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Development of a Customer-Oriented Knowledge Management Model and Its Impact on Service Innovation with the Moderating Role of Evaluation and Feedback

ABSTRACT

The purpose of this study was to develop a customer-oriented knowledge management model and examine its impact on service innovation, with the moderating role of evaluation and feedback, at Sina Bank. The study employed a mixed-methods (qualitative–quantitative) approach. In the qualitative phase, a meta-synthesis method based on the Sandelowski and Barroso framework was used to analyze 22 selected articles drawn from credible domestic and international scientific sources. Based on the coding and synthesis of the findings, customer-oriented knowledge management was identified as comprising four dimensions: customer-oriented knowledge acquisition, customer-oriented knowledge storage, customer-oriented knowledge sharing, and customer-oriented knowledge application. These dimensions, together with service innovation and evaluation and feedback, were incorporated into the conceptual model of the study. In the quantitative phase, the proposed model was tested using a descriptive-exploratory approach and partial least squares structural equation modeling (PLS-SEM). The statistical population consisted of employees working at the central headquarters of Sina Bank in Tehran, from whom 211 participants were selected as the study sample based on the Krejcie and Morgan sample-size table. Data were collected using a researcher-developed questionnaire and analyzed using SmartPLS 3. The findings indicated that customer-oriented knowledge management and its dimensions, including customer-oriented knowledge acquisition, customer-oriented knowledge storage, customer-oriented knowledge sharing, and customer-oriented knowledge application, had positive and statistically significant effects on service innovation. Furthermore, evaluation and feedback played a significant moderating role, positively strengthening the effect of customer-oriented knowledge management on service innovation. In addition, the proposed model demonstrated satisfactory fit and effectively explained service innovation. Accordingly, establishing a customer-oriented knowledge management system, together with the systematic application of evaluation and feedback mechanisms, can facilitate the development of service innovation, improve service quality, enhance customer satisfaction, and strengthen the competitive advantage of banks.

Keywords: Customer-Oriented Knowledge Management, Service Innovation, Evaluation and Feedback, Meta-Synthesis, Structural Equation Modeling

Introduction

The contemporary service economy is increasingly shaped by rapid technological change, intensified competition, evolving customer expectations, and the growing strategic importance of intangible organizational resources. Under these conditions, service organizations can no longer rely solely on physical assets, standardized offerings, or conventional operational efficiencies to maintain competitiveness. Their ability to acquire, organize, share, and apply knowledge has become central

to the development of differentiated services and the creation of sustainable customer value. This challenge is particularly important in financial services, where products are relatively easy to imitate and competitive differentiation increasingly depends on the quality, personalization, accessibility, and innovativeness of services. The literature on service innovation has long emphasized that innovation in services differs from conventional product innovation because it frequently involves changes in customer interfaces, delivery systems, organizational arrangements, technological processes, and value-creation mechanisms rather than the introduction of a tangible product alone [1]. Accordingly, successful service innovation requires organizational capabilities that enable firms to coordinate knowledge, technology, customer interaction, and internal processes in a systematic manner [2]. In the current digital environment, these requirements have become even more pronounced as knowledge-intensive and customer-facing organizations attempt to respond rapidly to market signals while simultaneously improving the customer experience.

Knowledge management provides an important organizational infrastructure for such adaptation because it facilitates the identification, acquisition, storage, dissemination, and utilization of strategically valuable knowledge. However, the mere existence of knowledge management systems does not necessarily generate innovation. The value of knowledge depends on how effectively it is transformed into organizational decisions, new service concepts, improved processes, and customer solutions. Research on knowledge management systems has therefore increasingly distinguished between traditional approaches focused primarily on documentation and storage and more innovation-oriented approaches in which knowledge is continuously mobilized for learning, experimentation, and organizational renewal [3]. Digitalization has further transformed this process by enabling organizations to integrate large volumes of heterogeneous information, automate knowledge flows, enhance accessibility, and support faster decision-making across organizational boundaries [4]. Moreover, emerging artificial intelligence applications can strengthen innovation management capabilities by improving data analysis, opportunity recognition, forecasting, idea generation, and decision support, thereby creating new possibilities for converting organizational and customer data into actionable knowledge [5]. These developments suggest that knowledge management should increasingly be conceptualized not as a passive repository of information but as a dynamic organizational capability closely connected with innovation.

Among the different forms of organizational knowledge, customer knowledge has particular strategic significance because customers constitute one of the most important sources of information regarding changing needs, preferences, expectations, experiences, complaints, and emerging patterns of demand. Customer knowledge management extends conventional knowledge management by systematically integrating knowledge about customers, knowledge for customers, and knowledge obtained from customers into organizational processes and decision-making. Such an approach allows firms to move from internally oriented knowledge practices toward a more customer-centered logic in which customer information is continuously transformed into market intelligence and service improvements. In this regard, customer relationship management and knowledge management are increasingly viewed as complementary rather than independent managerial systems. Evidence indicates that the integration of customer relationship management with knowledge management can strengthen customer satisfaction, profitability, and loyalty by improving the organization's understanding of customer needs and its ability to respond effectively to them [6]. Similarly, a knowledge-enabled customer-centric strategy requires the redesign of organizational processes so that customer information is embedded in operational and strategic decision-making rather than remaining fragmented across separate organizational functions [7].

The banking industry provides a particularly important setting for examining customer-oriented knowledge management. Banks interact with large numbers of customers through physical branches, digital platforms, mobile applications, call centers, automated systems, and increasingly data-driven service channels. These interactions continually generate information about financial behaviors, service preferences, transaction patterns, customer problems, and expectations. Nevertheless, the availability of large amounts of customer data does not in itself guarantee customer knowledge. Data must be accurately acquired, meaningfully organized, securely stored, appropriately shared across organizational units, and effectively applied to service design and delivery. In the banking context, the integration of customer knowledge management with customer relationship management has therefore been proposed as a mechanism for improving customer understanding and strengthening organizational responses to market requirements [8]. Furthermore, the growing importance of digital transformation has encouraged banks to adopt more open and networked forms of innovation in which internal capabilities are combined with external ideas, technologies, and stakeholder knowledge [9]. These developments highlight the need for banking organizations to establish customer-oriented knowledge systems that connect information collection with organizational learning and service innovation.

A customer-centric orientation also requires organizations to move beyond simply collecting information about customers and to involve customers more directly in value creation. Customer participation can provide organizations with contextual and experiential knowledge that may not be available through conventional market research. Such participation can strengthen innovation capacity when firms possess the dynamic capabilities required to absorb, interpret, and use customer knowledge effectively [10]. Similarly, customer knowledge sharing can improve organizational and employee capabilities by enriching customer relationship management processes and facilitating more informed responses to customer needs [11]. These mechanisms are especially important in service organizations because customers frequently participate directly in service production and consumption. Their experiences therefore constitute a valuable source of knowledge for identifying service failures, unmet needs, opportunities for customization, and possible innovations. As organizations become more customer-centered, knowledge acquisition should thus be understood not merely as a technical data-gathering activity but as an interactive process through which the organization develops a more accurate and dynamic understanding of customers.

The value of customer knowledge also depends substantially on how it is stored and integrated. Fragmented databases, incompatible information systems, weak standardization, limited accessibility, and inadequate security can restrict the organization's ability to convert customer information into useful knowledge. Effective knowledge storage requires technological infrastructure as well as rules for classification, integration, access, updating, confidentiality, and organizational ownership. In contemporary financial organizations, these issues are particularly sensitive because customer knowledge frequently includes confidential financial and behavioral information. At the same time, knowledge must remain sufficiently accessible to support innovation and customer-facing decisions. Research on knowledge-intensive business services indicates that knowledge resources and organizational capabilities constitute important antecedents of innovation, particularly where firms must combine specialized expertise with the ability to respond to changing customer requirements [12]. Accordingly, customer-oriented knowledge storage should provide more than archival functionality; it should establish a usable and integrated organizational memory from which employees and decision-makers can draw when designing and improving services.

Knowledge sharing represents another critical component of customer-oriented knowledge management. Even when high-quality customer knowledge has been acquired and securely stored, its strategic value remains limited if knowledge is confined to specific departments or individuals. Service innovation frequently requires cooperation among marketing, information technology, operations, customer service, strategy, and other organizational units. The sharing of customer knowledge across such boundaries facilitates collective interpretation and enables different functions to integrate their expertise around customer needs. External knowledge flows are similarly important. Research has demonstrated that the interaction of external knowledge, internal innovation, open innovation performance, and service innovation can contribute to broader organizational performance [13]. Inter-organizational trust and network relationships may also facilitate service innovation by enabling organizations to access complementary knowledge and capabilities beyond their formal boundaries [14]. From this perspective, effective knowledge sharing requires not only technological platforms but also an organizational culture that supports collaboration, trust, transparency, and incentives for knowledge exchange.

The final value of customer knowledge is realized through its application. Customer-oriented knowledge application refers to the conversion of acquired, stored, and shared knowledge into decisions and activities that improve services, customize offerings, redesign processes, and generate innovative customer solutions. Research conducted in small and medium-sized enterprises has linked customer knowledge management with innovation quality and organizational performance, demonstrating the strategic importance of connecting knowledge practices with innovation-related outcomes [15]. Similarly, customer knowledge management has been associated with innovation quality through strategic agility, suggesting that organizations capable of rapidly interpreting and responding to knowledge can translate customer insight into more effective innovation [16]. More broadly, empirical evidence indicates that knowledge management processes and customer relationship management can jointly stimulate innovation capability, reinforcing the argument that innovation depends not only on possessing knowledge but also on organizational mechanisms for converting that knowledge into action [17]. Customer-oriented knowledge application is therefore a crucial bridge between knowledge resources and service innovation.

Service innovation itself has become a fundamental source of competitiveness in increasingly dynamic service markets. It may involve the introduction of new services, substantial improvement of existing services, adoption of new technologies, redesign of delivery processes, customization, new interaction mechanisms, or changes in organizational arrangements supporting service provision. Dynamic service innovation capabilities can contribute to firm performance both directly and indirectly through competitive advantage, while the effectiveness of such capabilities may depend on environmental conditions [18]. In addition, co-creation and technological innovation can enhance service innovation and organizational performance by integrating customer involvement with technological capabilities [19]. These findings are consistent with the broader view that service innovation is not an isolated output but rather the consequence of interconnected organizational capabilities, resources, knowledge flows, and stakeholder interactions.

Recent developments further reinforce the importance of customer knowledge for service innovation. Open innovation emphasizes the use of internal and external knowledge sources to accelerate innovation and improve the relevance of new offerings. Service customization, in particular, benefits from open innovation practices because organizations must obtain diverse knowledge about customer preferences while also drawing on external capabilities and ideas [20]. Similarly, studies of sustainable innovation ecosystems in service-related industries point to the importance of multidimensional networks, actors, capabilities, and information exchanges in sustaining innovation over time [21]. In the financial sector, customer-

centric service design has emerged as a practical mechanism through which organizations can translate customer insights into redesigned services and organizational practices. Research on financial organizations indicates that service design can support the implementation of customer-centric strategies by aligning organizational processes with customer needs and experiences [22]. These perspectives collectively suggest that the innovation process becomes more effective when organizations systematically embed customer knowledge throughout the stages of service development.

Artificial intelligence and advanced analytics are also changing the relationship between customer knowledge and service innovation. Digital service organizations increasingly use algorithmic tools to identify behavioral patterns, segment customers, predict preferences, automate interactions, and generate personalized service recommendations. In service innovation, artificial intelligence can create new possibilities for integrating customer experience data with design and innovation methods, allowing firms to identify needs and opportunities with greater speed and granularity [23]. Nevertheless, technology alone cannot ensure customer-centered innovation. Analytical outputs must be interpreted in relation to strategic objectives, organizational experience, customer feedback, and ethical considerations. Therefore, the effectiveness of AI-enabled and digitally mediated knowledge management ultimately depends on organizational processes that connect technological insight with human judgment and customer-centered decision-making.

Within this process, evaluation and feedback constitute an especially important mechanism because organizations need continuous information about whether newly developed or modified services actually meet customer expectations. Innovation should not be regarded as complete when a new service is introduced; rather, it requires ongoing evaluation of customer satisfaction, acceptance, complaints, loyalty, effectiveness, and alignment with strategic objectives. Customer feedback can reveal discrepancies between intended and experienced service value and can provide new knowledge for subsequent rounds of improvement. This recursive relationship means that evaluation and feedback may strengthen the extent to which customer-oriented knowledge management is translated into effective service innovation. Organizations that acquire and use customer knowledge but lack systematic feedback mechanisms may fail to recognize whether innovations have generated the intended outcomes. Conversely, feedback-responsive organizations can refine their knowledge base continuously and use customer responses to modify service design, delivery, and personalization. This logic is compatible with customer-centric and co-creation perspectives, in which service innovation is understood as an iterative process involving repeated interaction between organizational knowledge and customer experience [19, 22].

Despite the growing literature on knowledge management, customer relationship management, dynamic capabilities, digital innovation, customer participation, and service innovation, several conceptual and empirical issues remain. First, many studies examine customer knowledge management as a relatively aggregated construct, while less attention is given to the potentially distinct roles of knowledge acquisition, storage, sharing, and application in explaining service innovation. Second, although prior research has established relationships among knowledge management, innovation capability, strategic agility, customer participation, and organizational performance [10, 16, 17], a more integrated understanding is needed of how different customer-oriented knowledge management dimensions collectively contribute to service innovation. Third, research on service innovation emphasizes multiple organizational, technological, relational, and dynamic capabilities [2, 18], yet the role of systematic evaluation and customer feedback in modifying the knowledge management–service innovation relationship remains comparatively underdeveloped. Finally, although digital and open innovation have received increasing attention in banking and other service industries [4, 9], further context-specific evidence is needed from banking

organizations operating in environments where customer expectations, technological transformation, competitive pressures, and regulatory requirements are changing simultaneously.

Addressing these gaps requires an approach capable of integrating fragmented findings from prior research and subsequently validating the resulting framework empirically. A meta-synthesis approach can provide a systematic basis for identifying recurring dimensions and indicators across the existing literature, while quantitative structural equation modeling can examine whether these theoretically derived relationships are supported within an organizational setting. Such an integrated approach is especially suitable for constructs such as customer-oriented knowledge management and service innovation, whose complexity cannot be adequately captured through a single isolated dimension. By combining evidence from prior scholarship with empirical assessment among banking employees, it becomes possible to clarify the mechanisms through which customer knowledge is transformed into innovative service outcomes and to assess whether evaluation and feedback strengthen this transformation.

Accordingly, the present study aimed to develop and empirically validate a model of the effect of customer-oriented knowledge management and its dimensions of knowledge acquisition, storage, sharing, and application on service innovation, while examining the moderating role of evaluation and feedback among employees of the central headquarters of Sina Bank in Tehran.

Methodology

The present study was applied in terms of its objective and employed a mixed-methods design integrating qualitative and quantitative approaches. In the first phase, a qualitative meta-synthesis was conducted to identify the dimensions, components, and indicators of customer-oriented knowledge management and service innovation. The meta-synthesis procedure was based on the framework proposed by Sandelowski and Barroso (2006). Relevant studies were identified through a systematic search of Google Scholar, Web of Science, ScienceDirect, and Scopus. The retrieved studies were screened according to predetermined inclusion and exclusion criteria through three successive stages involving examination of titles, abstracts, and full texts. Following the screening process, 22 eligible studies were retained for the final meta-synthesis. The concepts and findings reported in these studies were systematically extracted, coded, compared, categorized, and synthesized to identify the principal dimensions and indicators relevant to the research constructs. The resulting categories were subsequently integrated to develop the initial conceptual model of the study. The quality and methodological rigor of the qualitative phase were assessed according to Lincoln and Guba's criteria of credibility, transferability, dependability, and confirmability. To further assess the consistency of the coding process, inter-rater agreement was examined using Cohen's kappa coefficient. The obtained coefficient was 0.892, indicating a very high level of agreement between the evaluators and supporting the reliability of the coding and categorization process.

In the second, quantitative phase, a cross-sectional survey design was employed to validate the conceptual model derived from the qualitative meta-synthesis and to test the proposed research hypotheses. The statistical population consisted of 460 employees working at the central headquarters of Sina Bank in Tehran, Iran. The required sample size was initially estimated at 210 employees based on the Krejcie and Morgan sample-size determination table. To enhance the precision and adequacy of the quantitative analysis, 211 employees were ultimately selected through proportionate stratified random sampling, thereby allowing the different strata of the organizational population to be appropriately represented in the final

sample. Of the 211 participants, 125 (59.2%) were men and 86 (40.8%) were women. Regarding marital status, 160 respondents (75.6%) were married and 51 (24.4%) were single. In terms of age, 10 participants (4.7%) were younger than 25 years, 126 (59.7%) were between 25 and 35 years, 56 (26.5%) were between 36 and 45 years, and 19 (9.0%) were older than 45 years. With respect to educational attainment, 48 participants (22.7%) held a bachelor's degree, 112 (53.1%) held a master's degree, and 51 (24.2%) held a doctoral degree. These demographic characteristics indicated that the largest proportion of respondents were male, married, between 25 and 35 years of age, and educated at the master's degree level.

Data collection in the qualitative phase was based on a structured extraction and coding process applied to the 22 studies that satisfied the eligibility criteria of the meta-synthesis. Relevant concepts, dimensions, components, indicators, and relationships associated with customer-oriented knowledge management and service innovation were extracted from the selected studies and subjected to systematic coding and conceptual integration. Through repeated comparison and synthesis of conceptually similar codes, higher-order categories and dimensions were developed, which formed the basis of the initial research model. The trustworthiness of the qualitative findings was addressed through the criteria of credibility, transferability, dependability, and confirmability, while Cohen's kappa coefficient was used to quantify agreement in the coding of the reviewed studies. The kappa value of 0.892 demonstrated strong consistency between evaluators and provided evidence for the dependability of the extracted qualitative categories.

For the quantitative phase, data were collected using a researcher-developed questionnaire constructed on the basis of the dimensions, components, and indicators obtained from the qualitative meta-synthesis. Thus, the measurement instrument was directly grounded in the conceptual findings of the first phase rather than being adopted from a single pre-existing questionnaire. The items were formulated to operationalize the identified constructs and were scored using a five-point Likert-type scale, enabling respondents to indicate the extent of their agreement with each statement. The content validity of the questionnaire was evaluated through expert review, including assessment by the research supervisor, to determine the appropriateness, relevance, and consistency of the items with the conceptual dimensions identified during the qualitative phase. Following this evaluation, the questionnaire was refined where necessary before administration to the main sample. The reliability of the instrument was examined through a pilot study involving 30 completed questionnaires. Internal consistency was assessed by calculating Cronbach's alpha coefficients, and the resulting coefficients indicated satisfactory reliability of the questionnaire and its underlying dimensions. After confirming the adequacy of its validity and reliability, the finalized questionnaire was administered to the 211 employees selected for participation in the quantitative phase.

Qualitative data analysis was conducted according to the principles of meta-synthesis. After the systematic identification and screening of relevant publications, the findings of the 22 eligible studies were carefully extracted and subjected to coding. Similar concepts were compared and grouped into conceptually coherent categories, and these categories were subsequently synthesized into broader components and dimensions. This iterative process of extraction, coding, comparison, categorization, and integration was continued until a coherent conceptual structure representing customer-oriented knowledge management and service innovation was obtained. The final outcome of the qualitative analysis was an initial conceptual model that specified the principal constructs and indicators subsequently operationalized and tested in the quantitative phase. Agreement between evaluators during the coding process was examined by Cohen's kappa coefficient, with a value of 0.892 supporting a high degree of coding consistency.

The quantitative data were analyzed using SPSS and SmartPLS software. Descriptive statistical procedures were first employed to summarize the characteristics of the participants and the distributions of the study variables. These analyses included frequency and percentage for categorical variables and mean and standard deviation for continuous or composite study variables. Inferential analysis was subsequently performed using partial least squares structural equation modeling (PLS-SEM). This approach was employed to evaluate both the measurement and structural components of the proposed model and to test the hypothesized relationships among the study constructs. The measurement model was assessed to determine the adequacy of the indicators in representing their respective latent constructs and to establish the reliability and validity of the measurement structure. Following confirmation of the measurement model, the structural model was examined to evaluate the magnitude and statistical significance of the hypothesized relationships among the latent variables and to assess the explanatory performance of the proposed conceptual framework. Accordingly, the quantitative phase provided an empirical assessment of the model initially developed through the qualitative meta-synthesis and enabled the research hypotheses concerning the relationships among customer-oriented knowledge management, service innovation, and the associated model components to be formally tested.

Findings and Results

Following completion of the systematic literature search, the identified studies were entered into the meta-synthesis process according to the predefined inclusion and exclusion criteria. The retrieved records were screened sequentially on the basis of their titles, abstracts, full texts, and methodological quality. A total of 256 studies were initially identified across the selected databases. After the removal of duplicate records and studies that did not meet the eligibility criteria, 22 articles were ultimately retained for inclusion in the meta-synthesis. The distribution of the initially identified studies across the searched databases is presented in Table 1.

Table 1

Summary of the Database Search Results

Database	Number of Articles	Database	Number of Articles
Google Scholar	151	ScienceDirect	32
Web of Science	49	Scopus	24
Total	256		

Following selection of the eligible studies, the required information was systematically extracted and organized into initial codes. Conceptually similar codes were then compared, integrated, and classified through an iterative process of synthesis. Through this procedure, the initial codes were progressively organized into higher-order components and dimensions representing the principal constructs of the study. The results of the coding and conceptual classification process are presented in Table 2. The meta-synthesis identified customer-oriented knowledge management as a multidimensional construct comprising customer-oriented knowledge acquisition, customer-oriented knowledge storage, customer-oriented knowledge sharing, and customer-oriented knowledge application. Service innovation and evaluation and feedback were also identified as key components of the resulting conceptual framework.

Table 2*Coding and Classification of the Research Constructs*

Main Construct	Dimension	Indicators
Customer-Oriented Knowledge Management	Customer-Oriented Knowledge Acquisition	Accuracy and validity of collected data; frequency and speed of collecting customer information; degree of customer participation and cooperation in providing information; capacity to analyze customer behavior; use of intelligent tools to understand customers; depth of the information collected
Customer-Oriented Knowledge Management	Customer-Oriented Knowledge Storage	Efficiency of database management systems; degree of data and information standardization; rapid and convenient accessibility for internal bank users; security and confidentiality of customer information; degree of data integration across different organizational units and systems
Customer-Oriented Knowledge Management	Customer-Oriented Knowledge Sharing	Availability of technological platforms for knowledge sharing; organizational culture supportive of knowledge transfer; level of interaction and collaboration among employees and organizational units; transparency and efficiency of the information-transfer process; frequency of meetings and sessions intended to create knowledge synergy; organizational motivations and incentives for knowledge sharing
Customer-Oriented Knowledge Management	Customer-Oriented Knowledge Application	Degree of service personalization based on customer knowledge; speed of designing or redesigning new services; use of data analytics in service-design decisions; degree of alignment between services and customers' actual needs; degree of innovation in service packages based on customer insights; utilization of interdisciplinary teams in service design
Service Innovation	Service Innovation	Number of new services developed on the basis of customer knowledge; degree of differentiation of new services from those of competitors; level of customer acceptance of innovative services; speed of introducing new services to the market; extent of the bank's investment in knowledge-based innovation; success rate of new services in achieving predetermined objectives
Evaluation and Feedback	Evaluation and Feedback	Level of customer satisfaction with new services; customer loyalty and retention rate following the introduction of innovations; number or extent of complaints and negative feedback regarding new services; frequency and quality of innovation-effectiveness assessments; speed of the bank's response to customer feedback; rate of service improvement following receipt of feedback; comparison of innovative-service performance with the bank's strategic objectives

To empirically test the conceptual model derived from the qualitative phase and examine the research hypotheses, partial least squares structural equation modeling (PLS-SEM) was conducted using SmartPLS 3. Model evaluation was performed in two stages: assessment of the measurement model and assessment of the structural model.

In the first stage, the outer loadings of the measurement items were examined. The results indicated that the factor loadings of all items exceeded the minimum acceptable threshold of 0.40. Accordingly, no item was removed from the model, and all indicators were retained for subsequent assessment of the reliability and validity of the measurement model.

After establishing satisfactory indicator loadings, the reliability and convergent validity of the measurement model were evaluated using Cronbach's alpha, composite reliability (CR), and average variance extracted (AVE). Cronbach's alpha and composite reliability were used to assess the internal consistency of the constructs, whereas AVE was employed to evaluate convergent validity. As shown in Table 3, Cronbach's alpha and composite reliability values for all constructs exceeded the recommended threshold of 0.70, while all AVE values were greater than 0.50. These findings indicate satisfactory internal consistency reliability and convergent validity for all constructs included in the measurement model.

Table 3*Cronbach's Alpha, Composite Reliability, and Average Variance Extracted*

Construct	Dimension	Cronbach's Alpha	Composite Reliability	AVE
Customer-Oriented Knowledge Management	Knowledge Acquisition	0.871	0.905	0.622
	Knowledge Storage	0.898	0.924	0.710
	Knowledge Sharing	0.844	0.883	0.558
	Knowledge Application	0.842	0.884	0.568
Service Innovation	—	0.897	0.923	0.672
Evaluation and Feedback	—	0.852	0.887	0.532

Discriminant validity was subsequently examined using the Fornell–Larcker criterion. Under this criterion, the square root of the AVE for each latent construct is compared with its correlations with the other constructs, with adequate discriminant validity generally indicated when the square root of the AVE is greater than the corresponding inter-construct correlations.

The Fornell–Larcker matrix reported for the study constructs is presented in Table 4. The diagonal values represent the values reported for the individual constructs, whereas the values below the diagonal represent correlations between the constructs. Because the reported matrix contains values that require comparison with the corresponding AVE estimates, interpretation of discriminant validity should be made in conjunction with the AVE results presented in Table 3.

Table 4

Discriminant Validity Based on the Fornell–Larcker Criterion

Construct	Knowledge Sharing	Knowledge Storage	Service Innovation	Knowledge Application	Knowledge Acquisition
Knowledge Sharing	0.771				
Knowledge Storage	0.678	0.845			
Service Innovation	0.677	0.847	0.772		
Knowledge Application	0.565	0.743	0.691	0.755	
Knowledge Acquisition	0.670	0.469	0.513	0.680	0.732

Following assessment of the measurement model, the structural model was evaluated using the coefficient of determination (R^2) and predictive relevance (Q^2). The R^2 coefficient indicates the proportion of variance in an endogenous construct explained by its predictor variables, whereas Q^2 reflects the model's predictive relevance for the constructs under consideration. As shown in Table 5, the R^2 value for service innovation was 0.982, indicating that the predictors included in the structural model explained a very substantial proportion of the variance in service innovation.

Table 5

Coefficient of Determination (R^2)

Endogenous Construct	R^2
Service Innovation	0.982

The predictive relevance results are presented in Table 6. All reported Q^2 coefficients were positive, ranging from 0.378 to 0.532. The highest reported Q^2 value was observed for knowledge storage (0.532), followed by service innovation (0.517), knowledge acquisition (0.461), knowledge application (0.407), knowledge sharing (0.380), and evaluation and feedback (0.378). Overall, the positive Q^2 values provided evidence of predictive relevance for the corresponding components of the model.

Table 6

Predictive Relevance (Q^2)

Construct	Dimension	Q^2
Customer-Oriented Knowledge Management	Knowledge Acquisition	0.461
	Knowledge Storage	0.532
	Knowledge Sharing	0.380
	Knowledge Application	0.407
Service Innovation	—	0.517
Evaluation and Feedback	—	0.378

The effect-size coefficient (f^2) was also examined as an additional criterion for evaluating the structural model. In PLS-SEM, f^2 reflects the extent to which an exogenous construct contributes to the explanatory power of an endogenous construct by indicating the change in R^2 that would occur if a particular predictor were removed from the model. According to Cohen's (1988) conventional criteria, f^2 values of approximately 0.02, 0.15, and 0.35 indicate small, medium, and large effects, respectively. As shown in Table 7, customer-oriented knowledge acquisition had an exceptionally large effect on service

innovation ($f^2 = 3.32$), as did customer-oriented knowledge storage ($f^2 = 2.68$) and customer-oriented knowledge application ($f^2 = 1.30$). Customer-oriented knowledge sharing produced a comparatively smaller effect ($f^2 = 0.14$), which was slightly below the conventional threshold of 0.15 for a medium effect. These findings indicate that knowledge acquisition, storage, and application made particularly substantial contributions to the explanatory power of the structural model.

Table 7

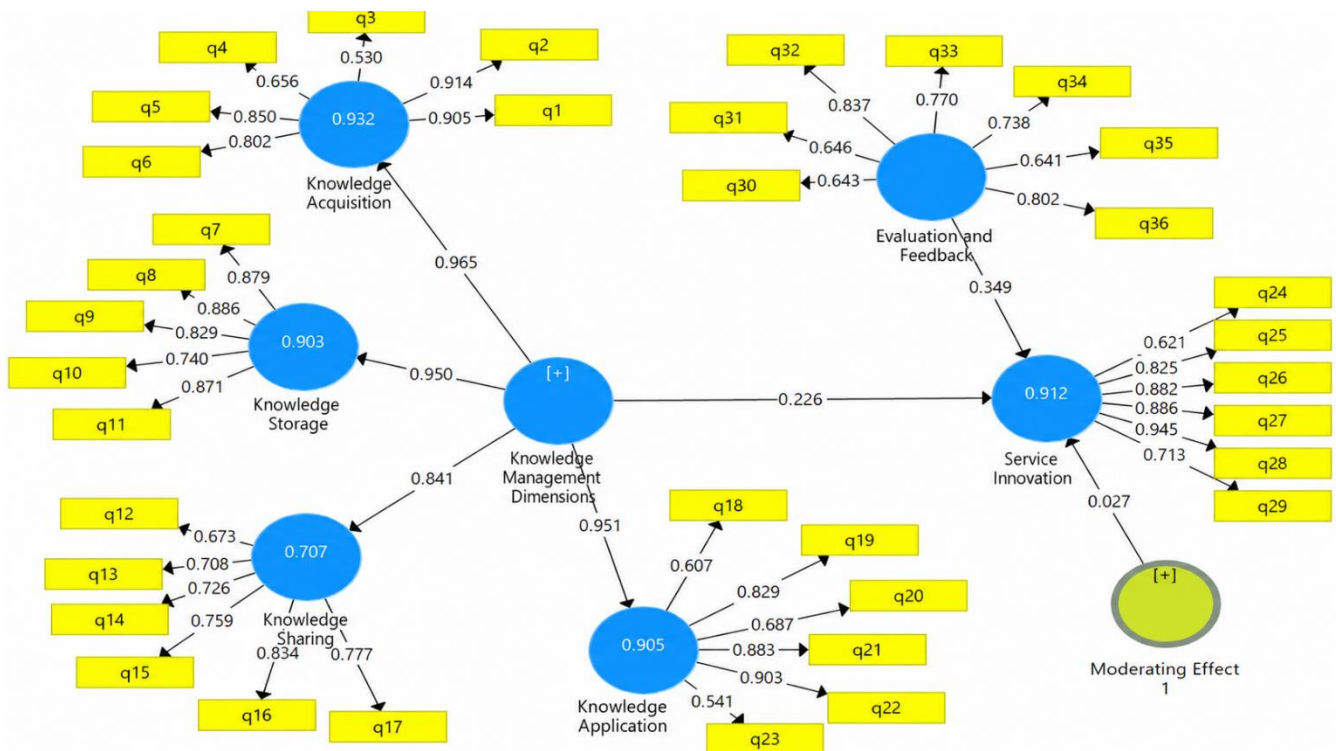
Effect Sizes (f^2)

Structural Relationship	f^2
Knowledge Acquisition → Service Innovation	3.32
Knowledge Storage → Service Innovation	2.68
Knowledge Sharing → Service Innovation	0.14
Knowledge Application → Service Innovation	1.30

Path coefficients were then examined to determine the magnitude and direction of the relationships between the exogenous and endogenous constructs in the structural model. Larger absolute path coefficients indicate stronger structural relationships, while positive coefficients indicate that increases in the predictor construct are associated with increases in the outcome construct. The standardized path coefficients for the research hypotheses are illustrated in Figure 1.

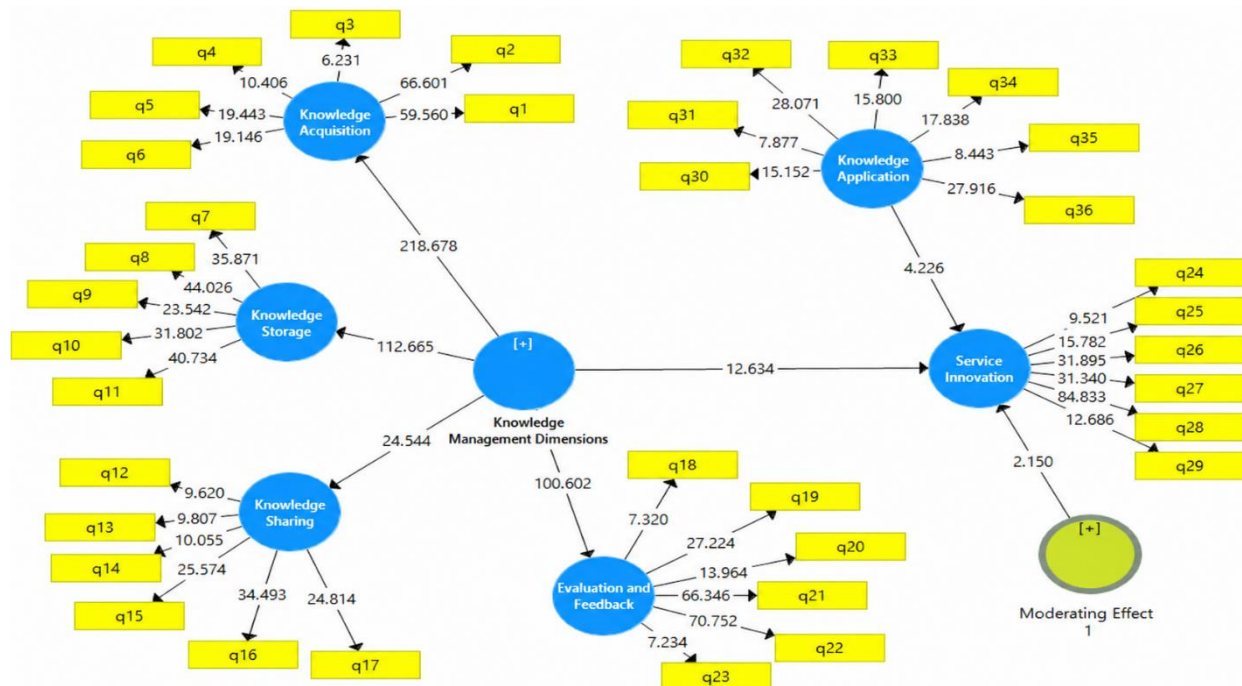
Figure 1

Path Coefficients for the Research Hypotheses



The statistical significance of the structural relationships was evaluated using bootstrapped t-statistics. In PLS-SEM, an absolute t-value greater than 1.96 indicates statistical significance at the 95% confidence level for a two-tailed test. The significance coefficients for the hypothesized relationships are illustrated in Figure 2. All t-values reported for the main hypothesis, the dimensional hypotheses, and the moderating effect exceeded the critical value of 1.96. Consequently, all hypothesized relationships were statistically significant and were supported by the empirical results.

Figure 2
Significance Coefficients (t-Values) for the Research Hypotheses



The detailed hypothesis-testing results are presented in Table 8. Customer-oriented knowledge management had a positive and statistically significant effect on service innovation ($\beta = 0.226$, $t = 12.634$), thereby supporting the main research hypothesis. Among the dimensions of customer-oriented knowledge management, customer-oriented knowledge acquisition exhibited the strongest positive association with service innovation ($\beta = 0.766$, $t = 16.384$). Customer-oriented knowledge storage also had a substantial positive and statistically significant effect on service innovation ($\beta = 0.552$, $t = 15.594$), followed by customer-oriented knowledge application ($\beta = 0.403$, $t = 10.342$). Customer-oriented knowledge sharing showed a smaller but still positive and statistically significant effect on service innovation ($\beta = 0.078$, $t = 3.460$). Thus, all four dimensions of customer-oriented knowledge management significantly contributed to service innovation.

The moderating role of evaluation and feedback was also statistically significant. Specifically, the interaction effect associated with evaluation and feedback in the relationship between customer-oriented knowledge management and service innovation was positive and significant ($\beta = 0.027$, $t = 2.150$). Although the magnitude of this moderating coefficient was relatively small, its t-value exceeded the critical threshold of 1.96, indicating that evaluation and feedback significantly strengthened the relationship between customer-oriented knowledge management and service innovation. Accordingly, the moderating hypothesis was also supported.

Table 8
Path Coefficients and t-Statistics for the Final Structural Model

Hypothesized Path	Path Coefficient (β)	t-Statistic	Result
Customer-Oriented Knowledge Management $\rightarrow$ Service Innovation	0.226	12.634	Supported
Customer-Oriented Knowledge Acquisition $\rightarrow$ Service Innovation	0.766	16.384	Supported
Customer-Oriented Knowledge Storage $\rightarrow$ Service Innovation	0.552	15.594	Supported
Customer-Oriented Knowledge Sharing $\rightarrow$ Service Innovation	0.078	3.460	Supported
Customer-Oriented Knowledge Application $\rightarrow$ Service Innovation	0.403	10.342	Supported
Evaluation and Feedback $\times$ Customer-Oriented Knowledge Management $\rightarrow$ Service Innovation	0.027	2.150	Supported

Discussion and Conclusion

The present study sought to develop and empirically validate a model explaining the effect of customer-oriented knowledge management on service innovation while examining the specific contributions of customer knowledge acquisition, storage, sharing, and application and the moderating role of evaluation and feedback. The findings provided overall support for the proposed conceptual framework. The measurement model demonstrated satisfactory internal consistency and convergent validity, as Cronbach's alpha and composite reliability coefficients exceeded the recommended threshold of 0.70 and the average variance extracted values were above 0.50 for all constructs. At the structural level, customer-oriented knowledge management had a positive and statistically significant effect on service innovation ($\beta = 0.226$, $t = 12.634$). Moreover, each of its four dimensions significantly predicted service innovation: customer-oriented knowledge acquisition exerted the strongest effect ($\beta = 0.766$, $t = 16.384$), followed by knowledge storage ($\beta = 0.552$, $t = 15.594$), knowledge application ($\beta = 0.403$, $t = 10.342$), and knowledge sharing ($\beta = 0.078$, $t = 3.460$). Evaluation and feedback also significantly moderated the relationship between customer-oriented knowledge management and service innovation ($\beta = 0.027$, $t = 2.150$). The structural model exhibited substantial explanatory power, with an R^2 of 0.982 for service innovation, while the positive Q^2 values indicated predictive relevance. Taken together, these results suggest that customer-oriented knowledge management represents an important organizational mechanism through which banking institutions can convert customer-related information and experience into innovative services.

The significant positive relationship between customer-oriented knowledge management and service innovation is consistent with the broader theoretical argument that knowledge constitutes a strategic resource whose value is realized when it is transformed into organizational capabilities and innovation outcomes. The finding supports evidence that knowledge management processes and customer relationship management jointly stimulate innovation capability by improving the organization's capacity to identify, interpret, and respond to customer requirements [17]. It is also consistent with research showing that customer knowledge management is associated with innovation quality and organizational performance [15]. From a resource-based perspective, customer knowledge can be regarded as a valuable and difficult-to-replicate organizational resource when it is embedded within organizational routines, information systems, employee expertise, and customer relationships. Knowledge-intensive organizations therefore achieve stronger innovation outcomes not merely by possessing information but by establishing capabilities that enable that information to be combined and mobilized effectively [12]. The present results extend this reasoning to the banking context by demonstrating that a customer-oriented configuration of knowledge management is closely associated with service innovation.

The result can also be interpreted in light of the multidimensional nature of service innovation. Service innovation requires organizations to integrate customer interfaces, delivery systems, technological options, organizational arrangements, and knowledge-based capabilities [2]. Earlier conceptualizations similarly emphasized that innovation in services is not restricted to the introduction of entirely new services but includes improvements in delivery, customer interaction, organizational processes, and value creation [1]. Consequently, customer-oriented knowledge management can support service innovation at several points in the innovation process. Knowledge about customer preferences can identify innovation opportunities; stored knowledge can provide continuity and organizational memory; knowledge sharing can coordinate innovation activities across functions; and knowledge application can translate insights into new or redesigned services. The present findings are therefore compatible with research showing that the interaction of external knowledge, internal innovation, open innovation

performance, and service innovation contributes to organizational performance [13], as well as research emphasizing that digital innovation can enhance the capability of knowledge management systems to support organizational adaptation and innovation [4].

Among the dimensions examined, customer-oriented knowledge acquisition had the strongest direct effect on service innovation ($\beta = 0.766$) and the largest reported effect size ($f^2 = 3.32$). This result indicates that the ability of a bank to obtain accurate, timely, sufficiently detailed, and behaviorally meaningful information about customers is particularly important for the development of innovative services. Service innovation begins with identifying unmet or emerging customer needs, and inadequate knowledge at this initial stage may result in services that are technologically advanced but poorly aligned with actual customer expectations. The finding is consistent with research emphasizing customer participation as a source of innovation-related knowledge. Customer participation can strengthen innovation capacity by providing firms with direct information about customer experiences and needs, particularly when customer knowledge management activities and dynamic capabilities allow that information to be absorbed and used [10]. Customer knowledge sharing has similarly been identified as a mechanism for improving CRM-related capabilities and supporting innovation-oriented organizational learning [11]. In financial organizations, where customer behavior generates extensive transactional and interaction data, systematic acquisition of customer knowledge can therefore provide a particularly strong foundation for innovation.

The strong role of knowledge acquisition is also consistent with contemporary developments in customer-centric service design and artificial intelligence. Financial institutions increasingly require sophisticated methods for understanding customer journeys, preferences, pain points, and expectations. Customer-centered service design can facilitate the implementation of customer-centric strategies by translating customer insights into organizational and service-design decisions [22]. At the same time, artificial intelligence is expanding organizations' capacity to extract patterns and innovation opportunities from large volumes of customer data. AI-supported innovation management can enhance capabilities related to analysis, opportunity identification, forecasting, and decision-making [5], while AI-based service innovation approaches can further integrate customer experience information into service-development processes [23]. Thus, the particularly large effect of knowledge acquisition observed in the present study may reflect the strategic importance of developing mechanisms that continuously capture both explicit customer information and less obvious patterns embedded in behavioral and digital data.

Customer-oriented knowledge storage was the second strongest predictor of service innovation ($\beta = 0.552$) and also exhibited a very large effect size ($f^2 = 2.68$). This finding demonstrates that acquiring customer knowledge is insufficient unless the organization can retain, structure, standardize, secure, integrate, and retrieve it effectively. In banking institutions, customer-related knowledge is often dispersed across branches, departments, CRM platforms, transaction systems, digital channels, and individual employees. Fragmentation can prevent potentially useful information from contributing to service development. An effective knowledge-storage infrastructure converts scattered information into organizational memory and enables customer knowledge to remain accessible beyond particular interactions or employees. This interpretation is consistent with the argument that knowledge management systems must move beyond traditional information repositories toward systems capable of supporting innovation and knowledge utilization [3]. It also aligns with work emphasizing the redesign of business processes around knowledge-enabled customer-centric strategies, in which organizational information systems and processes are configured around the acquisition and use of customer knowledge [7]. In banking specifically, the

integration of customer knowledge management with customer relationship management has been proposed as a means of creating a more coherent and usable customer knowledge infrastructure [8].

Customer-oriented knowledge application also exerted a substantial positive effect on service innovation ($\beta = 0.403$, $t = 10.342$), with a large effect size ($f^2 = 1.30$). This finding is theoretically important because knowledge creates competitive value only when organizations use it to modify behavior, decisions, services, and processes. Customer knowledge application may involve personalizing financial services, redesigning existing services according to customer needs, using analytics in decision-making, developing new service packages, or integrating customer insights into multidisciplinary service-development teams. The result is consistent with evidence that customer knowledge management contributes to innovation quality and that strategic agility can function as a mechanism through which customer knowledge is translated into innovation outcomes [16]. It also accords with the view that open innovation can facilitate service customization by combining customer information with internal and external sources of expertise [20]. Accordingly, the present findings imply that effective banking innovation requires an organizational transition from merely "knowing the customer" toward actively incorporating customer knowledge into service-design and decision processes.

Knowledge sharing had the smallest, although still statistically significant, direct effect on service innovation ($\beta = 0.078$, $t = 3.460$), and its effect size ($f^2 = 0.14$) was markedly lower than those of acquisition, storage, and application. This finding suggests that knowledge sharing is relevant to innovation but may operate more indirectly or depend strongly on organizational conditions. Simply transferring information among employees or departments may not produce meaningful innovation unless the shared knowledge is high quality, accessible, interpreted appropriately, and subsequently used in decisions. This result can be understood alongside research demonstrating that knowledge sharing supports CRM and employee innovation capabilities [11] and that external and internal knowledge flows contribute to service and open innovation [13]. Likewise, inter-organizational trust can facilitate innovation because knowledge exchange becomes more productive when relational conditions support the reliable transfer and interpretation of information [14]. Thus, the comparatively modest direct contribution observed in the present study does not imply that knowledge sharing is unimportant; rather, its influence may be contingent upon organizational culture, cross-functional cooperation, trust, incentives, and mechanisms that convert exchanged information into operational action.

The results further demonstrated that evaluation and feedback significantly moderated the effect of customer-oriented knowledge management on service innovation ($\beta = 0.027$, $t = 2.150$). Although the magnitude of the moderating coefficient was small, its statistical significance indicates that the relationship between customer-oriented knowledge management and innovation becomes stronger when organizations systematically evaluate service outcomes and respond to customer feedback. This finding reinforces the iterative nature of service innovation. Customer knowledge should not flow only from customers toward the organization before innovation occurs; information must also be generated after a new or revised service has been introduced. Satisfaction, complaints, acceptance, loyalty, service effectiveness, and other responses provide new knowledge that allows the organization to refine subsequent decisions. Such a feedback loop is consistent with customer co-creation perspectives, according to which customer involvement and technological innovation can jointly enhance service innovation and firm performance [19]. It is also compatible with customer-centered strategies that emphasize ongoing alignment between service design and customer experience [22].

The moderating result also has implications for organizational adaptation in dynamic environments. Dynamic service innovation capabilities contribute to organizational performance through service innovation and competitive advantage, particularly where environmental changes require firms to adjust continuously [18]. Evaluation and feedback can serve as a sensing mechanism within such a dynamic capability by showing whether existing innovations remain aligned with changing customer expectations. Similarly, innovation ecosystems depend on continuous exchanges of information among actors and on mechanisms for learning from outcomes [21]. Within banking, digital and open innovation models further increase the number of channels through which feedback can be generated and incorporated into innovation processes [9]. The present findings therefore imply that customer-oriented knowledge management should be viewed as a cyclical rather than linear process: organizations acquire customer knowledge, store and share it, apply it in service innovation, evaluate the resulting services, collect feedback, and then use that feedback as new knowledge for subsequent innovation.

Finally, the model explained 98.2% of the variance in service innovation, and all reported Q^2 values were positive, indicating substantial explanatory power and predictive relevance within the study sample. These results reinforce the central position of customer-oriented knowledge capabilities in the proposed model. At the same time, such a very high R^2 value should be interpreted within the specific organizational and measurement context of the present study rather than assumed to generalize automatically to other settings. Overall, the pattern of findings supports the broader literature emphasizing the interdependence of customer knowledge, technological capability, organizational learning, service customization, digital innovation, and customer-centered competitiveness [6, 7]. The findings also suggest that emerging technologies and knowledge infrastructures are most valuable when they remain closely connected to customer needs and service-development processes rather than being implemented as isolated technical systems [4, 5, 23]. In this respect, the study contributes to understanding service innovation in banking by empirically differentiating the roles of customer knowledge acquisition, storage, sharing, and application while simultaneously demonstrating the reinforcing role of evaluation and feedback.

Several limitations should be considered when interpreting the findings. First, the quantitative phase was conducted among employees of the central headquarters of a single bank in Tehran; therefore, the findings may reflect institution-specific organizational structures, technological systems, managerial practices, and customer-management processes and cannot automatically be generalized to other banks, financial institutions, geographic regions, or service industries. Second, the study used a cross-sectional survey design, which limits the ability to establish temporal and causal relationships among customer-oriented knowledge management, evaluation and feedback, and service innovation. Third, the quantitative data were based on self-reported employee perceptions, which may be affected by common method variance, social desirability, or differences in participants' access to organizational information. Fourth, although the qualitative meta-synthesis provided a systematic foundation for constructing the model, the final set of dimensions and indicators was influenced by the databases, inclusion criteria, and publications available during the review process. Finally, the very high explained variance observed for service innovation should be interpreted cautiously and warrants replication in independent samples to determine whether a similar level of explanatory power can be reproduced.

Future studies should test the proposed model in other public and private banks, financial technology firms, insurance companies, and service organizations to assess its external validity and determine whether the relative importance of the four customer knowledge dimensions varies across organizational contexts. Longitudinal designs are recommended to

examine how changes in customer knowledge management practices influence service innovation over time and to provide stronger evidence regarding causal direction. Researchers could also employ multilevel designs incorporating data from employees, managers, customers, and organizational records rather than relying on a single respondent group. Future research may extend the model by examining potential mediators such as organizational learning, strategic agility, digital capability, absorptive capacity, customer co-creation, or innovation culture, as well as moderators such as environmental dynamism, competitive intensity, technological turbulence, and organizational size. Comparative studies could investigate whether traditional banks and digitally oriented financial institutions differ in how they acquire and apply customer knowledge. Additional research should also replicate the measurement model, evaluate discriminant validity using complementary criteria such as HTMT, and test the stability of the exceptionally high explanatory power observed in the present study.

Bank managers should treat customer-oriented knowledge management as an integrated innovation infrastructure rather than as a conventional information-storage activity. Particular attention should be given to customer knowledge acquisition because it demonstrated the strongest relationship with service innovation; banks can strengthen this capability by integrating information from branches, digital banking platforms, customer-service interactions, complaints, transaction patterns, surveys, and other contact points. Knowledge-storage systems should be standardized and integrated across organizational units so that reliable customer information can be accessed securely and efficiently by authorized employees. Because knowledge sharing showed a comparatively smaller direct effect, managers should focus not only on increasing the volume of information exchanged but also on improving its relevance and usability through cross-functional teams, collaborative platforms, clear knowledge-sharing responsibilities, and incentives for interdepartmental cooperation. Customer knowledge should then be systematically incorporated into service design, personalization, process redesign, and innovation decisions. Finally, banks should institutionalize continuous evaluation and feedback mechanisms so that customer responses to newly introduced services are rapidly captured, analyzed, communicated to relevant units, and converted into corrective action, thereby establishing a continuous cycle of customer knowledge acquisition, innovation, evaluation, and service improvement.

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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.

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