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Proposing a Model for Selecting Knowledge Management Technologies by Implementing the PROMETHEE II Method: A Case Study of Eghtesad Novin Bank in Iran

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Abstract

Selecting appropriate knowledge management (KM) technologies has become a critical challenge for senior managers seeking to enhance organizational knowledge processes. This study proposed a structured decision-making model to support managers in identifying and prioritizing KM technologies for Eghtesad Novin Bank in Iran. Relevant KM technologies and their selection criteria were first extracted and classified through conducting a comprehensive literature review. Two rounds of expert-based surveys were then conducted. In the first round, two KM specialists determined the relative importance of the criteria using pairwise comparisons. In the second round, four KM experts assessed the performance of each technology with respect to these criteria. Criterion weights were computed through the Analytical Hierarchy Process (AHP) and the PROMETHEE II method was applied to obtain a complete ranking of the technologies. The findings revealed that networking technologies achieve the highest overall ranking, followed respectively by organizational communication/private social network technologies, public social networking technologies, web-based and multimedia presentation tools, web conferencing systems, large-scale webinar technologies, communication and collaboration tools, three-dimensional virtual immersive collaboration environments, and finally, groupware systems.

Keywords

Knowledge management, KM technologies, Multi-Criteria Decision-Making (MCDM), Analytical Hierarchy Process (AHP), PROMETHEE method.

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Introduction

Today, given the rapid changes occurring in business environment, delivering high-quality products and services at competitive prices is difficult—if not impossible—without effectively managing and utilizing strategic resources of knowledge (Firdaus et al., 2025; Pepple et al., 2022). As knowledge plays a critical role in organizations and serves as a key driver of both the idea economy and the knowledge economy, many companies have adopted knowledge management (KM) as a core mechanism for achieving competitive advantages (Koshelieva et al., 2023). KM refers to a set of systems, practices, and infrastructures that enable organizations to organize, integrate, share, and apply information and learning outcomes in a way that adds value (Hislop et al., 2018). The fundamental premise of KM is that knowledge is the primary basis for innovation (Hassan & Razip, 2019), and organizations that effectively manage their knowledge resources are more likely to achieve substantial performance outcomes (Ode & Ayavoo, 2020). KM processes also help organizations address challenges related to employee mobility and knowledge turnover, enabling them to better understand and leverage their knowledge resources to strengthen dynamic capabilities (Okumus, 2013).

Information technology, as the primary enabler of KM, has significantly improved the speed, accuracy, and efficiency of knowledge processes. Achieving KM objectives is therefore closely tied to the adoption of appropriate technologies (Al Mansoori et al., 2020). Despite the strategic importance of KM in contemporary organizations, the number of studies focused specifically on selecting suitable KM technologies remains limited (Deng et al., 2022). Organizations often struggle to identify which technologies best support their KM activities and how to develop the necessary technical infrastructure to implement them. A lack of clarity in this area can result in low system efficiency, ineffective KM strategies, and ultimately organizational failure (Leonardi & Treem, 2012; Murni et al., 2009).

The evaluation and selection of KM technologies constitute a multi-criterion decision-making (MCDM) problem due to the diversity of KM processes and the wide range of available technological tools. Various MCDM approaches have been applied in previous research. For instance, Ngai and Chan (2005) and Murni et al. (2009) used fuzzy AHP for evaluating KM systems, while Murni and Budiarto (2010) proposed a fuzzy inference system for KM tool assessment. Li et al. (2014) combined QFD and TOPSIS to evaluate KM systems from the users' perspectives. Khadivar and Mojibian (2018) developed a fuzzy expert system to recommend appropriate KM tools. Although these studies provided valuable insights, research on identifying and selecting appropriate KM technologies—particularly in knowledge-intensive sectors such as banking—has remained underdeveloped. The existing studies often lack sector-specific criteria and rarely offer systematic models tailored to the operational realities of banks, where effective knowledge sharing and information flow are essential. To address this gap, the present study proposed a decision-making model based on a hybrid AHP–PROMETHEE II approach. By integrating expert judgments with a structured MCDM method, this model aimed to help Eghtesad Novin Bank identify and select the most suitable KM

technologies to improve knowledge sharing and strengthen organizational performance.

Literature Review

Knowledge Management Technologies

KM technologies refer to information technologies specifically designed to facilitate the implementation of KM activities. Although closely related to traditional information technologies, KM technologies are distinguished by their focus on creating, storing, sharing, and applying knowledge rather than merely processing information. They support knowledge management systems and operate within the broader KM infrastructure. Such technologies include computer-based simulations, AI-based tools, decision support systems, case-based reasoning systems, enterprise resource planning systems, best-practices repositories, lessons-learned databases, expert systems, and electronic discussion platforms (Becerra-Fernandez & Sabherwal, 2014).

The critical role of technology in supporting KM processes has been extensively acknowledged in the literature. The increasing volume of knowledge and information that must be acquired, stored, and shared—combined with the geographical dispersion of users and the dynamic evolution of information—has transformed KM technologies from optional tools into essential components of organizational knowledge strategies (Liu et al., 2023). Through accelerating KM processes and enabling more effective knowledge flows, technological tools significantly enhance the efficiency and performance of KM initiatives.

Given their importance, researchers have proposed multiple classifications for KM technologies, using various grouping criteria. However, the most commonly adopted classification scheme is the one based on KM processes (Kumar Agarwal & Anwarul Islam, 2014; Hashemi et al., 2018). Among these categorizations, the framework proposed by Dalkir (2005) is widely regarded as the most influential. Dalkir organized KM technologies according to the three core stages of the knowledge management cycle: knowledge capture and/or creation, knowledge sharing and dissemination, and knowledge acquisition and application. These categories, which provide a comprehensive and process-oriented view of KM technologies, are summarized in Table 1.

The Criteria for KM Technology Selection

The selection of appropriate KM technologies represents a complex multi-criteria decision-making challenge due to the wide range of available tools and the diverse dimensions through which these technologies influence organizational performance. KM technologies affect not only technical capabilities but also economic outcomes, knowledge processes, organizational culture, and strategic alignment. Therefore, identifying a comprehensive and well-structured set of evaluation criteria is a critical prerequisite for developing any decision-support model for KM technology selection.

Table1
The Knowledge Management Technologies (Dalkir, 2005)

Technologies for knowledge capture and/or creation	Technologies for knowledge sharing and dissemination	Technologies for knowledge acquisition and application
Video related devices including video editing and video recording	Communication and collaboration technologies	Artificial intelligence technologies
Cooperation technologies, screen sharing and remote support technologies	Large audience webinars technologies-- > 100 participants	E-learning technologies
Collaborative visual reviewing technologies	Networking technologies	Event scheduling technologies
Collaborative writing technologies	Social networking technologies	Work grouping/team collaboration workspaces technologies
Content creation technologies	Virtual three-dimensional immersive collaboration technologies	Expertise profiling technologies
Document sharing-wikis technologies	Web conferencing technologies	Project management technologies
Knowledge community/profile capturing technologies	Web/multimedia presenting technologies	
Mindmapping and diagramming technologies	Groupwar including audio conferencing, file sharing, shared authoring tools, instant messaging/chat, and video conferencing	
Social content technologies		
White boarding technologies		
Content management technologies		

(Source: The Researcher's Findings)

A review of the existing literature revealed that studies focusing specifically on KM technology selection are relatively limited; however, several researchers have highlighted key dimensions that should be taken into account in such evaluations. Ngai and Chan (2005) proposed a hierarchical framework incorporating three major dimensions—cost, functionality, and vendor characteristics—which has subsequently been adopted and expanded in related works. Murni et al. (2009) emphasized the relevance of profit, cost, and risk considerations in KM-related technology investments, particularly within small and medium-sized enterprises. Likewise, Erensal and Albayrak (2006) and Zeng et al. (2008) applied comparable evaluation structures centered on financial, functional, and support-related attributes of KM technologies.

Beyond these financial and functional perspectives, other scholars have adopted a more process-oriented and strategic lens. Fallah et al. (2013) underscored the importance of selecting KM technologies that align with key knowledge processes—including knowledge acquisition, sharing, organization, and application. Hashemi et al. (2018) further emphasized the significance of strategic alignment and process compatibility in the successful implementation and utilization of KM technologies. Additionally, Ghadami (2015) demonstrated that organizational characteristics—such as structural configuration, organizational maturity, and strategic orientation—play decisive roles in determining the suitability of KM tools.

Complementing KM-specific studies, a broader stream of literature on general

organizational technology selection identifies a variety of influencing factors including system flexibility, technical and economic feasibility, infrastructure availability, enhancement of competitiveness, cultural readiness, and organizational requirements. These studies collectively affirmed that technology selection is not merely a technical evaluation but a socio-technical and strategically grounded decision.

Drawing on insights from both KM-focused and general technology selection research (summarized in Table 2), an initial comprehensive list of criteria and sub-criteria was compiled. To ensure conceptual clarity and avoid redundancy, a systematic consolidation process was conducted in which overlapping items were merged, terminological inconsistencies were resolved, and conceptually related factors were grouped. The resulting set of criteria forms a coherent, balanced, and academically grounded framework for evaluating and selecting KM technologies in organizational contexts.

Table2
The Selection Criteria for KM Technologies

No.	Researcher	Criteria	Sub-criteria
1	Grimaldi and Rippa (2011)	1. Knowledge development 2. Performance development 3. Network development	1. Cost 2. Time 3. Function 4. Reliability
2	Ngai and Chan (2005)	1. Cost 2. Function 3. Vendor	1-1 Capital costs 2-1 Operating costs 1-2 Document management 2-2 Cooperation 3-2 Communication 4-2 Measurement 5-2 Workflow management 6-2 Scalability 1-3 Vendor reputation 2-3 Instruction 3-3 Participation in implementation 4-3 KM consultancy services 5-3 Support, maintenance, updating, and integrity
3	Murni et al. (2009)	1. Profit 2. Cost 3. Risk	1-1 Organizational flexibility and process improvement 2-1 Personal and organizational knowledge power improvement 3-1 Customer services improvement 4-1 Improvement in responding to change 5-1 Group work improvement 6-1 Data management improvement 7-1 Communication improvement 8-1 Decision making improvement 1-2 Hardware accessories 2-2 Network equipment 3-2 Maintenance 4-2 Installation engineers 5-2 Personnel training 1-3 Security issue 2-3 Technical uncertainty and lack of knowledge 3-3 Lack of supportive information of system infrastructure 4-3 Minimum information technology expertise 5-3 Training costs of personnel who leave the organization

4	Shieh and Wang (2006)	1. Cost, benefit 2. Ease of use 3 Satisfaction of personnel knowledge requirements	
5	Murni and Budiarto (2010)	1. Cost 2. Function 3. Vendor	1-1 Capital costs 2-1 Operating costs 1-2 Document management 2-2 Cooperation 3-2 Communications 4-2 Measurement 5-2 Workflow management 6-2 Scalability 1-3 Vendor reputation 2-3 Instruction 3-2 Participation in implementation 4-3 KM consultancy services 5-3 Support, maintenance, updating, and integrity
6	Erensal and Albayrak (2006)	1. Cost 2. Function 3. Vendor	1-1 Capital costs 2-1 Operating costs 1-2 Document management 2-2 Cooperation 3-2 Communications 4-2 Measurement 5-2 Workflow management 6-2 Scalability 1-3 Vendor reputation 2-3 Instruction 3-2 Participation in implementation 4-3 KM consultancy services 5-3 Support, maintenance, updating, and integrity
7	Zeng et al. (2008)	1. Cost 2. Function 3. Vendor	1-1 Capital costs 2-1 Operating costs 1-2 Document management 2-2 Cooperation 3-2 Communications 4-2 Measurement 5-2 Workflow management 6-2 Scalability 1-3 Vendor reputation 2-3 Instruction 3-2 Participation in implementation 4-3 KM consultancy services 5-3 Support, maintenance, updating, and integrity
8	Hashemi et al. (2018)	1. KM technologies alignment with KM processes 2. KM technologies alignment with KM strategies	

(Source: The Researcher's Findings)

The final set of criteria was consequently grouped into three main categories ofeconomic, organizational, and technical (see Table 3). This classification aligns with the prevailing perspectives in technology evaluation literature and provides a clear, coherent, and non-overlapping framework for assessing KM technologies. By structuring the criteria in this manner, the model ensures a balanced evaluation that reflects the financial, organizational, and technical considerations essential for informed decision-making.

Table 3
The Criteria for Selection and Evaluation of KM technologies

Economic criteria	Organizational criteria	Technical criteria
Cost	Function	Document management ability
Measurement of investment risk	Technology vendor	Creating cooperation and knowledge sharing
	Aligning with KM processes	Communication boosting
	Aligning with KM strategies	Time needed for implementation
	Creating productivity	Workflow management
	Helping to gain competitive advantages	Scalability
	Personal and organizational knowledge improvement	Reliability
	Adaptability	Lightweight software model
	Compatibility with organization's standards	Content creation by users
	Improvement in responding to change	Power of long users' chain
	Improving customer services	Flexibility
	Improving decision making	Ease of use
	The effect of new technologies on personnel	Presenting true information to users
	Creating innovation	Knowledge evaluation
	Corresponding with organization's activities	Knowledge security guaranty
	Boosting personnel's spirit	Socializing and creating extensive participation among personnel

(Source: The Researcher's Findings)

Methodology

This study adopted a developmental–applied approach in terms of purpose and a descriptive methodology in terms of data collection. The research process was structured into three main stages to ensure a systematic and transparent development of the proposed decision-making model. In the first stage, an extensive review of the literature and previous research was conducted to identify relevant KM technologies and the criteria associated with their selection. Based on the extracted criteria, the second stage involved determining their relative importance using the AHP. Pairwise comparisons were carried out by two KM experts from Eghtesad Novin Bank, and the criteria weights were calculated following standard AHP procedures like consistency assessment to validate the reliability of expert judgments. In the final stage, the PROMETHEE II method was applied to evaluate and rank the KM technologies using the weighted criteria. Four KM experts assessed the performance of each alternative with respect to the identified criteria, and the PROMETHEE II computations were used to generate the complete ranking. By integrating AHP for criteria weighting and PROMETHEE II for alternative evaluation, the study employed a rigorous MCDM framework that enhances methodological clarity, strengthens result robustness, and supports a systematic approach to selecting the most appropriate KM technologies.

Analytical Hierarchy Process (AHP)

The AHP, developed by Thomas L. Saaty in the 1970s, is one of the most established and widely applied MCDM methods (Zeng et al., 2008). AHP decomposes a complex decision problem into a hierarchical structure consisting of a goal, criteria, and alternatives, enabling the systematic evaluation of both qualitative and quantitative factors through conducting pairwise comparisons. Because this method relies on expert judgment and

expresses preferences using a ratio scale, it is particularly suitable for decision problems involving multiple and often conflicting criteria (U-Dominic et al., 2021). In this study, the AHP procedure was implemented following Saaty's (2008) guidelines. The main steps are summarized below:

Step 1. Construct the hierarchical structure.

Step 2. Apply data scaling through linguistic variables to represent the criteria's importance weights, as presented in Table 4.

Table 4
The Linguistic Variables for the Importance Weights of the Criteria

Linguistic variables	Crisp AHP Scale
Equally Preferred (E_qP)	1
Equally to Moderately Preferred (E_P-MP)	2
Moderately Preferred (MP)	3
Moderately to Strongly Preferred (M-SP)	4
Strongly Preferred (SP)	5
Strongly to Very Strongly Preferred (S-VSP)	6
Very Strongly Preferred (VSP)	7
Very Strongly to Extremely Preferred (VS-ExP)	8
Extremely Preferred (ExP)	9

(Source: The Researcher's Findings)

Step 3. Develop the pairwise comparison matrix, $P_{n\times n}$ for criteria in which each element, P_{ij} (i, j=1,2,...,n), indicates the weight of the criterion assigned by the decision maker where $P_{ij} > 0$ and $P_{ji} = \frac{1}{P_{ij}}$.

Step 4. Construct the normalized pairwise comparison matrix. Each element of the matrix $P_{n\times n}$ is divided by the sum of its column, ensuring that the total of each column in the normalized matrix equals 1.

Step 5. Compute the weight of each criterion by calculating the average of the elements in each row of the $P_{n\times n}$ matrix.

Step 6. Compute the Consistency Ratio, CR using the following formula and the corresponding Random Index (RI) values presented in Table 5:

$$CR = \frac{CI}{RI}$$

where λ_{max} denotes the maximum eigenvector and n represents the size of the matrix. The Consistency Index (CI) is calculated as:

$$CI = \frac{\lambda_{max} - n}{n-1}$$

The judgment is consistent if CR<0.1.

Table 5
The Random Index (RI)

n	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49

(Source: The Researcher's Findings)

PROMETHEE II method

The PROMETHEE is one of the newer outranking-based MCDM techniques used for ranking a finite set of alternatives under multiple and often conflicting criteria (Behzadian et al., 2010). This method applies positive and negative preference flows to generate a weighted ranking of alternatives (Zhang & Li., 2025). Several variants of PROMETHEE have been introduced in the literature; however, Vinodh and Girubha (2011) emphasized that PROMETHEE II is the most widely used due to its ability to provide a complete ranking of alternatives. Accordingly, the present study employed the PROMETHEE II method. The fundamental stages for implementing the PROMETHEE II are outlined below:

- Determination of deviation through conducting pairwise comparisons

$$d_i(a,b)=C_j(a)-C_j(b)$$

where $d_j(a, \mathrm{b})$ denotes the difference between the evaluations of alternatives a and b for criterion j.

- Assessment of the preference function

The preference function indicates the degree to which alternative a is preferred over alternative b with respect to the criterion j.

$$P_i(a,b)=F_j\left(d_j(a,b)\right)$$

where $P_i(a,b)$ represents the preference of alternative a over b for criterion j, expressed as a function of $d_j(a,b)$.

Six types of preference functions have been proposed for PROMETHEE (Brans & Vincke, 1985). Given that all evaluation criteria in this study are quantitative and measured on continuous numerical scales, the linear (Type V) preference function was selected. This function is particularly suitable for continuous quantitative indicators because the degree of preference increases proportionally with the magnitude of deviation between alternatives.

Since the dataset does not contain predefined indifference (q) and strict preference (p) thresholds, no specific thresholds were defined. A consistent linear preference function was applied across all criteria to ensure methodological uniformity and transparency.

- Assessment of the overall preference index

The aggregated preference index for the pair of alternatives α and b is calculated by:

$$\pi(a,b)=\sum_{j=1}^{n}P_j(a,b)\,w_i,\forall a,b\in A$$

where $\pi(\alpha, \mathrm{b})$ is the weighted preference of α over b, w_j is the weight of criterion j, and A denotes the set of all alternatives.

- Assessment of outranking flows

The positive outranking flow reflects the extent to which alternative α is preferred over the other alternatives:

$$\varphi^{+}(a)=\frac{1}{n-1}\sum_{x\epsilon A}\pi(a,x)$$

Higher values of $\varphi^{+}(a)$ indicate a stronger preference for one alternative relative to the others. The negative outranking flow of each alternative is calculated as:

$$\varphi^{-}(a)=\frac{1}{n-1}\sum_{x\epsilon A}\pi(x,a)$$

The net outranking flow $\varphi(a)$represents the difference between the positive flow $\varphi^{+}(a)$ and the negative flow $\varphi^{-}(a)$, calculated as follows:

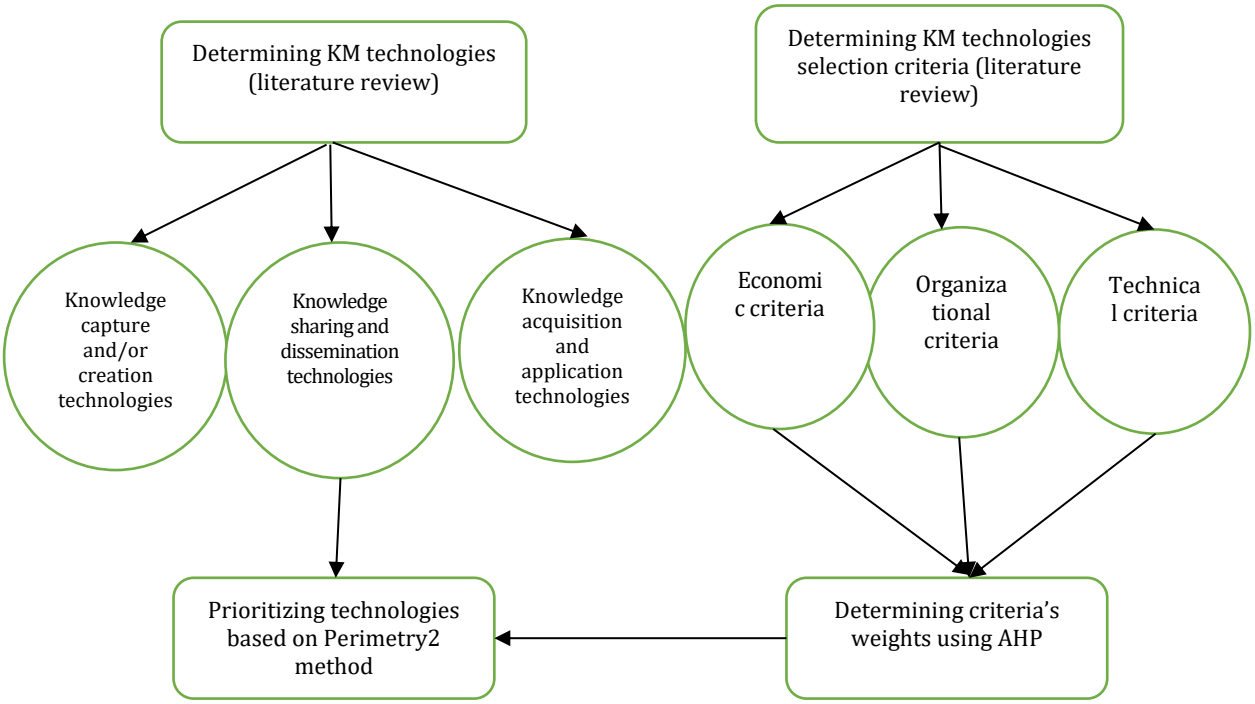
$$\varphi(a)=\varphi^{+}(a)-\varphi^{-}(a)$$

Therefore, if $\varphi(a)>\varphi(b)$, then alternative a is better than alternative b.

The Conceptual Model of the Research

Figure 1 illustrates the conceptual model of the study. In this research, the selection criteria for KM technologies were first grouped into three categories of technical, organizational, and economic. After defining these criteria, the AHP method was applied to determine their relative weights based on expert pairwise comparisons. The weighted criteria were then used in the PROMETHEE II method to rank the KM technologies. A linear preference function—appropriate for quantitative criteria—was adopted to ensure the consistency and transparency in the evaluation process.

Figure 1.
The Conceptual Model of the Research Study



(Source: The Researcher's Findings)

Findings

Determination of Criteria Weights Using AHP

The pairwise comparison data for the selection criteria of KM technologies were obtained from two experts at Eghtesad Novin Bank using the standard 1–9 Saaty scale. The comparisons were analyzed in Expert Choice software, and the consistency ratios (CR) of all pairwise comparison matrices were verified. Since all CR values were below the acceptable threshold (CR < 0.1), the expert judgments were considered as reliable. Following the standard AHP computational procedure, the average expert assessments were normalized to derive the final weight of each criterion. Table 6 presents the resulting criterion weights. The highest-weighted criteria include customer service improvement (1.000), document management ability (0.888), and helping to gain competitive advantages (0.822). In contrast, criteria such as lightweight software model (0.909), enhancement of employees' spirit (0.165), and reliability (0.215) received lower weights.

Table 6.
The Weights of Selection Criteria for Knowledge Management Technologies Obtained from AHP

Criterion	Importance coefficient	Criterion	Importance coefficient
Cost	0.581	Time needed for implementation	0.222
Measurement of investment risk	0.810	Function	0.670
Document management ability	0.888	Adaptability	0.295
Flexibility	0.815	creating productivity	0.734
Ease of use	0.810	The effect of new technologies on personnel	0.218
Knowledge evaluation	0.227	Presenting true information to user	0.341
Knowledge security guaranty	0.468	Technology vendor	0.296
Workflow management	0.510	creating innovation	0.192
Personal and organizational knowledge improvement	0.364	Corresponding with organization's activities	0.663
Improvement in responding to change	0.176	Aligning with KM strategies	0.555
Improvement of customer services	1.000	Aligning with KM processes	0.634
Improvement in decision making	0.660	Compatibility with organization's standards	0.293
Scalability	0.236	Boosting personnel's spirit	0.165
Reliability	0.215	Socializing and creating extensive participation among personnel	0.215
Communication boosting	0.278	Lightweight software model	0.090
Creating cooperation and knowledge sharing	0.259	Content creation by users	0.227
Helping to gain competitive advantages	0.822	Power of long users' chain	0.213

(Source: The Researcher's Findings)

Technology Prioritization Using PROMETHEE II

After determining the criterion weights through AHP, the resulting weights were incorporated into the PROMETHEE II method to prioritize the selected KM technologies. Visual PROMETHEE II software was used to conduct the analysis. All required inputs—including the list of criteria, their corresponding weights, the optimization direction of each criterion (maximize or minimize), the selected preference functions, and the set of

candidate KM technologies—were entered into the software. Because Visual PROMETHEE operates using integer weights, the AHP-derived real weights were scaled by a factor of ten and rounded according to the following rules: weights between 0 and 0.50 were set to 0, those between 0.51 and 1.50 were set to 1, and those between 9.51 and 10.50 were set to 10.

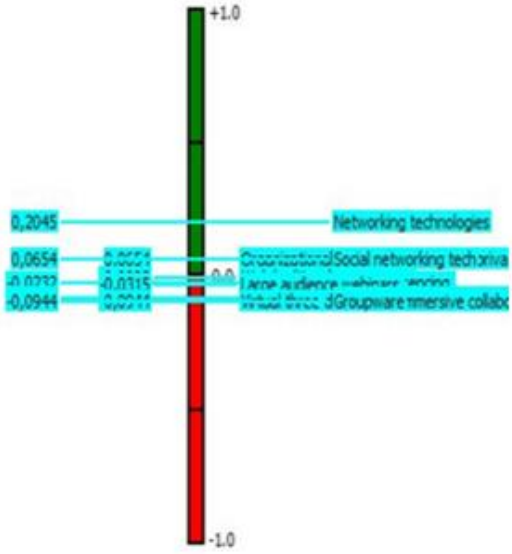
Most criteria were treated as maximization criteria, where higher scores indicate better technology performance. However, three criteria—cost, investment risk, and implementation time—were defined as minimization criteria. Since all evaluation criteria were quantitative, the linear (Type V) preference function was selected for all of them to ensure methodological consistency and alignment with the nature of the data.

To construct the decision matrix, four KM experts from Eghtesad Novin Bank assessed the performance of each technology against every criterion. The average of their evaluations was computed and entered into Visual PROMETHEE II. Based on these inputs, the software generated the positive outranking flows (+Φ), negative outranking flows (–Φ), and net outranking flows for all alternatives. The positive flow (+Φ) indicates the overall strength of each technology relative to others, while the negative flow (–Φ) reflects the extent to which a technology is dominated by others. Although both flows contribute to the final evaluation, their rankings are not always identical. As illustrated in Figure 2, networking technology obtained the highest positive and net outranking flows, confirming it as the most preferred option among the evaluated KM technologies. In contrast, the weakest technology differed depending on the specific outranking flow considered: communication and collaboration technologies ranked lowest based on the positive outranking flow (+Φ), whereas groupware exhibited the highest negative outranking flow (–Φ), making it the least favorable alternative in terms of being dominated by others.

In several instances, the crossing of lines in the PROMETHEE II ranking graph indicates that certain technologies are not fully comparable. This is expected in MCDM problems where alternatives may excel on different criteria, resulting in partial rather than complete dominance. The PROMETHEE II method resolves these inconsistencies through the computation of the net outranking flow, which combines both positive and negative flows to yield a final complete ranking. Overall, the PROMETHEE II results provided a transparent and analytically robust prioritization of KM technologies for Eghtesad Novin Bank. The combined use of AHP for weighting and PROMETHEE II for ranking ensures a coherent decision-making framework capable of supporting strategic, evidence-based technology selection.

The PROMETHEE II method provided a complete and linear ranking of alternatives based on the net outranking flow (Φ), calculated as the difference between the positive flow (+Φ)—which reflects the extent to which an alternative outranks other options—and the negative flow (–Φ), indicating the extent to which it is dominated by others. The net outranking flow ranges from −1 to +1, with higher values signifying stronger overall performance.

Figure 2.
The Results of Rating Technologies Using PROMETHEE II Method



(Source: The Researcher's Findings)

Table 7 presents the calculated +Φ, –Φ, and Φ values for all technologies. The results showed that networking technology has the highest net outranking flow, making it the most suitable technology for knowledge sharing and dissemination in Eghtesad Novin Bank. This is followed by organizational group communication/private social network, social networking technologies, web and multimedia presentation technologies, web conferencing systems, and large-audience webinar technologies. In contrast, communication and collaboration technologies and virtual 3D immersive collaboration technologies occupied the lower positions in the ranking, while groupware exhibited the lowest net outranking flow and was therefore considered as the least favorable option.

Unlike PROMETHEE I, which may produce partial rankings due to the presence of incomparabilities, PROMETHEE II resolves these limitations by generating a complete and unambiguous ranking of all alternatives. This ensures a clearer basis for managerial decision-making and strengthens the reliability of the derived priorities.

Table 7.
The Results of Rating Technologies Using PROMETHEE II Method

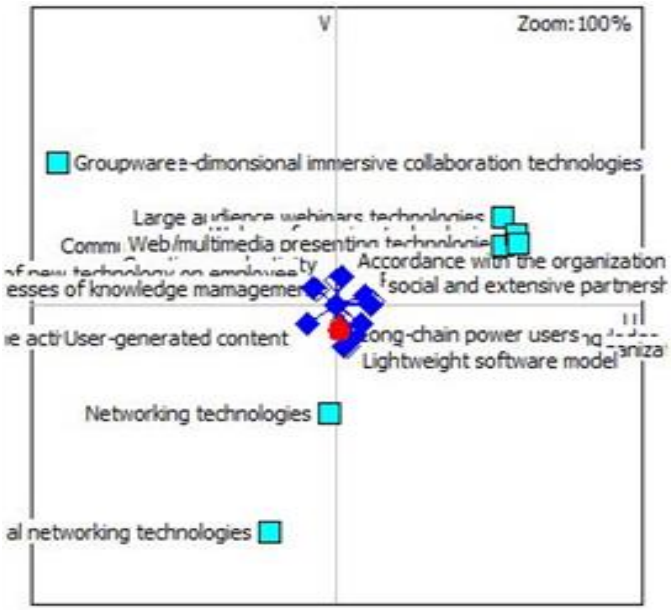
Actions	Phi	Phi+	Phi-
Networking technologies	0/2045	0/2144	0/0099
Organizational group communication/private social network techno	0/0654	0/1705	0/1051
Social networking technologies	0/0654	0/1705	0/1051
Web/multimedia presenting technologies	-0/0083	0/1101	0/1184
Web conferencing technologies	-0/0232	0/0952	0/1184
Large audience webinars technologies	-0/0315	0/1035	0/1349
Communication and collaboration technologies	-0/0836	0/0861	0/1697
Virtual three-dimonsional immersive collaboration technologies	-0/0944	0/1184	0/2127
Groupware	-0/0944	0/1184	0/2127

(Source: The Researcher's Findings)

Geometrical Analysis for Interactive Assistance (GAIA)

To complement and enhance the efficiency of the PROMETHEE method, the GAIA approach with its specific modeling capabilities was employed. The primary objective of GAIA is to represent multidimensional information as accurately as possible within a low-dimensional space. In MCDM problems, this visualization supports decision-makers by clarifying the combined effects of criteria and their corresponding weights on the final evaluation results. The GAIA method expands upon PROMETHEE by offering additional graphical and interpretive insights that enrich the analysis (Figueira et al., 2005). Figure 3 illustrates the GAIA representation of the evaluated technologies.

Figure 3.
The Results of GAIA



(Source: The Researcher's Findings)

The GAIA plane typically presents three categories of information:

1. The alternatives under evaluation,
2. The criteria, and
3. The criteria weights, illustrated by arrows.

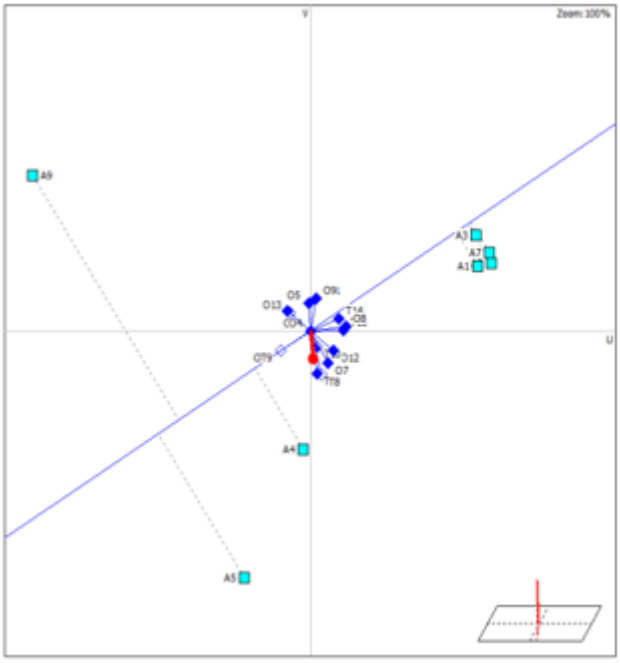
In this representation, alternatives with similar performance patterns appear in close proximity to one another. According to Figure 3, groupware was positioned notably distant from most other technologies, reflecting a performance profile that differs substantially from the rest. In contrast, network-oriented technologies (intranet, portal, internet, extranet) together with social networking technologies were located on the opposite side of the plane and lay closer to the GAIA decision axis (the net-flow direction). This closer positioning indicated greater alignment with the dominant decision criteria, thereby reinforcing their higher prioritization in the PROMETHEE II ranking. Consequently, networking technologies occupied the top rank, whereas groupware—situated farther from the decision axis—demonstrated a weaker overall preference.

In GAIA, criteria are depicted as arrows whose directions indicate whether they are

aligned with, independent of, or in conflict with one another. As shown in Figure 3, the criteria belonging to similar categories tended to point in comparable directions. For example, the organizational criteria are mainly concentrated in the upper-left area of the plane, while the technical criteria typically appear in the lower-right region.

The relative positions of the criteria and alternatives provide valuable analytical insights. By selecting the "show axis" option in the GAIA interface, the performance of each alternative can be examined with respect to a specific criterion. Figure 4 presents the GAIA projection for the criterion "helping to gain competitive advantages". The projection showed that the large-audience webinar technologies (A3) achieved the lowest performance on this criterion, while the groupware (A9) obtained the highest value for this single dimension. Nevertheless, when all criteria are considered jointly in the PROMETHEE II net-flow analysis, the groupware remained the lowest-ranked alternative overall. This type of analysis can be repeated for each criterion to more clearly identify the strengths and weaknesses of the evaluated technologies.

Figure 4.
The Options' Positions Based on the Criterion of Helping to Gain Competitive Advantages in GAIA



(Source: The Researcher's Findings)

Sensitivity Analysis

In this section, the influence of technical criteria on the ranking of knowledge sharing and dissemination technologies was examined. Although the overall objective of the study was to incorporate all relevant criteria into the technology selection process, the present analysis considered only one category of criteria. Accordingly, economic criteria—including cost and investment risk—were excluded, and the technologies were evaluated and ranked solely based on their technical attributes. The resulting evaluations and rankings under these conditions are presented in Table 8.

Table 8.
The Technologies Rating only Based on Technical Criteria

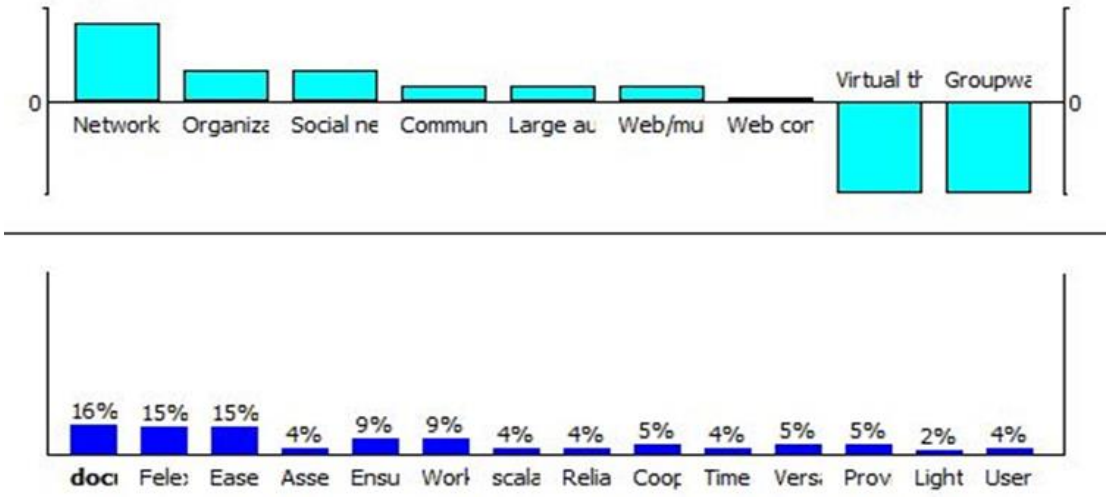
Actions	Phi	Phi+	Phi-
Networking technologies	0/2500	0/2591	0/0091
Organizational group communication/privat	0/0955	0/2091	0/1136
Social networking tech	0/0955	0/2091	0/1136
Communication and collaboration	0/0500	0/1500	0/1000
Large audience webinars	0/0500	0/1500	0/1000
Web/multimedia presenting	0/0500	0/1500	0/1000
Web conferencing	0/0091	0/1091	0/1000
Virtual three-dimonsional immersive collaboration	-0/3000	0/0636	0/3636
Groupware	-0/3000	0/0636	0/3636

(Source: The Researcher's Findings)

A comparison between the rankings obtained without economic criteria and those derived from the full set of evaluation factors revealed several noteworthy differences, demonstrating the substantial influence of economic considerations on the prioritization of technologies for knowledge sharing and dissemination. As shown in Figure 5, when economic criteria were omitted, communication and collaboration technologies were ranked seventh among the nine alternatives. However, when economic factors—such as cost levels and investment risk—were incorporated, their ranking improved significantly, rising to fourth place, as illustrated in Figure 6.

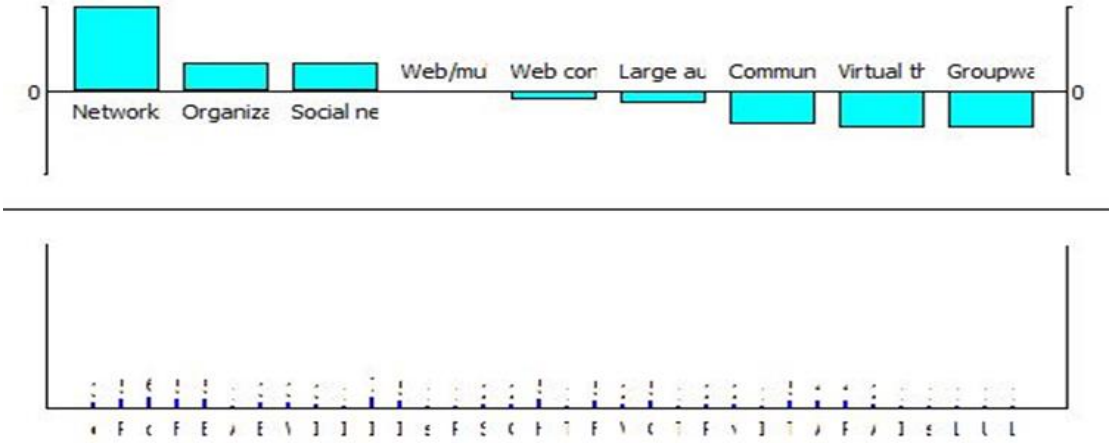
In addition, the observed shifts in the positions of other technologies—including web-based and multimedia presentation tools, web conferencing systems, and large-audience webinar platforms—further highlighted the decisive role of economic criteria in shaping the final preference structure and overall prioritization outcomes.

Figure 5.
The Technologies Rating without Considering the Economic Criteria



(Source: The Researcher's Findings)

Figure 6.
The Technologies Rating Based on All Criteria



(Source: The Researcher's Findings)

Sensitivity Analysis of Criteria Weights

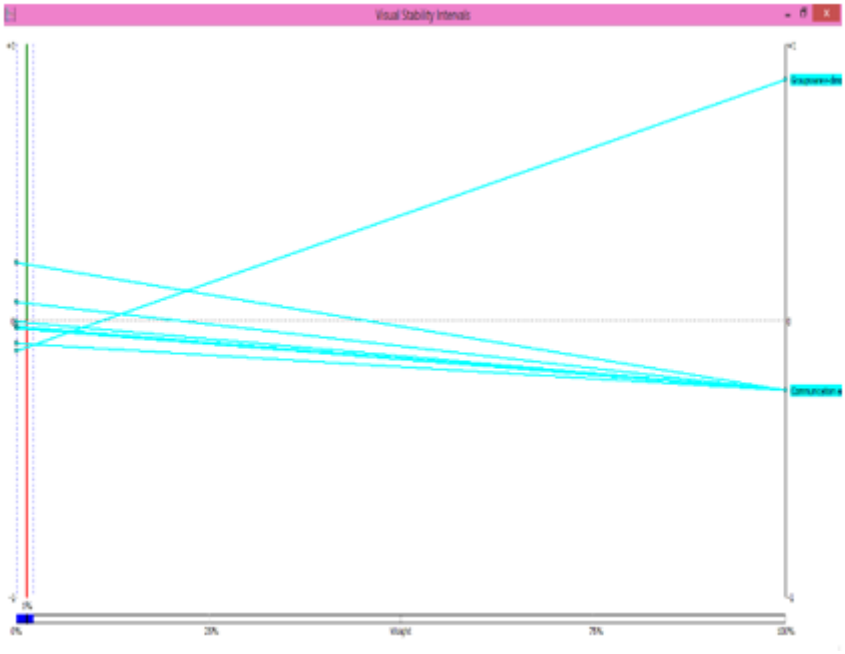
To assess the robustness of the obtained rankings and to address the concern regarding the limited validation, a detailed sensitivity analysis was performed using the Visual Stability Interval (VSI) approach within PROMETHEE. This method determines the range of weight values within which variations in a specific criterion do not affect the final ranking of the alternatives. For each analysis, one criterion and the full set of technological alternatives were selected in order to evaluate how incremental changes in the weight of that criterion influence the prioritization results. As an illustrative example, Figure 7 presents the sensitivity analysis for the criterion “time needed for implementation”. In this figure, the horizontal axis represents the percentage weight assigned to the criterion relative to the total criteria weight, which is normalized to 100%. The red and green vertical bars show the PROMETHEE scoring positions of the nine technologies with respect to this criterion. The two dotted vertical lines indicate the upper and lower stability limits—representing the interval within which changes in the weight of the “time needed for implementation” criterion do not alter the ranking of the technologies. According to the results, this stability interval ranged between 0% and 2.26%, indicating that as long as the weight assigned to this criterion remained within this range, the final ranking of the technologies remained unchanged. Therefore, the findings supported the robustness and reliability of the results against moderate fluctuations in the importance of this criterion.

The analysis also showed that the ranking of communication and collaboration technologies declined as the weight of implementation time increased, whereas the ranking of groupware technologies improved when this criterion received a higher weight. Among all alternatives, groupware exhibited the highest level of sensitivity to weight variations. Even minor changes in the assigned weight led to substantial shifts in its ranking. In contrast, the remaining technologies displayed relatively gradual and limited movements in rank, indicating lower sensitivity and stronger stability.

Overall, the results of this sensitivity analysis confirmed that the AHP–PROMETHEE II

model employed in this study yields stable and reliable rankings, thereby strengthening the validity of the proposed decision-making framework and directly addressing the reviewer's concern regarding the insufficient validation.

Figure 7.
The Sensitivity Analysis of the Time Needed for Implementation Criterion



(Source: The Researcher's Findings)

Discussion

This study aimed to address the challenge of selecting appropriate KM technologies in complex and highly regulated organizational environments by proposing an integrated MCDM framework based on AHP and PROMETHEE II. The empirical results indicated that networking-based technologies—particularly intranet, extranet, internet, and organizational portals—constitute the most appropriate solutions for facilitating knowledge sharing and dissemination in the banking sector.

A key contribution of this research is its advancement beyond the limited focus of earlier studies. Previous works, such as Ngai and Chan (2005) and Patel and Hlupic (2002), primarily emphasized traditional criteria such as cost, system functionality, and vendor-related factors. Although valuable, these approaches do not sufficiently capture the realities of today's collaborative and digitally embedded KM environments. By contrast, the present study incorporated a broader and more contemporary set of criteria, particularly Web 2.0 capabilities, collaborative intelligence, and network-based interactions, providing a more holistic and future-oriented framework for KM technology selection. Context-specific studies in SMEs and insurance organizations (e.g., Fallah et al., 2013; Mourne et al., 2010) also offered useful insights but lacked generalizability to large, knowledge-intensive institutions like banks. By applying the proposed model within Eghtesad Novin Bank, this study expanded the empirical domain of KM technology evaluation and demonstrated that platforms such as intranets and

organizational portals are especially valuable in environments characterized by distributed branches, formalized workflows, and structured governance systems.

Furthermore, although studies such as Hashemi et al. (2018) and Ghadami (2015) highlighted the theoretical alignment between KM technologies and organizational strategies, they did not operationalize this alignment through quantifiable decision-support tools. The hybrid AHP–PROMETHEE II framework developed in the present research addressed this gap by converting qualitative expert assessments into quantitative weights through AHP and translating them into a transparent, interpretable ranking of alternatives using PROMETHEE II.

From a methodological standpoint, prior studies employing PROMETHEE (e.g., Asgharizadeh & Nasrollahi, 2007; Mohammadi et al., 2014; Omidi et al., 2011) confirmed its suitability for multi-criteria contexts but did not address its inherent limitation regarding weight determination. This study resolved that shortcoming by integrating PROMETHEE with AHP, thereby improving the consistency, robustness, and reliability of the final results compared with single-method approaches such as AHP, ANP, or fuzzy systems.

Conclusion and Practical Implications

This study developed and validated a hybrid AHP–PROMETHEE II framework for the systematic selection and prioritization of KM technologies in knowledge-intensive organizations. The empirical application in Eghtesad Novin Bank revealed that network-based platforms—including intranets/organizational portals and Internet/Extranet solutions—are the most effective mechanisms for knowledge sharing and dissemination. Other technologies—including private and public social networks, multimedia tools, web conferencing systems, webinars, collaboration technologies, virtual 3D environments, and groupware—were subsequently ranked and may be considered complementary solutions depending on organizational readiness, context, and resource availability.

Accordingly, the proposed framework offered a transparent, practical, and transferable roadmap for guiding strategic KM technology investments in banking sector and other knowledge-driven environments.

Based on the results, the following implications are recommended:

1. **Use of Network-based Technologies (The Highest Priority):** Intranets and organizational portals should be employed to systematically collect, classify, and manage both explicit and tacit knowledge. Internet and Extranet platforms can further strengthen communication and facilitate efficient knowledge flows among employees, managers, and external stakeholders.
2. **Adoption of Private Social Networks and Organizational Communication Groups (The Second Priority)**: Secure internal social networks and communication groups enhance interaction among employees and create a trusted environment for exchanging experiences and best practices.
3. **Utilization of Public Social Networks (The Third Priority):** When properly

governed, public social networks can support collaborative problem-solving, strengthen inter-unit communication, and accelerate knowledge dissemination.

4. **Implementation of Web-Based and Multimedia Technologies (The Fourth P Priority):** Interactive and multimedia tools improve engagement, comprehension, and long-term knowledge retention.
5. **Deployment of Web Conferencing Systems (The Fifth Priority):** Web conferencing solutions reduce the cost and time associated with in-person meetings and enable real-time knowledge exchange across geographically dispersed branches.
6. **Use of Large-Audience Webinars (The Sixth Priority):** Webinars support organization-wide learning, provide simultaneous access to knowledge, and facilitate continuous professional development.
7. **Implementation of Communication and Collaboration Technologies (The Seventh Priority)**: These tools improve teamwork, enhance cross-departmental coordination, and support real-time knowledge exchange.
8. **Adoption of Three-Dimensional Virtual Collaboration Environments (The Eighth Priority):** Immersive 3D platforms simulate real working conditions, increase user engagement, and support advanced interactive learning.
9. **Use of Groupware Systems (The Ninth Priority)**: Groupware applications including chat, conferencing, file sharing, and collaborative document editing — facilitate effective cooperation among geographically dispersed employees.

Research Limitations and Suggestions for Further Research

Despite the insights provided, this study has several limitations. First, the number of experts participating in the weighting and evaluation phases was limited, which may affect the reliability of the results. Future studies should involve larger and more diverse expert groups to enhance the studies' robustness and generalizability. Second, this research was conducted as a single case study within Eghtesad Novin Bank and organizational characteristics may differ across industries. Future research is encouraged to replicate the model in other sectors—such as transportation, insurance, and SMEs—to assess its broader applicability. Third, due to the bank's immediate priorities, only the knowledge sharing and dissemination process was included in the decision-making model. Future studies should expand the framework to incorporate technologies supporting knowledge creation, acquisition, storage, and application to develop a more comprehensive KM technology selection model.

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