving service innovation, where digital transformation strategies serve as pathways to the creation of new service capabilities, improved customer experience, and organizational value realization (4, 27). The interplay of coopetition and innovation is another important theme, with studies demonstrating how firms in manufacturing and service sectors can use coopetition strategies to enhance innovation outcomes, offering implications for collaborative innovation initiatives in banking (27). Moreover, consumer behavior-based branding, market performance impacts, and innovation typologies derived from online reviews highlight the role of digital ecosystems in shaping service innovation effectiveness (28).

Given the increasing complexity of innovation ecosystems, the service innovation literature also stresses the need for holistic models that integrate strategic, technological, customer, and environmental dimensions. These include the need for responsiveness to environmental dynamism, capability building around digital technologies, organizational resilience, and collaboration within broader service ecosystems (11, 14). These trends underscore the importance of developing validated frameworks that can assess the antecedents, components, and outcomes of service innovation in specific organizational contexts, particularly in emerging-market banking systems where innovation adoption patterns may differ significantly from those in Western economies.

Given these considerations, the aim of this study is to validate a comprehensive service innovation model for the Agricultural Bank.

Methods and Materials

The present study is applied in terms of purpose and descriptive–correlational in terms of method. The statistical population of this research included all managers and employees of the Agricultural Bank in the northwestern provinces of the country (East Azerbaijan, West Azerbaijan, Ardabil, and Kurdistan), totaling 1,682 individuals. Based on Cochran's formula, the sample size was estimated to be 313 participants, selected through stratified random sampling. The statistical population and sample are presented in Table 1.

Table 1. Distribution of the Statistical Population and Sample in the Quantitative Section of the Study

Row	Branches	Number of Managers	Number of Employees	Population	Sample
1	Ardabil	6	32	38	7
2	Parsabad	1	8	9	2
3	Meshgin Shahr	2	13	15	3
4	Khalkhal	1	10	11	2
5	Germi	1	8	9	2

6	Bileh Savar	1	7	8	1
7	Namin	1	8	9	2
8	Kivi	1	6	7	1
9	Aslanduz	1	6	7	1
10	Nir	1	8	9	2
11	Sareyn	1	4	5	1
12	Angut	1	4	5	1
13	Hir	1	4	5	1
14	Ardabil Provincial Branch Management	4	46	50	9
15	Malekan	4	19	23	4
16	Mehraban	1	5	6	1
17	Dozdouzan	1	4	5	1
18	Sharbian	1	4	5	1
19	Mianeh	3	22	25	5
20	Varzeqan	1	6	7	1
21	Hadishahr	2	9	11	2
22	Jolfa	1	6	7	1
23	Heris	1	7	8	1
24	Khaje	1	4	5	1
25	Bakhshayesh	1	4	5	1
26	Kelvanagh	1	5	6	1
27	Hashtrud	1	8	9	2
28	Nazarkahrizi	4	24	28	5
29	Sardroud	1	5	6	1
30	Mamqan	2	12	14	3
31	Azarshahr	1	11	12	2
32	Gogan	1	7	8	1
33	Osku	1	6	7	1
34	Ilkhchi	1	5	6	1
35	Ahar	3	21	24	5
36	Bostanabad	5	29	34	6
37	Bonab	2	17	19	3
38	Tabriz	25	155	180	33
39	Tasuj	1	7	8	1
40	Khoda Afarin	2	13	15	3
41	Khosrowshahr	1	11	12	2
42	Sarab	5	31	36	7
43	Shabestar	1	11	12	2
44	Sharfkhaneh	1	6	7	1
45	Shendabad	1	4	5	1
46	Sufian	1	7	8	1
47	Ajab Shir	1	11	12	2
48	Qarah Aghaj	1	6	7	1
49	Kalibar	1	7	8	1
50	Abesh Ahmad	1	4	5	1
51	Maragheh	3	21	24	4
52	Marand	5	28	33	6
53	East Azerbaijan Provincial Branch Management	4	79	83	15
54	Urmia	15	87	102	19
55	Salmas	6	28	34	6
56	Khoy	9	59	68	13
57	Qarah Zia od Din	1	7	8	1
58	Poldasht	2	15	17	3
59	Showt	2	13	15	3
60	Maku	2	14	16	3
61	Chaldoran	2	14	16	3
62	Oshnavieh	1	13	14	3
63	Naqadeh	4	26	30	6
64	Piranshahr	2	16	18	3
65	Mahabad	4	47	51	9
66	Sardasht	1	13	14	3

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67	Miandoab	3	27	30	6
68	Bukan	4	34	38	7
69	Shahin Dezh	4	24	28	5
70	Takab	1	8	9	2
71	West Azerbaijan Provincial Branch Management	4	58	62	11
72	Sanandaj	5	36	41	8
73	Saqqez	3	21	24	4
74	Marivan	2	16	18	3
75	Baneh	3	17	20	11
76	Qorveh	2	9	11	2
77	Kamyaran	1	4	5	1
78	Bijar	2	11	13	2
79	Divandarreh	1	10	11	2
80	Dehgolan	1	6	7	1
81	Kurdistan Provincial Branch Management	4	36	40	7
Total	208	1,474	1,682	313	

In this study, the tool used for data collection was a researcher-designed questionnaire whose validity and reliability were assessed prior to use. The face validity of the instrument was confirmed by experts and specialists, and Cronbach's alpha coefficient was applied to evaluate reliability. The results of these assessments are presented in Table 2.

Table 2. Results of Cronbach's Alpha Reliability Test

Main Category	Subcategory	Cronbach's Alpha (Cronbach's Alpha > 0.7)
Antecedents of Service Innovation	Adoption of Competitive Behavior	0.867
	Strategic Agility	0.913
	Competitive Intelligence	0.824
	Innovative Customer Interaction	0.904
	Strengthening Loyalty through Innovative Services	0.861
	Advanced Customer Behavior Analysis	0.876
	Application of Modern Technologies	0.889
	Integration of Service Channels	0.902
	Innovation in Banking Business Models	0.920
	Enhancing Digital Security and Trust	0.820
	Overall Statistics for Service Innovation Antecedents	0.968
Components and Indicators of Service Innovation	Need-Based Service Innovation	0.961
	Experience-Based Service Innovation	0.954
	Value-Based Service Innovation	0.910
	Overall Statistics for Service Innovation Components and Indicators	0.977
Outcomes of Service Innovation	Enhancement of Positioning	0.792
	Enhancement of Communication Channels	0.869
	Customer Behavior-Based Branding	0.828
	Productivity Increase	0.827
	Reduction of Operational Costs	0.769
	Service Quality Improvement	0.869
	Collaboration in the Digital Ecosystem	0.797
	Creation of Social Value and Digital Sustainability	0.800
	Overall Statistics for Service Innovation Outcomes	0.955

In this study, the data were analyzed using the structural equation modeling (SEM) approach and the PLS3 software. The results obtained from this analysis are presented in the findings section.

Findings and Results

To examine the causal relationships and assess the fitness of the data with the research model, SEM and the partial least squares (PLS3) method were applied. The results of the analysis are illustrated in the figures below, and two main sections—namely the measurement model test and the structural model test—are subsequently explained in detail.
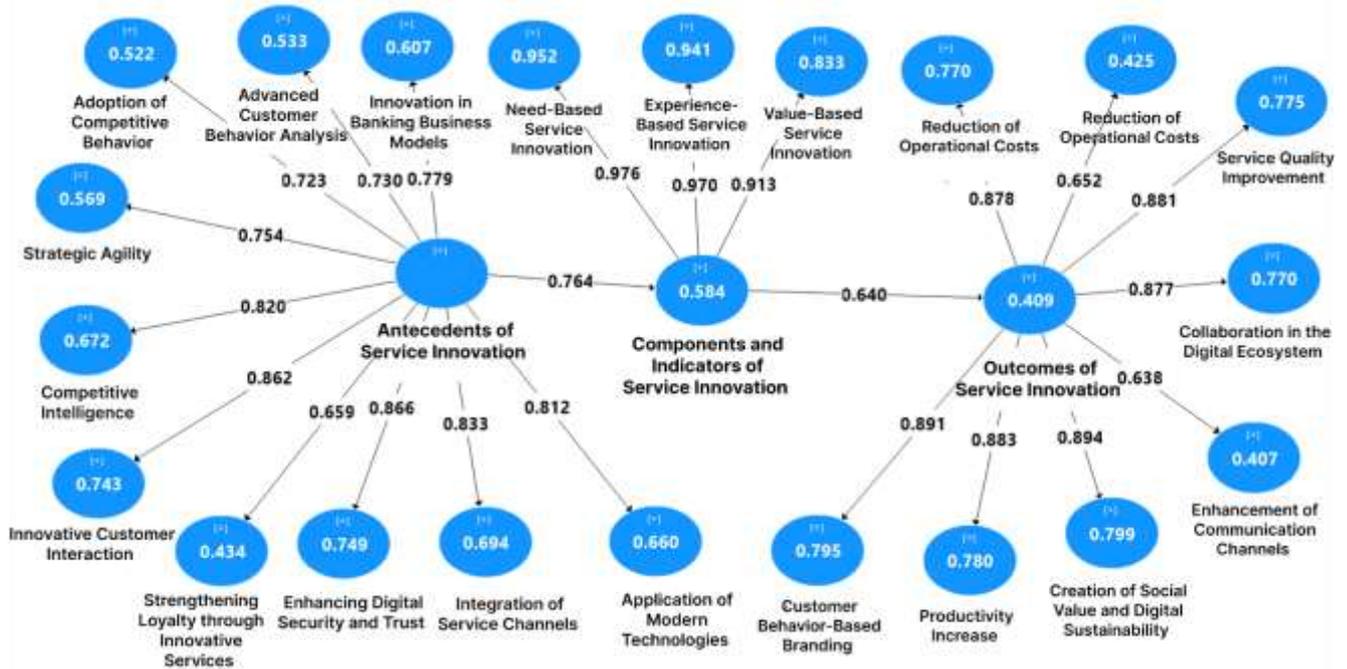

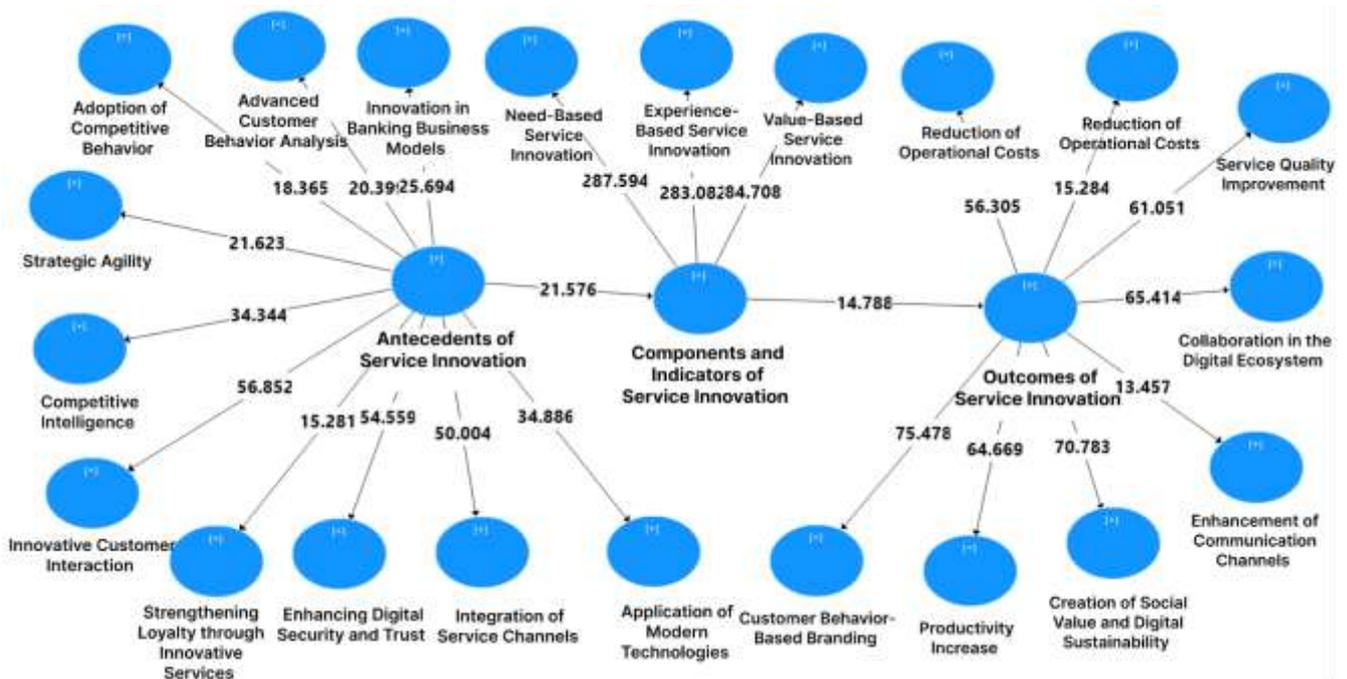**Figure 1. Structural Model with Estimated Standardized Coefficients**

Figure 2. Structural Model with Significance Coefficients

To assess the reliability of the research model, at least four reliability tests must reach acceptable thresholds consistent with the views of experts. The results of the reliability tests are presented in Table 3.

Table 3. Results of Reliability Tests for Research Variables

Main Category	Subcategory	Cronbach's Alpha (Cronbach's Alpha > 0.7)	Composite Reliability (CR > 0.7)	Spearman Correlation Coefficient (Rho > 0.7)	Communality Coefficient (COMMUNALITY > 0.5)
Antecedents of Service Innovation	Adoption of Competitive Behavior	0.867	0.919	0.870	0.791
	Strategic Agility	0.913	0.935	0.915	0.742
	Competitive Intelligence	0.824	0.885	0.819	0.662
	Innovative Customer Interaction	0.904	0.929	0.906	0.723
	Strengthening Loyalty Through Innovative Services	0.861	0.915	0.865	0.782
	Advanced Customer Behavior Analysis	0.876	0.915	0.879	0.728
	Application of Modern Technologies	0.889	0.931	0.890	0.818
	Integration of Service Channels	0.902	0.939	0.903	0.836
	Innovation in Banking Business Models	0.920	0.944	0.921	0.807
	Enhancing Digital Security and Trust	0.820	0.874	0.819	0.582
	Overall Statistics for Antecedents of Service Innovation	0.968	0.970	0.971	0.556
Components and Indicators of Service Innovation	Need-Based Service Innovation	0.961	0.967	0.962	0.787
	Experience-Based Service Innovation	0.954	0.963	0.956	0.814
	Value-Based Service Innovation	0.910	0.930	0.912	0.690
	Overall Statistics for Service Innovation Components and Indicators	0.977	0.979	0.978	0.701
Outcomes of Service Innovation	Enhancement of Positioning	0.792	0.864	0.816	0.614
	Enhancement of Communication Channels	0.869	0.911	0.871	0.718
	Customer Behavior-Based Branding	0.828	0.897	0.830	0.744
	Productivity Increase	0.827	0.885	0.829	0.658
	Reduction of Operational Costs	0.769	0.867	0.772	0.684
	Service Quality Improvement	0.869	0.920	0.870	0.793
	Collaboration in the Digital Ecosystem	0.797	0.881	0.800	0.711
	Creation of Social Value and Digital Sustainability	0.800	0.882	0.803	0.714
	Overall Statistics for Outcomes of Service Innovation	0.955	0.959	0.960	0.574

According to the data in Table 3, the reliability indices for the latent variables are within an appropriate range, indicating that the research instrument has acceptable reliability.

In this section, construct validity is evaluated in terms of convergent validity and discriminant validity.

Table 4. Results of the Average Variance Extracted (AVE) Test

Main Category	Subcategory	AVE
Antecedents of Service Innovation	Adoption of Competitive Behavior	0.791
	Strategic Agility	0.742
	Competitive Intelligence	0.662
	Innovative Customer Interaction	0.723
	Strengthening Loyalty Through Innovative Services	0.782
	Advanced Customer Behavior Analysis	0.728
	Application of Modern Technologies	0.818
	Integration of Service Channels	0.836
	Innovation in Banking Business Models	0.807
	Enhancing Digital Security and Trust	0.582
	Overall Statistics for Antecedents of Service Innovation	0.556
Components and Indicators of Service Innovation	Need-Based Service Innovation	0.787
	Experience-Based Service Innovation	0.814
	Value-Based Service Innovation	0.690
	Overall Statistics for Service Innovation Components and Indicators	0.701
Outcomes of Service Innovation	Enhancement of Positioning	0.614
	Enhancement of Communication Channels	0.718
	Customer Behavior-Based Branding	0.744
	Productivity Increase	0.658
	Reduction of Operational Costs	0.684
	Service Quality Improvement	0.793
	Collaboration in the Digital Ecosystem	0.711
	Creation of Social Value and Digital Sustainability	0.714
	Overall Statistics for Outcomes of Service Innovation	0.574

The results in Table 4 indicate that the AVE values for all variables are greater than 0.5; therefore, the initial condition for convergent validity is satisfied.

Table 5. Comparison of Composite Reliability and Average Variance Extracted

Main Category	Subcategory	AVE	CR
Antecedents of Service Innovation	Adoption of Competitive Behavior	0.791	0.919
	Strategic Agility	0.742	0.935
	Competitive Intelligence	0.662	0.885
	Innovative Customer Interaction	0.723	0.929
	Strengthening Loyalty Through Innovative Services	0.782	0.915
	Advanced Customer Behavior Analysis	0.728	0.915
	Application of Modern Technologies	0.818	0.931
	Integration of Service Channels	0.836	0.939
	Innovation in Banking Business Models	0.807	0.944
	Enhancing Digital Security and Trust	0.582	0.874
	Overall Statistics for Antecedents of Service Innovation	0.556	0.970
Components and Indicators of Service Innovation	Need-Based Service Innovation	0.787	0.967
	Experience-Based Service Innovation	0.814	0.963
	Value-Based Service Innovation	0.690	0.930
	Overall Statistics for Service Innovation Components and Indicators	0.701	0.979
Outcomes of Service Innovation	Enhancement of Positioning	0.614	0.864
	Enhancement of Communication Channels	0.718	0.911
	Customer Behavior-Based Branding	0.744	0.897
	Productivity Increase	0.658	0.885
	Reduction of Operational Costs	0.684	0.867
	Service Quality Improvement	0.793	0.920
	Collaboration in the Digital Ecosystem	0.711	0.881
	Creation of Social Value and Digital Sustainability	0.714	0.882
	Overall Statistics for Outcomes of Service Innovation	0.574	0.959

Based on the data in Table 5, the CR values for all latent variables exceed their respective AVE values. Therefore, the second condition for convergent validity is met, indicating that the research model possesses convergent validity.

In this section, two tests—Fornell and Larcker, and the heterotrait–monotrait (HTMT) ratio as a multi-trait, multi-method approach—are used to assess the discriminant validity of the indicators.

Table 6. Results of the Fornell–Larcker Test

	Components and Indicators of Service Innovation	Outcomes of Service Innovation	Antecedents of Service Innovation
Components and Indicators of Service Innovation	0.837		
Outcomes of Service Innovation	0.764	0.757	
Antecedents of Service Innovation	0.640	0.723	0.745

According to the data in Table 6, it can be observed that the square root of the AVE for each variable is greater than its correlations with other variables. Therefore, the discriminant validity of the variables is confirmed.

Table 7. Results of the HTMT Test

	Components and Indicators of Service Innovation	Outcomes of Service Innovation	Antecedents of Service Innovation
Components and Indicators of Service Innovation			
Outcomes of Service Innovation	0.693		
Antecedents of Service Innovation	0.778	0.772	

With reference to Table 7, it is evident that, in addition to reliability, the model also enjoys construct validity, including both convergent and discriminant validity.

These tests are conducted after evaluating the validity and generalizability of the model results in the measurement section and ensuring the appropriate quality of the model in predicting outcomes related to the causal relationships among latent variables.

In this test, the researcher subjects the pattern derived in the research design—based on the qualitative phase results—to partial least squares estimation. The results of the significance test are presented in Table 8.

Table 8. Results of the Test of Significance, Strength, and Direction of Relationships Between Indicators

Row	Path	Path Coefficient (β)	T-Value	P-Value	Test Result
1	Components and indicators of service innovation ← Value-based service innovation	0.913	84.708	0.000	Confirmed
2	Components and indicators of service innovation ← Experience-based service innovation	0.970	283.082	0.000	Confirmed
3	Components and indicators of service innovation ← Need-based service innovation	0.976	287.594	0.000	Confirmed
4	Components and indicators of service innovation ← Outcomes of service innovation	0.640	14.788	0.000	Confirmed
5	Outcomes of service innovation ← Enhancement of positioning	0.652	15.284	0.000	Confirmed
6	Outcomes of service innovation ← Enhancement of communication channels	0.638	13.457	0.000	Confirmed
7	Outcomes of service innovation ← Service quality improvement	0.881	61.051	0.000	Confirmed
8	Outcomes of service innovation ← Productivity increase	0.883	64.669	0.000	Confirmed
9	Outcomes of service innovation ← Creation of social value and digital sustainability	0.894	70.783	0.000	Confirmed
10	Outcomes of service innovation ← Customer behavior-based branding	0.891	75.478	0.000	Confirmed
11	Outcomes of service innovation ← Collaboration in the digital ecosystem	0.877	65.414	0.000	Confirmed
12	Outcomes of service innovation ← Reduction of operational costs	0.878	56.305	0.000	Confirmed

13	Antecedents of service innovation ← Adoption of competitive behavior	0.723	18.365	0.000	Confirmed
14	Antecedents of service innovation ← Enhancement of digital security and trust	0.866	54.559	0.000	Confirmed
15	Antecedents of service innovation ← Application of modern technologies	0.812	34.886	0.000	Confirmed
16	Antecedents of service innovation ← Advanced analysis of customer behavior	0.730	20.399	0.000	Confirmed
17	Antecedents of service innovation ← Innovative interaction with customers	0.862	56.852	0.000	Confirmed
18	Antecedents of service innovation ← Strengthening loyalty	0.659	15.281	0.000	Confirmed
19	Antecedents of service innovation ← Components and indicators of service innovation	0.764	21.576	0.000	Confirmed
20	Antecedents of service innovation ← Innovation in business models	0.779	25.694	0.000	Confirmed
21	Antecedents of service innovation ← Competitive intelligence	0.820	34.344	0.000	Confirmed
22	Antecedents of service innovation ← Strategic agility	0.754	21.623	0.000	Confirmed
23	Antecedents of service innovation ← Integration of service channels	0.833	50.004	0.000	Confirmed

According to Table 8, the path coefficients of the main categories, subcategories, and concepts are greater than 0.5, and the significance coefficients meet the conditions T-Value > 1.96 and P-Value < 0.05. This indicates that, at the 99% confidence level, there is a positive and significant relationship among the antecedents, components and indicators, and outcomes of service innovation in the Agricultural Bank, and that all indicators possess good explanatory power.

To examine the overall model fit, the GOF (Goodness of Fit) criterion is used, for which the values 0.01, 0.25, and 0.36 are introduced as weak, medium, and strong levels of GOF, respectively.

This criterion is calculated using the following formula:

$$\text{GOF} = \sqrt{(\overline{Communalities} \times \bar{R^2})}.$$

$\overline{Communalities}$ is obtained from the mean of the communality values of the latent variables in the research, as shown in Table 9.

Table 9. Results of Overall Model Fit

Communality	R²	GOF	SRMR
0.717	0.642	0.678	0.002

Given the GOF value of 0.678 obtained in Table 9, the overall fit of the model is confirmed as being highly satisfactory.

Discussion and Conclusion

The purpose of this study was to validate a comprehensive model of service innovation in the Agricultural Bank by examining the relationships among antecedents, components, indicators, and outcomes of service innovation. The structural equation modeling (SEM) results demonstrated that all hypothesized paths were significant, and the relationships between antecedents, service innovation components, and resulting outcomes were positive and meaningful. These findings indicate that service innovation is not a linear or isolated construct but rather a multidimensional system shaped by technological, organizational, customer-based, and environmental factors. Such a conclusion aligns with broader literature emphasizing the growing sophistication of service innovation ecosystems in digitally transforming industries (1).

One of the most important findings of this study was the strong influence of antecedents—such as competitive behavior, strategic agility, competitive intelligence, use of modern technologies, and customer interaction—on the core components and indicators of service innovation. This result corresponds with prior research showing that intellectual capital, digital readiness, and data analytics capabilities substantially enhance a firm's capacity to innovate in services (17). In highly competitive sectors, such as banking, the ability to adopt strategic agility and integrate competitive intelligence enables organizations to sense market shifts, identify customer needs, and act on emerging opportunities, thereby strengthening innovation performance (2). The significant paths from antecedents to innovation components in this study confirm the theoretical expectation that innovation readiness must precede innovation execution.

Furthermore, the results showed that components of service innovation—including need-based, experience-based, and value-based innovation—played a fundamental mediating role between antecedents and outcomes. These findings align with studies emphasizing the role of customer experience and value co-creation as central mechanisms of modern innovation models. For instance, research in the roadside assistance sector highlights that service innovation grounded in customer experience design can increase satisfaction and perceived service quality (8). Similarly, in the tourism and hospitality domain, innovation driven by experiential value and digital interaction has been shown to improve memorable experiences and influence behavioral outcomes (9). The relationship patterns observed in the Agricultural Bank thus reinforce a broader theoretical movement toward customer-centric innovation frameworks.

The powerful relationship between service innovation components and outcomes—such as improved positioning, enhanced communication channels, service quality elevation, productivity gains, social value creation, and digital sustainability—also aligns with global trends in service innovation research. Studies demonstrate that digital transformation strategies lead to improved service capabilities, higher value creation, and better market performance when organizations embed digital tools within service processes and customer touchpoints (4). Similarly, research on continuous service innovation indicates that collaborative, ecosystem-based approaches can significantly strengthen innovation outcomes, especially in dynamic industries where customer expectations evolve rapidly (3). The present study provides empirical evidence supporting these theoretical claims within the context of Iranian banking.

Additionally, the strong effect of service innovation outcomes on behavioral and operational indicators—such as brand strengthening, reduction of operational costs, productivity increases, and improved service quality—parallels findings from digital retail environments, where smart and automated service systems enhance experiential relationship quality and shopping outcomes (10). In banking, these effects may manifest in improved customer loyalty, reduced transaction friction, and better alignment of financial services with customer needs. Such mechanisms further resonate with studies showing that technology-driven service quality significantly influences consumer satisfaction in digital banking contexts (18).

The study's findings regarding competitive intelligence as a significant antecedent of service innovation echo literature that underscores the strategic value of informed decision-making in innovation ecosystems. Manufacturing and service firms adopting coopetition strategies—where competitiveness coexists with collaboration—demonstrate stronger service innovation outcomes when supported by competitive intelligence and environmental scanning tools (27). The significant path effects from competitive intelligence and modern technology adoption in this study suggest that innovation in banking requires both interpretive capabilities and technological infrastructure.

Another notable finding concerns the role of technological adoption—including advanced analytics, digital platforms, and integrated service channels—as a major predictor of innovation components. This is consistent with studies in healthcare, hospitality, and finance, where AI-enabled CRM systems and smart technologies drive service innovation by improving sensing, responding, and personalization capacities (29). AI-powered service innovation frameworks also argue that data-driven capabilities are necessary for building adaptive and future-oriented service models (5). In the Agricultural Bank, integration of digital channels, enhancement of digital trust, and adoption of new technologies appear to be shaping the foundation for innovative value propositions.

Moreover, the findings related to organizational and employee-related antecedents support research on ethical leadership, employee well-being, and service innovation behavior. For instance, the role of ethical leadership and sleep quality in influencing employees' innovative service behaviors highlights how human resource factors contribute to innovation success (21). Although the current study did not explicitly assess leadership or well-being, the significance of antecedents such as innovative customer interaction and loyalty-building behaviors suggests that human-centered processes remain central to innovation in banking.

The observed relationships also align with studies emphasizing the mediating role of service innovation in enhancing firm performance. Dynamic service innovation capabilities have been shown to significantly influence performance outcomes, particularly in volatile environments, by enabling organizations to adapt and respond effectively to market changes (19). The Agricultural Bank's significant path coefficients similarly reflect the capacity of its service innovation system to reinforce organizational competitiveness and strategic positioning.

In the Iranian context, the findings contribute to an emerging body of research exploring innovation in banking. Studies in Melli Bank and Gardeshgari Bank have demonstrated the importance of dynamic capabilities, customer co-creation, and structural alignment in shaping effective service innovation models (22, 23). The present study adds empirical support by validating a comprehensive model tailored specifically for the Agricultural Bank, emphasizing the interconnectedness of antecedents, innovation components, and outcomes. This is also consistent with research advocating for integrated dynamic capability approaches in Iranian banking systems, where cultural, infrastructural, and technological challenges require holistic modeling techniques (24).

Another important implication of this research lies in the role of sustainability and social value creation. Service innovation is increasingly viewed as a means to support digital sustainability goals and enhance societal well-being. Research in sustainability-oriented business model innovation indicates that service innovation can help organizations contribute to circularity and broader ecological outcomes (12). The significant path coefficients related to social value creation in this study demonstrate that the Agricultural Bank's innovation initiatives may have positive externalities for communities, particularly through improved service accessibility, digital literacy, and financial inclusion.

The findings regarding need-based, experience-based, and value-based innovation as powerful predictors of service innovation outcomes also echo studies across industries. Patient-driven service innovation and customer co-creation frameworks support the idea that users co-produce value by actively participating in innovation processes, thereby improving service system well-being (14). Similarly, the influence of online reviews on innovation types and market performance highlights how customer feedback shapes innovation trajectories in digital service environments (28). Such findings reinforce the importance of integrating customer insights, interaction patterns, and digital footprints into banking innovation strategies.

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Finally, the strong overall model fit (GOF = 0.678) confirms the robustness of the validated service innovation model. This result aligns with systematic reviews asserting that well-constructed service innovation models must integrate technological, organizational, experiential, and strategic dimensions to accurately capture the complexity of service ecosystems (11). It also supports the broader theoretical argument that successful innovation systems require the synergy of antecedents, capabilities, and outcomes within a cohesive framework.

Overall, the findings of this study not only validate the proposed model but also contribute to the body of knowledge by demonstrating the structural and dynamic interplay among antecedents, service innovation components, and outcomes within the context of a major Iranian bank. By situating the results within the wider literature, this study highlights the significance of technological readiness, customer-centric design, competitive intelligence, dynamic capabilities, and sustainability-oriented innovation practices in shaping service innovation performance in modern banking.

This study has several limitations that should be acknowledged. First, data were collected from managers and employees in a single banking institution, which may limit the generalizability of the findings to other banks or financial sectors. Second, the cross-sectional design prevents any causal inference about the direction of relationships beyond statistical modeling. Third, self-reported data may introduce bias, such as social desirability or overestimation of innovation capabilities. Fourth, the study focused primarily on internal organizational factors, while external influences such as regulatory policies, economic conditions, and technological disruptions were not systematically examined. Finally, the model did not incorporate potential moderating variables—such as organizational culture, leadership style, or customer characteristics—which may influence innovation outcomes.

Future studies should consider longitudinal research designs to investigate how service innovation capabilities evolve over time and respond to environmental changes. Comparative studies across multiple banks or financial institutions could enhance the generalizability of findings and identify sector-wide patterns. Researchers may also explore moderating and mediating variables—such as digital maturity, organizational culture, customer trust, or employee empowerment—to deepen understanding of the innovation ecosystem. Additionally, qualitative methods could provide richer insights into the lived experiences of employees and customers involved in service innovation processes. Lastly, future work could examine the impact of emerging technologies such as generative AI, blockchain, and open banking on innovation trajectories.

Managers should strengthen service innovation by investing in technologies that enhance customer experience, data analytics, and process automation. Developing dynamic capabilities such as agility, foresight, and collaborative problem-solving can significantly improve innovation outcomes. Building a culture of innovation—where employees are encouraged to test ideas, learn from failures, and engage with customers—can also support the model's effectiveness. Furthermore, strategic partnerships with fintech firms, technology providers, and customer communities can extend the bank's innovation ecosystem. Finally, organizations should continuously evaluate and refine their innovation strategies to ensure alignment with market needs, digital trends, and long-term sustainability goals.

Acknowledgments

Authors' Contributions

All authors equally contributed to this study.

Declaration of Interest

The authors of this article declared no conflict of interest.

Ethical Considerations

All ethical principles were adheried in conducting and writing this article.

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.

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