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Evaluation and Analysis of Knowledge Management Dimensions with Structural Equation Modeling Approach in Knowledge-Based Project-Oriented Organizations

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ABSTRACT

This study aims to evaluate knowledge management and its components in knowledge-based project-oriented organizations; knowledge management plays an important role in improving performance, innovation, and sustainable competitive advantage. This applied mixed-method research utilized both qualitative and quantitative approaches. In the qualitative phase, meta-synthesis and the fuzzy Delphi method were used to identify and validate key components. In the quantitative phase, a researcher-developed questionnaire was administered using stratified random sampling. Data were analyzed with SPSS and model fit was assessed via Smart PLS. The validity and reliability of the instrument were confirmed through expert evaluations and Cronbach's alpha exceeded 0.7. Six main dimensions of knowledge management—process, technology, human resources, organizational structure, strategy, and leadership—along with 25 components were identified. The Quantitative results demonstrated that these dimensions were generally in a favorable state. Among them, the process dimension had the highest impact while technology had the lowest. The most influential components included strategy, leadership, and knowledge culture. Evaluating knowledge management enables knowledge-based project-oriented organizations to optimize their resources, enhance productivity, and achieve a sustainable competitive advantage. **©authors**.

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1. Introduction

Knowledge-based project-oriented organizations focus on utilizing knowledge and expertise to guide projects and achieve specific goals. These organizations prioritize the creation, sharing, and application of knowledge and consider intellectual capital their most valuable asset. Effective use of knowledge enables them to simplify processes, reduce redundancies, and improve the efficiency of project execution. The synergy between knowledge and project management leads to successful outcomes and continuous improvement. Access to and management of relevant knowledge can reduce project failure risks, enhance decision-making, foster innovative solutions, and increase customer satisfaction (Suparwadi & et. al, 2024).

Knowledge management is a chain of activities involving the production, storage, transfer, and sharing of knowledge within an organization. Studies have shown that effective knowledge management contributes to accumulating intellectual capital, boosting innovation, and improving organizational performance (Jarmooka, Fulford, Morris, & Barratt-Pugh, 2022). In project-oriented organizations, knowledge management is a key tool for achieving success and greater productivity. Developing and implementing effective knowledge management methods helps organizations better meet customer needs and reduce risks related to knowledge gaps and disruptions in information flow (Pereira, 2021).

The primary goal of knowledge management is to optimize the use of organizational knowledge for making informed decisions and generating new ideas (Mohd Yunus et al., 2024). Without proper knowledge management, knowledge assets from projects may be lost once projects conclude, leading to organizational knowledge fragmentation and lost learning (Rastegar et al., 2023). Moreover, given the temporary nature of projects, project-based companies require specific approaches to knowledge management to leverage created knowledge and foster a shared culture for exchanging experiences and information (Zycka, Kluczek & Bagiński, 2022).

Dimensions, systems, and practices of knowledge management should be continuously evaluated to determine their effectiveness and identify strengths and weaknesses. Evaluating knowledge management in such organizations helps with:

1. Improving decision-making by ensuring access to accurate and relevant knowledge
2. Strengthening team collaboration, thereby boosting innovation and efficiency
3. Optimizing resource use and reducing redundancy
4. Measuring the impact of knowledge management initiatives and refining strategies
5. Promoting a culture of continuous improvement and adapting management practices
6. Creating sustainable competitive advantage through effective utilization of organizational knowledge assets (Idris et al., 2023 and Abu Bakr et al., 2019).
7. Considering the importance of this topic, the present study aims to examine and evaluate knowledge management along with its dimensions and elements in knowledge-based project-oriented organizations. The main objectives are:
8. Assessing the status of knowledge management dimensions and components from the perspective of managers and experts
9. Ranking the importance of knowledge management dimensions in these organizations

2. Literature Review

2.1. Knowledge management

Knowledge management (KM) is a strategic effort to preserve, guide, and enhance an organization’s knowledge assets to foster improved performance, innovation, and sustainable competitive advantage (Lengnick-Hall et al., 2023; Manesh et al., 2020). It involves identifying tacit knowledge held by individuals and converting it into explicit organizational knowledge accessible for decision-making

(Edwards & Lönnqvist, 2023). KM comprises dynamic, continuous processes such as knowledge creation, storage, sharing, and utilization rooted in individual and social structures (Mohd Yunus et al., 2024). The ultimate goal is to optimize the use of knowledge resources for better decision-making and organizational benefit.

2.2. Project-Oriented Organizations

Project-oriented organizations (POOs) are entities that center most of their activities around projects, utilizing temporary, task-based units to execute strategic objectives, structural changes, and innovations (Gemünden, 2017; Khalghati & Fazeli-Kebria, 2018). A distinctive feature of POOs is the transient nature of their business units — once a project's goal is achieved, the related organizational unit dissolves, and personnel move to new projects or functional units (Naeemabadi, 2013; Ghazizadeh et al., 2010). This temporariness creates challenges in sustaining knowledge continuity across projects.

2.3. Knowledge-Based Companies

Knowledge-based companies (KBCs) focus on generating value through knowledge-intensive products and services, leveraging expertise and experience within their workforce (Rezaian et al., 2018). These organizations are pivotal players in knowledge economies, fostering innovation, scientific development, and economic growth (Gorji & Barati, 2010; Argoubi et al., 2021). Governments increasingly recognize KBCs as key drivers of income and employment creation, underscoring their role in societal advancement (Etzkowitz, 2019).

2.4. Knowledge Management in Project-Oriented Knowledge-Based Organizations

In knowledge-based project-oriented organizations (KBPOs), KM is critical to retaining and deploying valuable knowledge through the temporary and multidisciplinary nature of projects (Akbari et al., 2022; Rastegar et al., 2023). Challenges arise from project teams' heterogeneity, transience, and often autonomous operation, which hinder knowledge sharing and organizational learning (Dadras & Habshizadeh, 2022). Effective KM practices—such as acquisition, sharing, and transfer—are essential for reducing knowledge loss and improving project outcomes.

Empirical studies corroborate the importance of several KM dimensions in KBPO success:

Mirzaei (2023) found a positive link between organizational culture and project KM mechanisms.

Akbari et al. (2022) identified knowledge creation as most impactful in reducing delays in construction projects.

Gorji and Barati (2019) underscored organizational structure, leadership, technology, processes, employees, strategy, and outcomes as key factors in KM implementation.

Rezaian et al. (2018) highlighted cultural, structural, and communication factors driving knowledge networks.

Santos et al. (2023) emphasized knowledge sharing and exchange as best practices for KM enhancement.

Gonzalez et al. (2022) examined the role of organizational structure and dynamic knowledge capability in innovative performance of project teams.

Ghasemi and Valmohammadi (2021) identified 13 critical success factors for knowledge management, including process, IT, business strategy, culture, and others.

Yavari et al. (2024) identified stakeholder satisfaction as the most important criterion for evaluating knowledge management tools and practices. Among the sub-criteria, capital cost, knowledge transfer, and customers were given the highest weights. Social media was recognized as the most important tool, and ideation sessions were identified as the most important practice.

Fathi et al. (2021) used three components: "knowledge acquisition," "knowledge conversion," and "knowledge application" as key measures of structured knowledge. The results indicated a positive and significant role of structured knowledge and its components on organizational performance, customer knowledge management, and organizational agility.

Table 1 identifies the dimensions and components of knowledge management based on previous studies.

Table 1*. Dimensions and components of knowledge management*

Year	**Researchers**	**Key Dimensions and Elements Examined**
2018	.Rezaian et al	Type of knowledge, cultural factors, organizational structures, communication mechanisms
2018	Khalghati & Fazeli Kebria	Management and leadership factors, human resources-related factors, financial factors
2018	.Ekambaram et al	Identifying and properly sharing knowledge, technologies, and management tools
2019	Gorji & Barati	Organizational structure, leadership, technology, processes, employees, strategy, and outcomes
2019	Amidi, Hashemzadeh & Alizadeh	Knowledge, intellectual capital, financial resources, innovation, and processes
2020	.Khajeh Fouad Latif et al	Knowledge-based leadership, organizational communications, strategies
2020	Ayatollahi & Zeraatkar	Organizational culture, information technology, organizational structure, evaluation and assessment
2021	Ghasemi & Valmohammadi	Knowledge management processes, IT, business strategy, KM activities, KM systems, culture, partnerships, organizational environment
2021	Fathi et al	knowledge acquisition, knowledge conversion, knowledge application
2022	.Gonzalez et al	Knowledge creation and synthesis, knowledge absorption/acquisition
2023	.Santos et al	Knowledge sharing, exchange, dissemination, use, and acquisition
2022	.Akbari et al	Knowledge creation, storage and maintenance, assessment and learning
2023	Mirzaei	Organizational culture and knowledge management mechanisms
2024	Yavari et al	stakeholder satisfaction, knowledge transfer, capital cost, customers

2.5. Research Gap and Justification

Although existing literature identifies critical KM dimensions, there remains limited empirical research that systematically integrates and evaluates these dimensions specifically in project-oriented, knowledge-based organizations. Furthermore, previous studies often focus narrowly on isolated dimensions rather than adopting comprehensive models that reflect KM's inherent complexity and multidimensionality.

This study fills this gap by developing and empirically testing a comprehensive model, incorporating key KM dimensions identified through systematic literature synthesis, validated via structural equation modeling (SEM). By doing so, this research not only addresses existing gaps in theory but also provides practical guidance for organizations striving to optimize KM practices in dynamic, project-based environments.

2.6. Conceptual Model of the Study

The conceptual model of this study is an integrated framework developed based on theoretical literature review and qualitative and quantitative field findings.

It examines knowledge management in knowledge-based project-oriented organizations through six key dimensions:

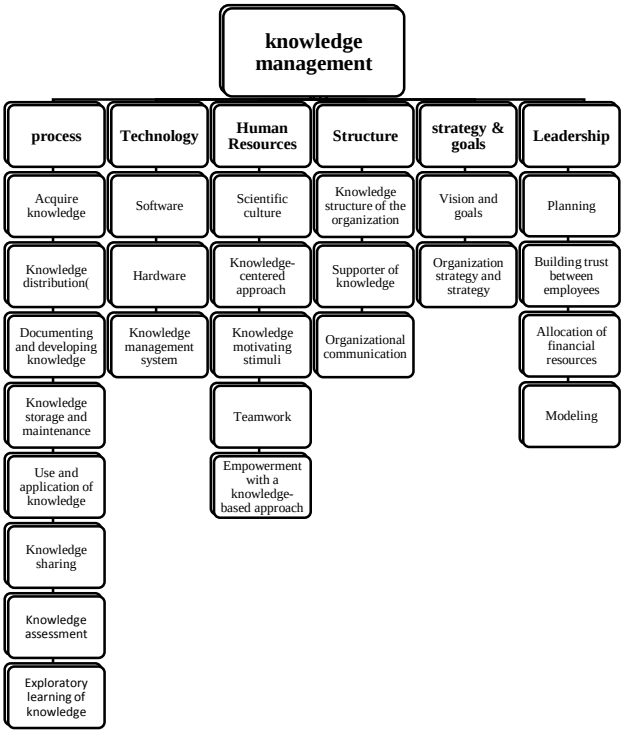

Figure 1. *Model of dimensions and components of knowledge management*

1. Knowledge Management Processes

Including activities of knowledge creation, documentation, distribution, storage and maintenance, utilization, sharing, and evaluation, which form the core knowledge flow in the organization and constitute the foundation of knowledge management.

2. Information Technology

Software and hardware tools and infrastructures that facilitate the effective execution of knowledge management processes.

3. ***Human Resources***

Comprising knowledge-oriented culture, empowerment, motivation, and teamwork of employees, playing a vital role in knowledge sharing and retention.

4. Organizational Structure

Communication networks, organizational knowledge structures, and organizational support mechanisms which create a suitable environment for knowledge flow.

5. Strategy and Objectives

Policies, vision, and overall organizational strategies that guide knowledge management efforts.

6. Leadership

Effective planning, building trust, resource allocation, and managerial role modeling that are key in promoting a knowledge culture and supporting knowledge management.

These dimensions serve as independent variables in the model and, through direct and indirect influences on each other, enhance the **effectiveness of knowledge management** which is the dependent variable. Ultimately, this leads to improved organizational performance, innovation, and success of knowledge-based projects.

The model also considers reciprocal relationships among variables, such as the impact of leadership and strategy on human resources culture and the role of technology in facilitating processes. This interactional structure provides a comprehensive framework to study and analyze knowledge management in the complex environment of project-oriented organizations.

3. Method

The present study is a mixed-method (combination of qualitative and quantitative) applied research, designed with an exploratory approach. The qualitative phase employs integrative and Delphi methods, while the quantitative phase involves survey-based analytical techniques.

3.1-Qualitative phase

In this phase, a comprehensive literature review was conducted, and based on Sandelowski & Barroso's seven-step model, six principal dimensions and twenty-five components influencing knowledge management in knowledge-based project-oriented organizations were identified. The primary dimensions include processes, technology, human resources, organizational structure, strategy and objectives, and leadership. The components comprise knowledge acquisition, documentation and development, knowledge distribution, storage and maintenance, utilization, sharing, evaluation, exploratory learning, software and hardware technologies, knowledge management systems, knowledge-oriented culture, knowledge-based approach in human resource recruitment and utilization, empowerment with a knowledge focus, motivating drivers, teamwork, organizational knowledge structure, knowledge support, organizational communications, vision and goals, organizational strategies, planning, trust-building among employees, financial resource allocation, and managerial benchmarking.

To assess the importance of each component, the Delphi method was applied. In the first round, a questionnaire containing the identified criteria was sent individually to experts, requesting them to rate each criterion on a scale from 1 to 5. In the second round, components with a mean score below 3 were excluded. Subsequently, Kendall's W test was conducted to measure expert consensus, yielding a coefficient of 0.674 with a significance level below 0.05, indicating satisfactory agreement. Accordingly, the Delphi rounds concluded, and the confirmed dimensions and components were incorporated into the main questionnaire design.

3.2- Quantitative phase

In this phase, data were collected using the questionnaire developed in the qualitative stage. Data analysis was performed with SPSS version 26, including descriptive and inferential statistics. Moreover, the conceptual model of knowledge management was validated and analyzed using Structural Equation Modeling (SEM) in Smart PLS software. SmartPLS was chosen due to its suitability for exploratory and predictive

modeling, as well as its flexibility in handling both formative and reflective measurement models.

3.3. Population and Sampling

The study population was defined in two phases:

Qualitative phase: 20 purposively selected experts, including professors in information science and knowledge studies, knowledge management specialists, and managers in knowledge-based project-oriented organizations.

Quantitative phase: 321 managers, deputies, consultants, and experts from electrical, mechanical, human resources management, MBA, and information technology fields. Sample size was determined by Morgan's table and Cochran's formula, resulting in 176 participants selected through stratified random sampling.

3.4. Validity and Reliability of Instruments

Content validity of the questionnaire was examined by supervisors, advisors, and experts and confirmed through the Delphi panel's two rounds. Reliability was assessed via Cronbach's alpha coefficient, yielding a value above 0.7, which indicates acceptable reliability of the measurement instrument.

3.5. Research Objectives and Questions

The research aims to evaluate the competency level of knowledge management in six key areas within knowledge-based project-oriented organizations. The main research questions are:

Are the dimensions and components of knowledge management evaluated favorably from the perspectives of managers and experts in these organizations?

How are the six dimensions of knowledge management ranked in these organizations?

4. Findings

4.1. Assessment of the Theoretical Model

The theoretical model of the study was evaluated using Smart PLS software, and its validity and reliability were assessed. According to the software output, the research model, along with factor loadings and p-values, is illustrated in Figure 2.

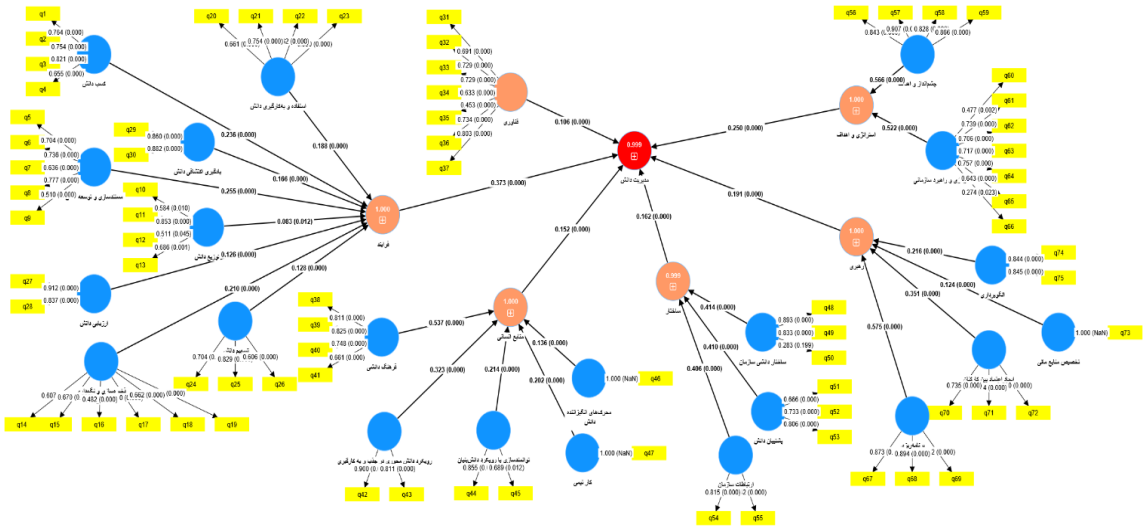

***Figure 2**: Research Model with Factor Loadings and p-values*

4.1.1. Reliability of the Knowledge Management Model

Reliability refers to the generalizability and internal consistency of the constructs. Table 3 presents the reliability evaluation of the variables in the knowledge management model using three main criteria: Cronbach's alpha, Composite Reliability (CR), and Average Variance Extracted (AVE). Cronbach's alpha measures internal consistency, with values above 0.7 indicating acceptable reliability. CR reflects the accuracy and dependability of the constructs, while AVE assesses convergent validity, with an acceptable threshold above 0.5.

Table 3*. Reliability assessment of variables in the knowledge management model*

Knowledge Management Constructs	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Organizational Communication	0.717	0.746	0.687
Knowledge Evaluation	0.700	0.738	0.766
Strategy and Objectives	0.861	0.893	0.631
Organizational Strategy and Policy	0.742	0.785	0.676
Knowledge Utilization	0.756	0.750	0.543
Benchmarking	0.840	0.980	0.713
Building Trust Among Employees	0.740	0.714	0.517
Planning	0.818	0.820	0.734
Knowledge-Based Empowerment	0.700	0.740	0.603
Knowledge Distribution	0.796	0.726	0.502
Knowledge Storage and Maintenance	0.699	0.756	0.620
Leadership	0.803	0.842	0.784
Knowledge-Oriented Approach in HR	0.710	0.681	0.734
Organizational Structure	0.735	0.790	0.521
Organizational Knowledge Structure	0.772	0.712	0.523
Process	0.886	0.899	0.583
Knowledge Culture	0.760	0.774	0.584
Technology	0.809	0.828	0.561
Knowledge Management	0.946	0.957	0.521
Knowledge Documentation and Development	0.702	0.716	0.611
Human Resources	0.776	0.796	0.577
Knowledge Support	0.865	0.708	0.544
Vision and Objectives	0.884	0.885	0.742
Knowledge Acquisition	0.739	0.742	0.564
Exploratory Knowledge Learning	0.756	0.685	0.759

Most variables demonstrate a Cronbach's alpha exceeding 0.7, indicating appropriate internal consistency. Composite reliability values are generally high (e.g., Knowledge Management: 0.957, Process: 0.899).

However, "Knowledge-Based Empowerment" shows a composite reliability of 0.374 implying the need for reviewing related indicators to improve reliability. AVE values for all constructs exceed the 0.5 threshold, confirming convergent validity. Thus, the overall reliability of the model is confirmed.

4.1.2. Validity of the Knowledge Management Model

Validity reflects the appropriateness of the model, comprising convergent and discriminant validity. Convergent validity is confirmed when AVE exceeds 0.5 and CR exceeds AVE, as demonstrated in Table 3.

Discriminant validity was tested using the **Fornell-Larcker criterion** (Table 4), which ensures each construct measures distinct concepts by comparing the square root of AVE (diagonal values) against correlations with other constructs (off-diagonal values).

Table 4*.Fornell-Larker test*

Elements and components	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Organizational communications	0.8																				
Knowledge assessment	0.3	0.9																			
Strategy and goals	0.5	0.4	0.8																		
Organizational strategy and tactics	0.4	0.3	0.9	0.8																	
Use and application of knowledge	0.7	0.4	0.5	0.5	0.7																
Modeling	0.2	0.2	0.3	0.2	0.1	0.8															
Building trust between employees	0.6	0.1	0.6	0.5	0.4	0.3	0.7														
Planning	0.6	0.4	0.8	0.7	0.5	0.4	0.6	0.9													
Allocation of financial resources	0.0	0.1	0.1	0.2	0.1	0.6	0.2	0.3	0.8												
Empowerment with a	0.5	0.3	0.4	0.3	0.4	0.2	0.5	0.5	-0.1	0.7											

knowledge-based approach																				
Knowledge distribution	0.1	0.3	0.1	0.1	0.1	0.0	0.3	0.0	0.3	0.0	0.8									
Knowledge storage and maintenance	0.3	0.4	0.4	0.3	0.5	0.0	0.5	0.2	0.1	0.3	0.4	0.9								
Leadership	0.6	0.3	0.7	0.6	0.5	0.6	0.8	0.6	0.5	0.5	0.1	0.3	0.9							
Knowledge-centered approach In recruiting and employing	0.3	0.3	0.4	0.3	0.4	0.3	0.3	0.3	0.2	0.3	0.4	0.3	0.4	0.7						
Structure	0.8	0.3	0.6	0.5	0.6	0.2	0.5	0.7	0.0	0.6	0.0	0.3	0.6	0.3	0.7					
Organizational knowledge structure	0.6	0.3	0.4	0.4	0.6	0.3	0.2	0.5	0.0	0.5	-0.1	0.3	0.4	0.2	0.8	0.8				
Process	0.5	0.6	0.6	0.6	0.6	0.2	0.6	0.6	0.2	0.5	0.4	0.8	0.6	0.5	0.6	0.5	0.8			
Knowledge culture	0.4	0.3	0.2	0.2	0.4	0.4	0.4	0.2	0.3	0.2	0.2	0.4	0.4	0.6	0.4	0.2	0.5	0.7		
Technology	0.6	0.3	0.4	0.3	0.5	0.3	0.3	0.4	0.1	0.3	0.2	0.3	0.4	0.3	0.5	0.4	0.4	0.3	0.7	
Motivational stimuli Knowledge	0.4	0.3	0.2	0.3	0.3	0.4	0.2	0.4	0.4	0.2	0.1	0.2	0.5	0.3	0.3	0.2	0.4	0.2	0.2	0.8
Knowledge management system	0.7	0.6	0.8	0.7	0.7	0.4	0.7	0.8	0.3	0.6	0.3	0.6	0.8	0.6	0.8	0.6	0.6	0.5	0.6	0.4	0.8
Documentation and development Knowledge	0.4	0.4	0.5	0.5	0.4	0.0	0.6	0.3	0.1	0.4	0.5	0.7	0.4	0.3	0.4	0.3	0.8	0.3	0.3	0.2	0.7
Human Resources	0.6	0.4	0.5	0.4	0.5	0.5	0.5	0.5	0.4	0.5	0.3	0.4	0.6	0.8	0.6	0.4	0.7	0.6	0.4	0.4	0.8
Knowledge support	0.5	0.2	0.4	0.4	0.2	0.1	0.5	0.6	-0.1	0.5	0.1	0.2	0.5	0.3	0.8	0.4	0.4	0.3	0.3	0.3	0.6
Vision and goals	0.5	0.4	0.9	0.7	0.5	0.3	0.5	0.7	0.1	0.5	0.0	0.4	0.7	0.4	0.5	0.4	0.6	0.2	0.4	0.1	0.8
Teamwork	0.4	0.2	0.6	0.5	0.4	0.6	0.5	0.5	0.5	0.2	0.0	0.2	0.7	0.3	0.5	0.5	0.4	0.4	0.5	0.4	0.6
Acquiring knowledge	0.4	0.3	0.5	0.4	0.6	0.2	0.5	0.6	0.2	0.4	0.2	0.5	0.6	0.4	0.4	0.2	0.7	0.4	0.1	0.3	0.7
Knowledge discovery learning	0.4	0.5	0.5	0.5	0.6	0.3	0.4	0.6	0.4	0.5	0.2	0.3	0.6	0.5	0.5	0.4	0.7	0.4	0.2	0.4	0.7

The square root of AVE must be greater than all corresponding correlations, a condition met by the model, confirming distinctiveness among constructs.

4.1.3. Evaluation of Model Predictive Quality and Impact of Independent Variables on Dependent Variables

Model fit and predictive quality were assessed using the **F-Square (f^2) effect size**, which measures the impact strength of each independent variable on dependent variables by indicating the change in the coefficient of determination (R^2) when an independent variable is omitted from the model.

Interpretation of f^2 values:

- $f^2 < 0.02$: negligible effect
- $0.02 \leq f^2 < 0.15$: weak effect
- $0.15 \leq f^2 < 0.35$: moderate effect
- $f^2 \geq 0.35$: strong effect

Table 5. *F-Square Values Indicating Variable Effects*

Path	f^2 Effect Size
Organizational Communication → Structure	0.126
Knowledge Evaluation → Process	0.124
Strategy and Objectives → Knowledge Management	0.044
Organizational Strategy → Strategy and Objectives	0.391
Knowledge Utilization → Process	0.036
Benchmarking → Leadership	0.213
Building Trust → Leadership	0.569
Planning → Leadership	1.426
Financial Resource Allocation → Leadership	0.075
Knowledge-Based Empowerment → Human Resources	0.102
Knowledge Distribution → Process	0.005
Knowledge Storage and Maintenance → Process	0.030
Leadership → Knowledge Management	0.022
Knowledge-Oriented Approach in HR → Human Resources	0.169

Structure → Knowledge Management	0.021
Organizational Knowledge Structure → Structure	0.141
Process → Knowledge Management	0.100
Knowledge Culture → Human Resources	0.456
Technology → Knowledge Management	0.013
Motivating Drivers → Human Resources	0.037
Knowledge Documentation and Development → Process	0.036
Human Resources → Knowledge Management	0.016
Knowledge Support → Structure	0.155
Vision and Objectives → Strategy and Objectives	0.460
Teamwork → Human Resources	0.077
Knowledge Acquisition → Process	0.025
Exploratory Knowledge Learning → Process	0.029

According to the results, "Planning" has a very strong effect on "Leadership", emphasizing a critical role for planning in leadership effectiveness. Other variables with strong impacts include "Building Trust" on "Leadership" and "Vision and Objectives" on "Strategy and Objectives". Moderate to weak but significant effects were found for other variables.

4.2. Research Question 1: Are the Dimensions and Components of Knowledge Management Rated Favorably by Managers and Experts in Knowledge-Based Project-Oriented Organizations?

Table 6 summarizes descriptive statistics for six main dimensions based on responses from 89 participants.

Table 6. *Frequency distribution of dimensions*

Dimension	N	Min	Max	Mean	Std. Dev.	Variance
Process	89	3.20	5.00	4.08	0.37	0.13
Technology	89	2.29	5.00	4.12	0.58	0.33
Human Resources	89	3.20	5.00	4.12	0.44	0.20
Structure	89	2.88	5.00	4.13	0.48	0.23
Strategy	89	3.09	5.00	4.12	0.48	0.23
Leadership	89	3.44	5.00	4.26	0.45	0.20

The highest mean was for Leadership (4.26), indicating the most positive evaluation, while the Process dimension had the lowest mean (4.08). Technology had the highest variability in responses (Std. Dev. = 0.58), suggesting greater divergence of opinion.

In Table 7, a One-Sample t-Test examined whether the means significantly exceeded the neutral midpoint of 3:

Table 7. *One-sample test of dimensions*

Dimension	t-value	df	p-value	Mean Difference	95% CI Lower	95% CI Upper
Process	27.70	88	<0.001	1.08	1.00	1.15
Technology	18.28	88	<0.001	1.12	0.99	1.24
HR	23.75	88	<0.001	1.12	1.02	1.21
Structure	22.27	88	<0.001	1.13	1.03	1.23
Strategy	21.74	88	<0.001	1.12	1.01	1.22
Leadership	26.50	88	<0.001	1.26	1.16	1.35

Results indicate all six dimensions are evaluated significantly above the mid-point level, confirming a generally favorable status.

4.3. Research Question 2: Ranking the Six Dimensions of Knowledge Management in Knowledge-Based Project-Oriented Organizations

Path analysis results for the structural equation model are shown in Table 8, providing path coefficients, standard errors, t-values, and p-values. Relationships with t-statistics above 1.96 and p-values below 0.05 are considered significant.

Table ۸. *Path Relationship Analysis*

Path	Coefficient (β)	Std. Error	t-value	p-value
Organizational Communication → Structure	0.406	0.037	11.10	<0.001
Knowledge Evaluation → Process	0.126	0.022	5.63	<0.001
Strategy and Objectives → Knowledge Management	0.250	0.029	8.49	<0.001
Organizational Strategy → Strategy and Objectives	0.522	0.037	14.10	<0.001
Knowledge Utilization → Process	0.188	0.032	5.85	<0.001
Benchmarking → Leadership	0.216	0.036	5.95	<0.001
Building Trust → Leadership	0.351	0.041	8.62	<0.001
Planning → Leadership	0.575	0.043	13.43	<0.001
Financial Resource Allocation → Leadership	0.124	0.029	4.27	<0.001
Knowledge Sharing → Process	0.128	0.023	5.64	<0.001
Knowledge-Based Empowerment → Human Resources	0.214	0.038	5.70	<0.001
Knowledge Distribution → Process	0.083	0.032	2.60	0.009
Knowledge Storage and Maintenance → Process	0.210	0.026	7.95	<0.001
Leadership → Knowledge Management	0.191	0.024	8.12	<0.001
Knowledge-Oriented Approach in HR → Human Resources	0.323	0.044	7.26	<0.001
Structure → Knowledge Management	0.162	0.027	6.00	<0.001
Organizational Knowledge Structure → Structure	0.414	0.051	8.12	<0.001
Process → Knowledge Management	0.373	0.039	9.59	<0.001
Knowledge Culture → Human Resources	0.537	0.048	11.17	<0.001
Technology → Knowledge Management	0.106	0.028	3.81	<0.001
Motivating Drivers → Human Resources	0.136	0.029	4.66	<0.001
Knowledge Documentation and Development → Process	0.255	0.030	8.57	<0.001
Human Resources → Knowledge Management	0.152	0.024	6.36	<0.001
Knowledge Support → Structure	0.410	0.055	7.44	<0.001
Vision and Objectives → Strategy and Objectives	0.566	0.036	15.79	<0.001
Teamwork → Human Resources	0.202	0.026	7.77	<0.001
Knowledge Acquisition → Process	0.236	0.033	7.05	<0.001
Exploratory Knowledge Learning → Process	0.166	0.019	8.90	<0.001

Even the variables with lower path coefficients (e.g., Knowledge Distribution to Process) showed statistically significant effects.

4.4. Ranking of Knowledge Management Dimensions

Based on the total effects on Knowledge Management, the importance ranking from managers and experts is as follows (Table 9):

Table ۹. *Importance of Knowledge Management Dimensions*

Dimension	Total Effect
Process → Knowledge Management	0.373
Strategy and Objectives → Knowledge Management	0.250
Leadership → Knowledge Management	0.191
Structure → Knowledge Management	0.162
Human Resources → Knowledge Management	0.152
Technology → Knowledge Management	0.106

5. Discussion

In the current model, among the six main dimensions of knowledge management, the **Process** dimension demonstrated the highest impact on knowledge management effectiveness (factor loading: 0.373), while the **Technology** dimension exhibited the least influence (factor loading: 0.106). Analysis of the 25 main components further revealed that the top contributors included **Strategy** (especially Vision and Objectives, and Organizational Strategy), **Leadership** (notably Planning), and **Human Resources** (Knowledge Culture). Meanwhile, components such as **Knowledge Distribution** within the Process dimension had comparatively lower significance.

The findings highlight organizational structure's vital role in supporting knowledge management implementation, the need for continuous evaluation of work processes to enhance performance, and the importance of aligning organizational and knowledge strategies in shaping organizational objectives. Formal knowledge structures, benchmarking of successful projects, and motivational drivers for engaging employees also emerged as highly influential, whereas the role of knowledge-

oriented recruitment in decision-making appeared less pronounced.

5.1. Comparative Analysis with Prior Studies

A comparison with the work of Garaji and Barati (2019) reveals that, although both studies address knowledge management in knowledge-based organizations, each views the issue from a different perspective. This research offers a more comprehensive framework with six dimensions and 25 components, reflecting the complex and multifaceted nature of knowledge management in such organizations. In contrast, Garaji and Barati identified seven factors; the present study provides more granular distinctions—especially within knowledge management processes (acquisition, documentation, distribution, storage, utilization, and sharing)—and places greater emphasis on cultural and human aspects (knowledge culture, teamwork, trust-building).

Both studies confirm organizational structure and leadership as key enablers; however, the current work introduces added detail regarding knowledge-focused leadership and supportive structures, enabling a deeper understanding of these factors. The findings also align with earlier research by Aitollahi and Zeraatkar (2020), Khawaja Fouad Latif et al. (2020), Rahimzadeh et al. (2017), Khalaghti and Fazeli (2018), and Rezaeian et al. (2018), which collectively underscore the critical roles of leadership, organizational structure, organizational communication, and strategy. Notably, Mirzaei's (2023) thesis emphasized the need for a robust knowledge culture—a finding echoed in this study as knowledge culture displayed a high factor loading. Conversely, a contrast appears in the Technology dimension: while this study found a lesser impact, Qasemi and ValMohammadi (2021) reported a prominent role for information technology, a difference possibly arising from variation in organizational context or technological maturity.

5.2. Synthesis of Results and Practical Implications

Overall, the results confirm that knowledge management in knowledge-based project-oriented organizations is a complex, multidimensional phenomenon requiring a comprehensive, systematic approach. Success demands simultaneous attention to multiple domains: processes, technology, human resources, organizational structure, strategy, and leadership. The validated model underscores the influence of organizational planning and strategic policies on effective knowledge management.

For practitioners and policymakers, these findings suggest a need to invest in strengthening knowledge processes, cultivating an enabling organizational culture, developing strategic alignment, and fostering effective leadership practices. Emphasis should also be given to continuous benchmarking, motivational mechanisms, and institutionalizing knowledge structures within project activities.

5.3. Limitations

Despite its comprehensive approach, this study faces several limitations. The sample was restricted to certain organizational contexts, which may influence the generalizability of results. The cross-sectional design and reliance on self-reported data or expert judgment may introduce subjective biases. Future research may address these issues by adopting broader sampling strategies or employing longitudinal methodologies.

5.4. Future Research Directions

Further work could expand the scope to include more diverse organizational settings and industries, or use longitudinal designs to better capture temporal dynamics in knowledge management capabilities. Examining additional dimensions—such as external environmental influences or the moderating effects of organizational culture—could yield deeper insights into the mechanisms underlying effective knowledge management.

5.5. Scientific Contribution

This research advances the field of knowledge management by presenting a validated, multidimensional model tailored to the specific context of knowledge-based

project-oriented organizations. The model integrates detailed distinctions within knowledge management processes and emphasizes the strategic, structural, human, and cultural determinants of effective knowledge management—addressing previous gaps in the literature. By situating these findings within the broader research landscape and offering actionable recommendations, the study makes a significant contribution to both theory and practice.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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