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Designing and Explaining the Model for Institutionalizing Dynamic Knowledge Management with a Sustainable Development Approach in the Oil Industries Commissioning and Operation Company (Mixed-Methods Approach)

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Abstract

This study was conducted with the objective of designing a model for institutionalizing dynamic knowledge management with a sustainable development approach in the Oil Industries Commissioning and Operation Company (OICO). In the qualitative phase of the research, and with the aim of developing the model based on the grounded theory methodology, a group of experts—including academic faculty members, senior managers of the Oil Industries Commissioning and Operation Company, and experienced consultants in the oil, gas, and petrochemical sectors—were selected as the statistical population and participated in in-depth interviews. In this phase, theoretical sampling was applied, and the process continued until theoretical saturation was reached; in total, 11 interviews were conducted. In the quantitative phase, senior, middle, and operational managers of the Oil Industries Commissioning and Operation Company were considered the target population. Out of this population, 108 individuals were selected as the statistical sample using the simple random sampling method. In the qualitative phase of the research, the primary tool for data collection consisted of deep and semi-structured interviews with the experts. In the quantitative phase, the main data collection instrument was a closed-ended researcher-made questionnaire comprising 33 items, which was developed based on the initial conceptual model. Ultimately, the findings of this study led to the development of a model for institutionalizing dynamic knowledge management with a sustainable development approach in the Oil Industries Commissioning and Operation Company, and the hypothesized relationships within the model were tested and confirmed across a broader organizational sample.

Keywords: Dynamic Knowledge Management, Sustainable Development, Oil Industries Commissioning and Operation Company (OICO)

1. Introduction

In the era of rapid technological change and intensifying global competition, organizations face the dual imperative of sustaining competitive advantage and aligning their strategies with sustainable development goals (SDGs). Knowledge management (KM) has emerged as a crucial enabler of both objectives, providing a structured approach to acquiring, sharing, and applying knowledge resources to respond to environmental complexity and dynamic market needs (Ritala et al., 2023). In knowledge-intensive sectors such as oil, gas, and energy, where volatility and long-term ecological and social commitments intersect, the capacity to create and institutionalize *dynamic knowledge management* (DKM) becomes a key determinant of sustainable organizational growth (Nabi et al., 2023). Dynamic KM refers to the ability to continually reconfigure and renew knowledge assets to meet shifting demands and is strongly tied to dynamic capabilities theory (Kaur, 2023; Oliva et al., 2019). This view underscores the strategic nature of KM, moving beyond static repositories to flexible, innovation-driven systems (Scuotto et al., 2022; Spanellis et al., 2021).

Recent research emphasizes that organizations integrating DKM within sustainability-driven strategies achieve higher adaptability, operational excellence, and innovative capacity (Jalali, 2023). In the oil and gas industry, where operations often have complex environmental and social impacts, embedding sustainability principles into knowledge processes is not optional but essential (Arbabi et al., 2021). This integration supports balanced decision-making that accounts for environmental stewardship, social responsibility, and long-term economic performance (Davoudi & Fanaee, 2023; Rousta & Allaf Jafari, 2024). Moreover, the rise of Industry 4.0 technologies and artificial intelligence (AI) has reshaped how knowledge is captured, processed, and utilized, reinforcing the strategic role of DKM in managing complexity and achieving sustainable outcomes (Husayn, 2025; Mahmoud et al., 2025). Organizations that develop dynamic knowledge-based capabilities adapt more effectively to external shocks, innovate faster, and maintain competitiveness in turbulent markets (Nabi et al., 2023; Tariq et al., 2024).

At the theoretical level, DKM sits at the intersection of dynamic capabilities and sustainable development theories. Dynamic capabilities refer to an organization's ability to integrate, build, and reconfigure internal and external competencies in rapidly changing environments (Kaur, 2023; Oliva et al., 2019). These capabilities support continuous renewal of knowledge assets, fostering agility and resilience (Spanellis et al., 2021). In parallel, sustainable development frameworks emphasize environmental, social, and economic equilibrium, urging companies to embed long-term responsibility into their innovation systems (Swati et al., 2020; Zakari & Feely, 2019). Combining these two perspectives positions DKM as a central driver of green growth, enabling firms to create, share, and utilize knowledge in ways that support environmental conservation, social equity, and profitability (Davoudi & Fanaee, 2023; Mousavi, 2022).

Scholars have shown that knowledge-oriented strategies become more effective when embedded in supportive organizational cultures and structures. Culture acts as a catalyst for knowledge sharing, learning, and collaboration (Kiakjoori et al., 2025; Moslehi et al., 2021). Organizations with dynamic, learning-oriented cultures adapt more readily to environmental shifts and encourage employees to contribute to sustainability-oriented initiatives (Mahdizadeh Rostam et al., 2024). Conversely, rigid, hierarchical structures often inhibit knowledge flows and innovation (Gheybipour & Hajikaimi, 2023). Building a culture aligned with sustainability values encourages employees to internalize green knowledge practices, while empowering them enhances their willingness and ability to apply new knowledge dynamically (Adhikari & Shrestha, 2023). This cultural embedding becomes especially critical in industries like oil and gas, where legacy systems and entrenched operational logics often resist transformation (Arbabi et al., 2021; Norouzi et al., 2021).

The literature also highlights the growing interplay between DKM and emerging digital technologies. AI and smart technologies have become powerful enablers of real-time knowledge acquisition, analysis, and application (Husayn, 2025; Mahmoud et al., 2025). These tools automate knowledge flows, detect patterns in complex datasets, and provide actionable intelligence to support sustainability-driven decision-making. For example, AI-supported KM can optimize resource allocation and reduce environmental footprints by enhancing predictive maintenance and process control (Mubarakh et al., 2025).

Likewise, digital innovation enables rapid reconfiguration of knowledge networks and fosters agility across global supply chains (Scuotto et al., 2022; Tariq et al., 2024). However, technological change also introduces uncertainty, requiring organizations to balance knowledge protection with openness and renewal (Ritala et al., 2023). Companies must develop strategies for managing intellectual capital while still enabling knowledge exchange crucial for innovation and sustainability (Kaur, 2023; Oliva et al., 2019).

Contextual and structural factors strongly influence the institutionalization of DKM. Organizational design, governance mechanisms, and leadership commitment determine the extent to which dynamic knowledge systems become embedded (AlMulhim, 2023; Mousavi, 2022). Leaders play a pivotal role by shaping vision, allocating resources, and modeling knowledge-sharing behavior (Mubarakh et al., 2025; Nabi et al., 2023). Stewardship-oriented leadership, for example, fosters trust and psychological safety, encouraging employees to share insights that drive radical innovation and sustainable transformation (Nabi et al., 2023). At the same time, effective KM implementation requires robust infrastructures—technological, procedural, and human—that support continuous learning and adaptability (AlMulhim, 2023; Mahdizadeh Rostam et al., 2024). Developing these infrastructures is particularly important in project-based oil and gas firms, where knowledge fragmentation and turnover can erode long-term organizational memory (Arbabi et al., 2021; Norouzi et al., 2021).

Institutionalizing DKM with a sustainable development approach also demands integrating environmental and social metrics into knowledge systems. Studies show that green KM, which incorporates ecological knowledge and environmental awareness, can improve environmental performance and contribute to sustainable organizational development (Davoudi & Fanaee, 2023; Rousta & Allaf Jafari, 2024). Similarly, aligning KM with corporate social responsibility ensures that knowledge creation and use reflect ethical considerations and community impact (Mousavi, 2022; Swati et al., 2020). The oil and gas sector, often criticized for ecological and social consequences, can leverage DKM to embed sustainability at both strategic and operational levels, meeting regulatory demands and societal expectations (Arbabi et al., 2021; Zakari & Feely, 2019). Moreover, dynamic sustainability-oriented KM supports agile responses to policy changes and market pressures, strengthening corporate legitimacy and long-term survival (Davoudi & Fanaee, 2023; Norouzi et al., 2021).

Despite these advances, empirical models capturing the interplay between DKM and sustainable development remain underdeveloped, particularly in emerging economies and knowledge-intensive yet environmentally impactful industries such as oil commissioning and operations (Mousavi, 2022; Shariatmadari & Mazrae Farahani, 2021). While conceptual frameworks have evolved, there is a shortage of integrative models that clarify causal, contextual, and strategic factors necessary for embedding DKM in sustainability pathways (Gheybipour & Hajikaimi, 2023; Shariatmadari & Mazrae Farahani, 2021). Moreover, the dynamic and turbulent nature of the energy sector demands tailored approaches that account for environmental uncertainty, knowledge volatility, and technology-driven disruption (Scuotto et al., 2022; Spanellis et al., 2021). Iranian and regional oil and gas companies face the compounded challenge of legacy infrastructures and urgent sustainable transformation, making context-specific research critical (Arbabi et al., 2021; Kiakjoori et al., 2025).

This study addresses these gaps by developing and testing a model for institutionalizing dynamic knowledge management with a sustainable development orientation in the Oil Industries Commissioning and Operation Company (OICO).

2. Methods and Materials

The present study is applied in terms of its purpose and applied–exploratory in terms of its approach. It should be noted that this research was carried out in the following two main phases:

- **Phase 1:** Designing the model for institutionalizing dynamic knowledge management with a sustainable development approach in the Oil Industries Commissioning and Operation Company (OICO). (Qualitative approach: Grounded Theory)

- **Phase 2:** Fitting the model for institutionalizing dynamic knowledge management with a sustainable development approach in the Oil Industries Commissioning and Operation Company (OICO). (Quantitative approach: Structural Equation Modeling)

In the qualitative phase of the study, to design the model based on the grounded theory methodology, a group of experts—including academic faculty members, senior managers of the Oil Industries Commissioning and Operation Company (OICO), and experienced consultants in the oil, gas, and petrochemical industry—were considered as the statistical population. The criteria for selecting experts included the following: mastery of organizational knowledge management and familiarity with dynamic knowledge management in the oil, gas, and petrochemical industry; expertise in sustainable development within the oil, gas, and petrochemical industry; familiarity with knowledge management processes in the Oil Industries Commissioning and Operation Company (OICO); possession of a master's or doctoral degree; and having management or consulting experience in the oil, gas, and petrochemical industry.

In the quantitative phase of the study, to test and fit the model, a larger population was needed. Therefore, all senior, middle, and operational managers of the Oil Industries Commissioning and Operation Company (OICO) were considered as the statistical population, totaling 150 individuals.

In the qualitative phase of the research, theoretical sampling was employed. In this method, the sample size depends on reaching theoretical saturation. The sampling process continued until theoretical saturation was achieved, and a total of 11 interviews were conducted.

In the quantitative phase of the study, based on Krejcie and Morgan's table, the required sample size was determined to be 108 individuals. It should be noted that in this research, to select the final quantitative sample, the simple random sampling method was used.

In the qualitative phase of the research, since the grounded theory method was used, the main data collection tool consisted of deep and semi-structured interviews with experts in the marketing domain. In these interviews, the researcher sought to engage participants smoothly and establish initial trust, asking questions indirectly about the antecedents and consequences of institutionalizing dynamic knowledge management with a sustainable development approach. Through this method, the initial concepts needed for designing the model were extracted.

In the quantitative phase, the main data collection instrument was a closed-ended, researcher-made questionnaire consisting of 33 items, designed based on the initial conceptual model. Responses in this questionnaire were based on a five-point Likert scale ranging from "strongly disagree" to "strongly agree." The structure of this questionnaire, including its various dimensions, is shown in Table 1.

Table 1. Structure of the Quantitative Research Questionnaire

Variable	Label in Software	Corresponding Items in the Questionnaire
Causal Factors	Var1	1 to 5
Organizational Determination to Institutionalize Dynamic Knowledge Management with a Sustainable Development Approach	Var2	6 to 8
Contextual Factors	Var3	9 to 12
Intervening Factors	Var4	13 to 16
Strategic Factors	Var5	17 to 24
Outcomes	Var6	25 to 33

In the qualitative phase of the research, the grounded theory method and three levels of coding (open, axial, and selective) were employed to achieve the conceptual model of the study.

In the quantitative phase, to analyze the data and test the research hypotheses, statistical software SPSS and LISREL were used. Both descriptive statistics (mean, standard deviation, frequency, etc.) and inferential tests (Cronbach's alpha, construct validity, confirmatory factor analysis, and path analysis) were applied.

3. Findings and Results

In this study, a total of 11 interviews were conducted, and 130 initial concepts were extracted. After reviewing, merging, and eliminating repetitive concepts, 44 final concepts were identified. Then, by carefully analyzing the identified concepts and

determining their similarities and differences, broader categories referred to as “themes” were created, and related and coherent concepts were placed within these higher-level categories. The outcome of this process was the identification of 17 main categories (Table 2).

Table 2. Categories Identified from Axial Coding

Concepts (Open Coding)	Categories (Axial Coding)	Row
Advances in information technology directly influence how organizational knowledge is managed	Technological changes in knowledge management	1
It is completely natural that with technological advancement, the style of management in organizations evolves		
Technologies are now available that were unimaginable just years ago		
Dynamic knowledge management is a strategic advantage and superiority	The company’s strategic outlook toward dynamic knowledge management	2
If senior managers adopt a strategic perspective on organizational knowledge management, they will certainly welcome modern approaches in this field		
Previous research shows that dynamic knowledge management emerges at the strategic levels of organizations and is implemented at lower operational levels		
Implementing any new method or approach requires certain infrastructures that must be considered	Provision of technical and technological infrastructures for dynamic knowledge management	3
Dynamic knowledge management requires specific technical and technological infrastructures		
Allocating sufficient budget in the Oil Industries Commissioning and Operation Company for implementing dynamic knowledge management	Organizational determination to institutionalize dynamic knowledge management with a sustainable development approach	4
Commitment of the company’s core leadership to aligning all organizational transformation projects with the sustainable development approach		
Static, traditional, and past-oriented organizational cultures contradict the spirit of dynamism	Organizational culture aligned with dynamic knowledge management	5
An organizational culture aligned with dynamic thinking is a crucial driver in the field of dynamic knowledge management		
Organizational culture is a causal variable for many organizational factors and is also influenced by some of them		
The Oil Industries Commissioning and Operation Company must promote and institutionalize dynamic thinking across its different levels	Institutionalizing dynamic thinking in organizational knowledge management	6
The current knowledge management system in the Oil Industries Commissioning and Operation Company is not aligned with dynamic approaches, but inevitably must move toward dynamism		
Managers and knowledge management specialists in the company must establish this approach as a new paradigm across the entire organization		
Institutionalizing dynamic thinking in the organizational knowledge management system paves the way for implementing strategies in this field		
Proper management of organizational knowledge can lead to faster decision-making and prompt actions	Enhancing organizational agility	7
A shared characteristic of agile organizations is the use of a dynamic and environment-sensitive knowledge management system		
In today’s era, agility is a necessity rather than a competitive advantage, and accurate organizational knowledge at the right time and place is required to achieve agility		
Organizational changes and improvements mainly originate from the top levels of the organization	Senior managers’ awareness of the necessity and importance of dynamic knowledge management	8
Senior managers in the Oil Industries Commissioning and Operation Company must deeply understand why moving toward dynamic knowledge management is critical		
As long as the significance and necessity of an issue are not evident to senior managers, they will not move forward in its implementation		
Some senior managers in the Oil Industries Commissioning and Operation Company are unfamiliar with the concept of dynamic knowledge management, let alone its importance and necessity		
The company must consider environmental issues in its development and improvement path	The company’s strategic outlook on sustainable development	9
The company must consider the economic concerns of society in its development and improvement path		

The company must consider the concerns of the general public in its development and improvement path		
Senior managers in the Oil Industries Commissioning and Operation Company must practically demonstrate their commitment to institutionalizing dynamic knowledge management	Senior managers' commitment to institutionalizing dynamic knowledge management	10
Senior managers must express their commitment to the dynamic knowledge management system in words and through various organizational platforms, thereby serving as role models for employees and increasing the perceived importance of this approach		
Previous knowledge management processes in the company are not suitable for dynamic approaches	Redesigning organizational knowledge management processes to align with dynamic knowledge management	11
Transitioning from traditional knowledge management systems to dynamic knowledge management requires organizational process redesign		
Managers in the Oil Industries Commissioning and Operation Company must ensure that dynamic knowledge management processes do not contradict the dimensions of sustainable development	Aligning dynamic knowledge management processes with sustainable development requirements	12
A task force can be established to ensure compliance with sustainable development principles in the company		
Dynamic knowledge management can play a role in enhancing the efficiency of the Oil Industries Commissioning and Operation Company	Improving organizational productivity	13
If dynamic knowledge management is properly institutionalized and implemented, the company's effectiveness in achieving its improvement goals will increase		
Compared to the past, society's expectations from the Oil Industries Commissioning and Operation Company have significantly increased	Stakeholder expectations regarding sustainable development	14
Regulatory pressures on oil and gas companies to comply with sustainable development principles have intensified		
Environmental variables affecting oil, gas, and petrochemical companies, both in terms of software and hardware, are constantly changing	Continuous environmental changes	15
Environmental scanning is one of the most important management principles, especially in today's highly dynamic world		
Environmental monitoring and assessments must be continuous, not occasional		
Compliance with certain requirements can keep the company on the path of sustainable development	Advancing the company along the sustainable development path	16
Moving along the sustainable development path represents an important relative advantage		
One of the main drivers of implementing dynamic knowledge management is empowering employees and individuals involved in the processes of this domain	Employee empowerment in dynamic knowledge management	17
Empowering employees both clarifies the necessity and importance of dynamic knowledge management and helps them understand how to implement this new approach		

In the next step, the identified categories were positioned within the paradigm model structure (Figure 1).

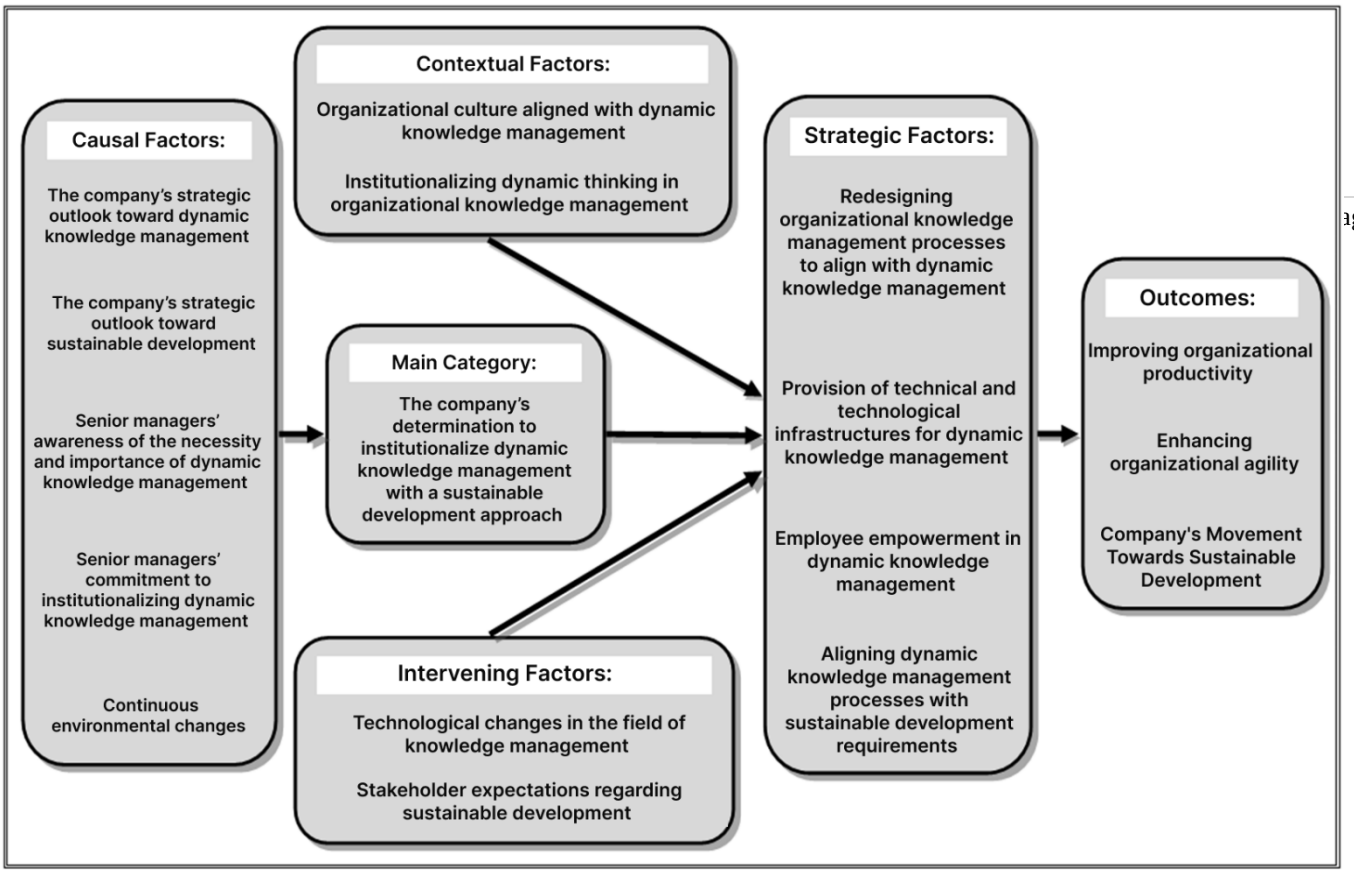

Figure 1. Placement of the Categories in the Paradigm Model Structure

Based on the above model, the research hypotheses were formulated as follows:

(1) Causal factors have a significant effect on the company's determination to institutionalize dynamic knowledge management with a sustainable development approach.

(2) The company's determination to institutionalize dynamic knowledge management with a sustainable development approach has a significant effect on strategic factors.

(3) Contextual factors have a significant effect on strategic factors.

(4) Intervening factors have a significant effect on strategic factors.

(5) Strategic factors have a significant effect on improving organizational productivity.

(6) Strategic factors have a significant effect on enhancing organizational agility.

(7) Strategic factors have a significant effect on advancing the company along the sustainable development path.

To examine the fit of structural models, several criteria are used. The first criterion for assessing the relationships among constructs in the model is the significance of t-values; the t-values must be either greater than +1.96 or less than -1.96 to confirm the validity of the relationships among the constructs and to support the research hypotheses at a 95% confidence level (Figure 4). It should be noted that the intensity of the relationships among the constructs can be observed in Figure 3.

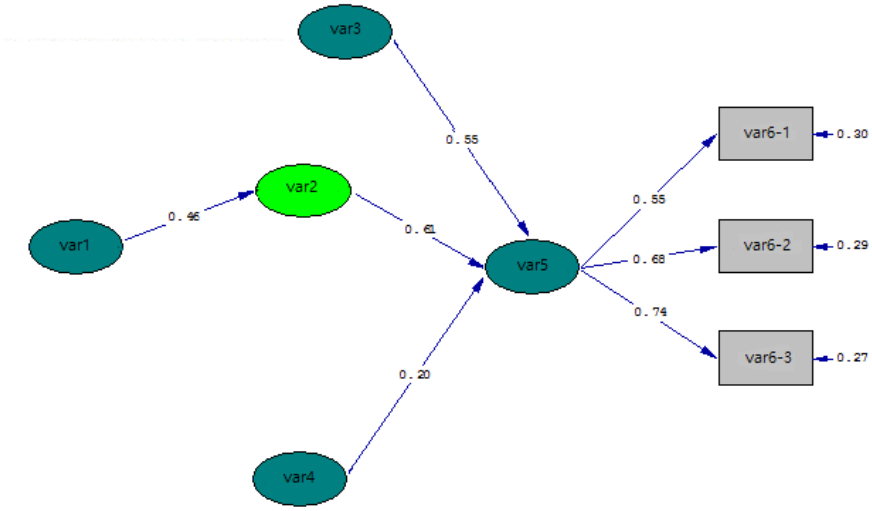

Figure 2. Fitted Research Model in the Standardized State

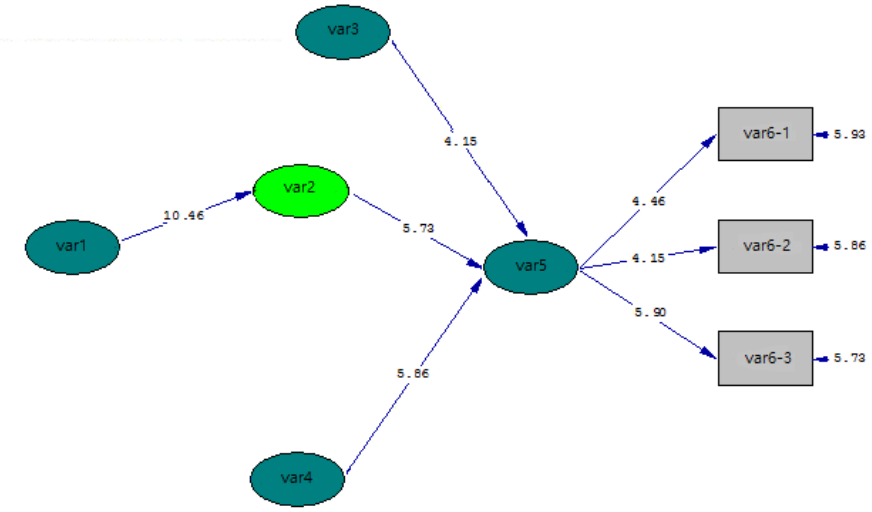

Figure 3. Fitted Research Model in the Significance State

According to the software output in Table 3, the Root Mean Square Error of Approximation (RMSEA) is 0.069. The Goodness of Fit Index (GFI) is 0.976, the Adjusted Goodness of Fit Index (AGFI) is 0.92, the Comparative Fit Index (CFI) is 0.928, the Non-Normed Fit Index (NNFI) is 0.95, and the Incremental Fit Index (IFI) is 0.93.

Table 3. Fit Indices of the Conceptual Research Model

Fit Index	Desired Value	Model Value	Result
χ^2/df	< 3.00	1.77	Fitted
RMSEA (Root Mean Square Error of Approximation)	< 0.08	0.069	Fitted
GFI (Goodness of Fit Index)	> 0.90	0.97	Fitted
AGFI (Adjusted Goodness of Fit Index)	> 0.90	0.92	Fitted
RMR (Root Mean Square Residual)	< 0.05	0.034	Fitted
NFI (Normed Fit Index)	> 0.90	0.97	Fitted
NNFI (Non-Normed Fit Index)	> 0.90	0.95	Fitted
CFI (Comparative Fit Index)	> 0.90	0.92	Fitted
IFI (Incremental Fit Index)	> 0.90	0.93	Fitted

The significance coefficients of the model paths indicate whether the research hypotheses are statistically meaningful. If the path significance coefficient between two variables is greater than +1.96 or less than -1.96, this indicates that the relationship between the two variables is significant at the 95% confidence level, and the hypothesis is confirmed. Table 4 summarizes the significance coefficients and the results of the tested hypotheses.

Table 4. Results of Testing the Research Hypotheses

Hypotheses	Standard Coefficient	t-value	Result
Causal factors have a significant effect on the company's determination to institutionalize dynamic knowledge management with a sustainable development approach.	0.46	10.46	Confirmed
The company's determination to institutionalize dynamic knowledge management with a sustainable development approach has a significant effect on strategic factors.	0.61	5.73	Confirmed
Contextual factors have a significant effect on strategic factors.	0.55	4.15	Confirmed
Intervening factors have a significant effect on strategic factors.	0.20	5.86	Confirmed
Strategic factors have a significant effect on improving organizational productivity.	0.55	4.46	Confirmed
Strategic factors have a significant effect on enhancing organizational agility.	0.68	4.15	Confirmed
Strategic factors have a significant effect on advancing the company along the sustainable development path.	0.74	5.90	Confirmed

4. Discussion and Conclusion

The present study developed and validated a comprehensive model for institutionalizing dynamic knowledge management (DKM) with a sustainable development orientation in the Oil Industries Commissioning and Operation Company (OICO). The findings of the qualitative phase revealed seventeen core categories, which were subsequently positioned within a paradigm model and empirically tested using structural equation modeling (SEM). The quantitative results confirmed all seven hypothesized relationships, underscoring the robust interplay between causal, contextual, and strategic factors in shaping organizational agility, productivity, and the company's advancement along a sustainable development trajectory.

A key result was the significant influence of causal factors—including strategic outlook toward DKM and sustainable development, senior managers' awareness and commitment, and responsiveness to continuous environmental changes—on the company's determination to institutionalize DKM. This aligns with prior studies emphasizing the foundational role of leadership vision and environmental scanning in dynamic knowledge strategies (Kaur, 2023; Nabi et al., 2023). (Nabi et al., 2023) found that stewardship-oriented leaders foster organizational readiness for radical innovation by leveraging dynamic KM capabilities under uncertain conditions. Similarly, (Arbabi et al., 2021) highlighted that in the Iranian oil and gas context, top management's commitment to sustainable development objectives catalyzes the adoption of transformative practices, including knowledge-oriented initiatives. These results also support (Oliva et al., 2019), who posits that leadership's ability to sense and respond to environmental change underpins the renewal of knowledge resources essential for long-term competitiveness.

The study further confirmed that the company's determination to institutionalize DKM significantly drives strategic factors such as redesigning knowledge processes, building technical infrastructures, empowering employees, and aligning KM processes with sustainability requirements. This is consistent with (AlMulhim, 2023), who found that organizational determination and knowledge management capability mediate performance outcomes by enhancing opportunity recognition and adaptability in dynamic environments. The empowerment dimension resonates with (Mahdizadeh Rostam et al., 2024), who emphasized that restructured organizational systems and empowered employees are critical for implementing new KM paradigms effectively. Additionally, (Kaur, 2023) notes that dynamic knowledge-based capabilities, when supported by structural and cultural readiness, enable organizations to orchestrate resources toward sustainability-driven innovation.

The findings also indicated that contextual factors, including an organizational culture aligned with DKM and the institutionalization of dynamic thinking, exert a significant effect on strategic factors. This supports the proposition that culture is both an antecedent and enabler of knowledge-oriented transformation (Kiakjoori et al., 2025; Mousavi, 2022). (Kiakjoori et al., 2025) reported that organizational cultures fostering collaboration, flexibility, and learning substantially improve KM maturity in Iranian firms. Similarly, (Norouzi et al., 2021) emphasized that dynamic and innovation-supportive cultures facilitate the integration of KM and management innovation, leading to superior export performance. These cultural dimensions are essential for the oil and gas industry, where legacy systems and entrenched operational logics often inhibit knowledge flows and sustainability integration (Arbabi et al., 2021).

Another validated relationship was the positive impact of intervening factors—technological changes in KM and stakeholder expectations for sustainability—on strategic KM initiatives. This underscores the external pressures and opportunities shaping DKM strategies in energy-intensive sectors. The finding parallels (Mahmoud et al., 2025), who showed how integrating KM

with smart technologies enhances responsiveness and sustainability in public pharmaceutical organizations. (Husayn, 2025) also demonstrated that AI adoption reshapes KM practices, enabling dynamic adaptation to stakeholder and regulatory demands. Furthermore, (Rousta & Allaf Jafari, 2024) highlighted how increasing environmental knowledge and responsibility among stakeholders create pressure for organizations to embed sustainability considerations into their operational knowledge systems.

Importantly, the study verified that strategic KM factors significantly improve organizational productivity and agility, confirming the theoretical assertion that DKM is a source of operational excellence and adaptability (Scuotto et al., 2022; Spanellis et al., 2021). (Scuotto et al., 2022) found that international marketing firms leveraging DKM achieve superior responsiveness and innovative capabilities in global markets. Likewise, (Spanellis et al., 2021) documented how dynamic KM models in energy companies directly improved efficiency and decision-making agility by linking knowledge flows with operational feedback loops. The productivity gains found here also support (Davoudi & Fanaee, 2023), who reported that green KM initiatives in urban organizations enhanced sustainable performance and resource efficiency.

Another major contribution is the empirical evidence that strategic KM practices enable the company's movement along the sustainable development path. The positive and significant influence of redesigned knowledge processes, empowered employees, and sustainability-aligned KM infrastructures on sustainable transformation echoes the conclusions of (Adhikari & Shrestha, 2023), who argued that stakeholder-driven KM initiatives in higher education advance SDG 4.7 by embedding sustainability content into institutional practices. (Mubarakh et al., 2025) similarly highlighted the mediating role of KM in linking leadership to value-driven organizational outcomes, including sustainability. These results affirm that DKM serves as a bridge between operational agility and sustainability, balancing efficiency with environmental and social accountability (Mousavi, 2022; Swati et al., 2020). For oil and gas companies, where compliance with sustainability regulations and public expectations is critical, this finding offers a practical roadmap for transformation.

The study also extends the work of (Shariatmadari & Mazrae Farahani, 2021), who noted the fragmentation of KM research and the lack of integrated models contextualized for Iranian industries. By linking causal antecedents, cultural enablers, and strategic KM actions to tangible performance outcomes such as agility, productivity, and sustainability progression, this research provides a unified framework that addresses both theoretical and practical gaps. It demonstrates how DKM can be embedded not as an isolated IT or HR initiative but as an organization-wide paradigm supported by leadership commitment, cultural alignment, stakeholder engagement, and technological infrastructure (AlMulhim, 2023; Gheybipour & Hajikaimi, 2023). The model thus operationalizes dynamic capabilities and sustainability theory within the complex, high-impact oil and gas context, offering actionable insights for firms facing environmental scrutiny and digital disruption.

Moreover, the validation of environmental scanning and responsiveness as critical causal elements supports the argument that sustainability and agility are mutually reinforcing outcomes of DKM (Oliva et al., 2019; Ritala et al., 2023). By continually sensing environmental change and renewing knowledge resources, organizations can simultaneously enhance resilience and reduce ecological and social risks. This duality echoes findings by (Rousta & Allaf Jafari, 2024) regarding the interplay between environmental knowledge and sustainable consumption patterns, as well as (Tariq et al., 2024), who linked networking capabilities and knowledge worker productivity to sustainable performance in SMEs.

Overall, the discussion affirms that integrating sustainability principles into DKM strengthens the strategic agility of energy-intensive firms, enhances innovation, and meets growing stakeholder demands. It shows that knowledge is not merely an operational asset but a transformative force shaping the sustainable future of organizations in volatile and environmentally sensitive sectors.

Although the study provides a comprehensive and empirically validated model, several limitations should be acknowledged. First, the research was conducted within a single organization, the Oil Industries Commissioning and Operation Company (OICO), which may limit the generalizability of the findings across the broader oil and gas sector or other industries with different structural and cultural characteristics. Second, while the study used both qualitative and quantitative methods to ensure model validity, the cross-sectional design restricts causal inference over time. Dynamic knowledge management and sustainability are long-term processes; longitudinal research could better capture how these systems evolve. Third, the sample

size, though adequate for SEM, was constrained by organizational access and may not fully represent all employee perspectives, especially frontline operational staff. Fourth, the study primarily relied on self-reported perceptions and managerial insights, which could introduce social desirability bias, particularly concerning sustainability-related questions.

Future studies could expand this work by applying the model across multiple organizations within the oil and gas industry and beyond, such as renewable energy, manufacturing, or public service sectors, to test its robustness and contextual adaptability. Comparative analyses between industries undergoing digital transformation and those with entrenched legacy systems would provide deeper insight into how technological readiness influences DKM institutionalization. Additionally, longitudinal research could track the impact of implementing the proposed model over time, examining how cultural change, technological integration, and leadership commitment affect long-term sustainability outcomes. Researchers might also explore the role of emerging digital platforms—such as AI-driven analytics and knowledge graphs—in accelerating dynamic KM for sustainability. Moreover, integrating external stakeholder perspectives, including regulators, communities, and supply chain partners, would enrich understanding of how external pressures and collaboration shape knowledge strategies.

For practitioners, the study offers clear guidance for embedding DKM into sustainability-driven strategies. Leaders should begin by articulating a compelling vision that links knowledge renewal to sustainable value creation and communicate this across all organizational levels. Investing in cultural transformation programs to encourage openness, learning, and collaboration is essential, particularly in traditionally hierarchical industries. Organizations should also allocate resources to build robust KM infrastructures, including digital platforms and AI-enabled tools that enhance knowledge flow and decision support. Empowering employees with training and participatory involvement in KM initiatives will increase engagement and accelerate change adoption. Finally, aligning knowledge processes with sustainability metrics and establishing cross-functional task forces can ensure that knowledge-driven decisions contribute directly to environmental stewardship, social responsibility, and long-term competitive advantage.

Ethical Considerations

All procedures performed in this study were under the ethical standards.

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Conflict of Interest

The authors report no conflict of interest.

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