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ORIGINAL

Investigating the role of knowledge management on the relationship between integration management, risk factors, and performance management of construction projects: a case of UAE

Investigando el papel de la gestión del conocimiento en la relación entre la gestión de integración, los factores de riesgo y la gestión del desempeño de los proyectos de construcción: un caso de los EAU

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ABSTRACT

Introduction: this research aimed to assess the impact of integration management, social risk, and technical risk on project management performance within the construction sector in the UAE.
Method: a survey questionnaire was developed by extracting items from existing literature. A random sampling technique was used for data collection, resulting in a final valid response of 288 questionnaires. The data was empirically tested through measurement and structural models using Smart PLS.
Results: the study demonstrated reliability, convergent validity, and discriminant validity of the latent constructs. The structural model results confirmed that integration management, technical risk, and knowledge management had a significant effect on construction project performance. Additionally, knowledge management significantly moderated the relationship between integration management and project performance, as well as between social risk and project performance in the UAE.
Conclusions: the findings suggest that effective knowledge management can enhance project performance by moderating the impact of integration management and risk factors. Several policy implications were provided based on these results.

Keywords: Integration Management; Social Risk; Technical Risk; Project Performance; Knowledge Management.

RESUMEN

Introducción: esta investigación tuvo como objetivo evaluar el impacto de la gestión de integración, el riesgo social y el riesgo técnico en el desempeño de la gestión de proyectos dentro del sector de la construcción en los EAU.
Método: se desarrolló un cuestionario de encuesta extrayendo ítems de la literatura existente. Se utilizó una técnica de muestreo aleatorio para la recolección de datos, obteniendo una respuesta válida final de 288 cuestionarios. Los datos fueron analizados empíricamente a través de modelos de medición y estructurales utilizando Smart PLS.
Resultados: el estudio demostró la fiabilidad, validez convergente y validez discriminante de los constructos latentes. Los resultados del modelo estructural confirmaron que la gestión de integración, el riesgo técnico y la gestión del conocimiento tuvieron un efecto significativo en el desempeño de los proyectos de construcción. Además, se encontró que la gestión del conocimiento moderaba significativamente la relación entre la

gestión de integración y el desempeño del proyecto, así como entre el riesgo social y el desempeño del proyecto en los EAU.
Conclusiones: los hallazgos sugieren que una gestión eficaz del conocimiento puede mejorar el desempeño del proyecto al moderar el impacto de la gestión de integración y los factores de riesgo. Se proporcionaron varias implicaciones políticas basadas en estos resultados.

Palabras clave: Gestión de Integración; Riesgo Social; Riesgo Técnico; Desempeño del Proyecto; Gestión del Conocimiento.

INTRODUCTION

The concept of integration management (IM) in construction projects has garnered significant attention from researchers, focusing on its critical role in coordinating various project procedures. Asif et al. defines IM as a meticulous process that establishes a governance structure to meet stakeholder requirements systematically.[1] Historically, IM has been a crucial component of systems engineering[2] and involves the coordination of all project activities to enhance success.[3] The "Project Management Body of Knowledge Guide" highlights IM as a key area, emphasizing its impact on project performance. Risk in projects refers to potential complications and issues affecting project objectives.[4] It is associated with uncertainty and can influence project components like scope, cost, quality, and schedule.[5] Construction projects, characterized by their complexity and dynamic environments, face inherent risks.[6] Knowledge management (KM) has emerged as a strategic asset for improving organizational performance. While past studies have focused on the service and manufacturing sectors,[7,9] some scholars argue that KM investment may not always enhance firm performance.[10] The construction industry, in particular, is affected by delays and cost overruns due to inadequate KM practices,[11] highlighting the need for better KM integration.

Overview of the Construction Industry in the UAE

Recently, the UAE construction industry has shown signs of recovery, with a growth rate of 3,1 % in 2021 following a 4,8 % decline in 2020. It is expected to grow at an annual average of 3,8 % from 2022 to 2025.[12] New regulations, such as the Dubai Building Code, aim to reduce construction costs, and the UAE government has introduced a three-stage economic package to support investment and the labor market. Additionally, infrastructure development is a priority for the Emirate and the broader GCC region. Despite these positive trends, the COVID-19 pandemic has disrupted numerous projects, leading to reduced profits. However, significant events like Expo 2020, rescheduled to October 2021–March 2022, are anticipated to drive demand for construction, particularly in hospitality and public infrastructure. The sector faces challenges such as rising material costs and funding constraints but remains a vital part of the UAE economy. The UAE construction market is the largest in the Middle East, accounting for 41% of the GCC construction contract value since 2004 see figure 1. Key segments include residential, commercial, industrial, and energy construction. To highlight some practical policy implications and strategic guidelines for the project managers, industry experts, and other stakeholders as associated with the construction projects in UAE.

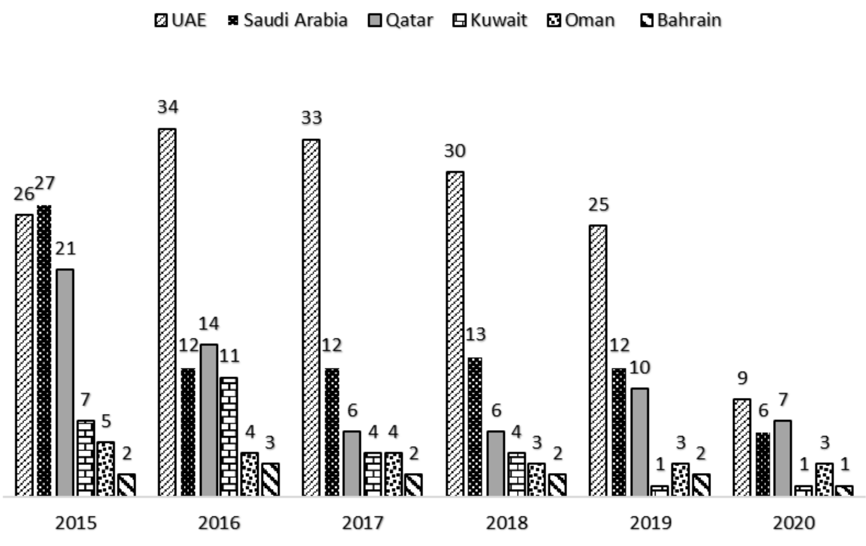

Figure 1. GCC Construction and transportation contract awards 2015-2020 ($bn)
Source: Mashreq (2020)

Literature review

Integration Management and Performance

Mitchell found that effective integration of specialized knowledge significantly impacts the successful design of products and processes, including large-scale IT projects.(13) Cox regression analysis indicated that access to external knowledge and internal knowledge integration both help reduce delays in IT projects.(13) Franz et al. explored how team integration and group cohesion affect project performance across 204 projects, revealing that delivery methods influence team integration.(14) Mellado and Lou examined how information modeling, lean practices, and sustainability improve construction performance, emphasizing the direct environmental impact of the construction industry.(15)

Technical Risk and Performance

Wiguna and Scott identified technical risks such as design defects and delays as critical factors affecting residential building projects.(16) Business performance can be understood through performance measurement, which assesses organizational success and improvement.(17,18)

Social Risk and Performance

Joynt Maddox et al. investigated social risk factors affecting hospital performance,(19) while Xiahou et al. analyzed social performance in construction projects [20]. Social risk can damage an organization's reputation, leading to reduced customer loyalty and market share.(21) It can also increase costs and affect financial performance by raising legal and insurance expenses.(22)

Knowledge Management and Performance

Recent studies highlight the importance of knowledge management (KM) for improving performance. Lee et al. found that KM infrastructure and organizational learning are linked to performance.(23) Reich et al. confirmed KM's significant role in IT project performance.(24) Darroch showed that firms with more KM resources have higher innovation and performance.(25) Lim et al. demonstrated that KM practices in sustainable supply chain management enhance performance.(26) Zack et al. found that KM practices directly affect performance, indirectly influencing financial outcomes.(27)

Knowledge Management as Moderator

The moderating role of KM has been explored in various studies. Laroche et al. found that KM moderates the relationship between product intangibility and perceived risk.(28) Abd Rahman et al. showed that KM improves organizational effectiveness and training.(29) Wang et al. found that KM moderates the relationship between personal attitudes and organic food buying intentions.(30) Saffar and Obeidat demonstrated that knowledge sharing moderates the impact of total quality management on employee performance.(31) Figure 2 reflects the research framework of the study.

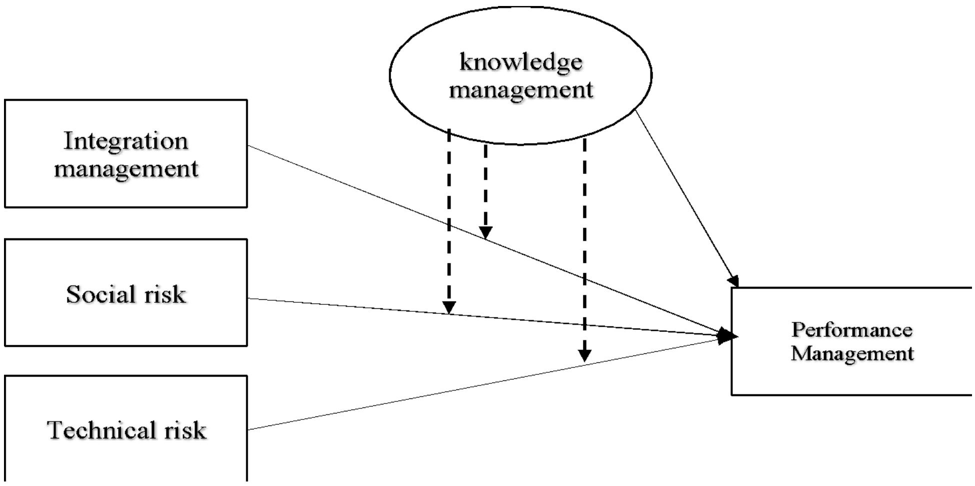

Figure 2. Research Framework

Considering above literature, below mentioned research hypotheses have been developed and tested:

H1: Integration management significantly impacts the performance management of construction projects in the UAE.

H2: Social risk significantly impacts the performance management of construction projects in the UAE.

H3: Technical risk significantly impacts the performance management of construction projects in the UAE.

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H4: Knowledge management significantly impacts the performance management of construction projects in the UAE.

H5: Knowledge management moderates the relationship between integration management and the performance management of construction projects in the UAE.

H6: Knowledge management moderates the relationship between technical risk and the performance management of construction projects in the UAE.

H7: Knowledge management has a significant moderating effect on the relationship between social risk and the performance management of construction projects in the UAE.

Research methodology

This study has considered primary data collection with the help of a self-administrated structural questionnaire. The main reason to select the questionnaire technique as a data collection tool is that it helps the respondents provide their valuable opinions most appropriately and easily. Furthermore, it also helps summarize the responses more efficiently and effectively (Corbetta, 2003; AlDhaheri, 2023). Besides, it is also stated that a survey questionnaire is the most reliable and valid source for the data collection (Brush & Vanderwerf, 1992). As stated earlier, the existing research is based on the primary data by undertaking the survey technique through questionnaire. For this purpose, existing literature has been reviewed. Overall, five variables have been considered: integration management, social risk, technical risk, project knowledge management, and project performance. More specifically, there are three independent variables, one moderator and one dependent variable under present study. To measure these variables, five points Likert scale has been used. It is observed that many studies have utilized five points Likert scale for data collection (Chyung, Roberts, Swanson, & Hankinson, 2017; Derrick & White, 2017; H. Wu & Leung, 2017). For measuring the integration management, six items from the research work of Demirkesen and Ozorhon (2017b) have been extracted. On the other side, the measurement of Social Risk is based on the theoretical and empirical contribution by Miao, Huang, and He (2019). Additionally, the Technical Risk is measured through seven items as found the study of (El-Sayegh et al., 2021). As part of measuring the knowledge management, three dimensions, entitled enabling environment, knowledge practices and knowledge stock have been considered from the research work of (Reich et al., 2014a). Finally, the project management performance is measured through three items as adopted from the research work of Demirkesen and Ozorhon (2017b). Appendix-1 provides the structure of the questionnaire along with the relevant items under consideration. Using the structural questionnaire, random sampling technique was adopted for the purpose of data collection from the construction industry in UAE. Table 1 provides the details related to response rate.

For empirical estimation, current research considers demographic analysis, descriptive measures and two step approach entitled measurement model and structural model, respectively.

Table 1. Sample Response Rate

Description	Number of Questionnaire	%
Total Questionnaires distributed and received.	384	100
Questionnaires observed with invalid responses.	96	25
Questionnaires observed as Valid for the Data Analysis/useable Questionnaires.	288	75

RESULTS

Demographic Analysis

Field of Operations

Out of 288 respondents, 29,9 % are from engineering, 42,7 % from architecture, and 27,4 % from construction (table 2).

Table 2. Field of Operations (FOO)

Categories		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Engineering	86	29,9	29,9	29,9
	Architecture	123	42,7	42,7	72,6
	Construction	79	27,4	27,4	100,0
	Total	288	100,0	100,0	

Company's Experience in the Construction Industry

Experience distribution is as follows: 13,9 % with 0-10 years, 42% with 10-20 years, 16,7 % with 20-30 years, 16,3 % with 30-40 years, and 11,1 % with over 50 years (table 3).

Table 3. Company's Experience (CEX) in the Construction Industry					
Categories		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	0-10 Years	40	13,9	13,9	13,9
	10-20 Years	121	42,0	42,0	55,9
	20-30 Years	48	16,7	16,7	72,6
	30-40 Years	47	16,3	16,3	88,9
	>50 Years	32	11,1	11,1	100,0
	Total	288	100,0	100,0	

Company's Expertise

The expertise distribution is: infrastructure (13,5 %), transportation (13,9 %), building (32,3 %), industrial (12,8 %), water structures (15,6 %), and other fields (11,8 %) (table 4).

Table 4. Company's Expertise (CEX) in the Relevant Industry					
Details		**Frequency**	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Infrastructure	39	13,5	13,5	13,5
	Transportation	40	13,9	13,9	27,4
	Building	93	32,3	32,3	59,7
	Industrial	37	12,8	12,8	72,6
	Water Structures	45	15,6	15,6	88,2
	Others	34	11,8	11,8	100,0
	Total	288	100,0	100,0	

Descriptive Statistics

Table 5 provides means, standard deviations, and ranges for various study variables, including technical risk (TNR), social risk (SCR), project performance (PMP), integration management (ITM), enabling environment (ENN), knowledge practices (KNP), and knowledge stock (KNS).

Table 5. Descriptive Statistics				
Items	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
Technical Risk (TNR)				
TNR1	1,00	5,00	3,1667	1,00867
TNR2	2,00	5,00	3,8438	.51449
TNR3	1,00	5,00	3,8368	.49150
TNR4	2,00	5,00	4,0069	.42560
TNR5	1,00	5,00	3,1667	.94813
TNR6	2,00	5,00	3,9931	.45718
TNR7	1,00	5,00	2,9688	1,08637
Social Risk (SCR)				
SCR1	2,00	5,00	3,8438	.51449
SCR2	1,00	5,00	3,8542	.46432
SCR3	1,00	5,00	4,6042	.81978
SCR4	1,00	5,00	3,8958	.49694
SCR5	1,00	5,00	3,8576	.58781
SCR6	1,00	5,00	3,8924	.54633
SCR7	1,00	5,00	3,4514	1,30039
SCR8	1,00	5,00	3,5382	1,31141
Project Performance (PMP)				
PMP1	1,00	5,00	3,8472	.58815
PMP2	2,00	5,00	4,6944	.70120
PMP3	1,00	5,00	3,8924	.53992
Integration Management (ITM)				
ITM1	2,00	5,00	4,7118	.68095
ITM2	2,00	5,00	3,8646	.45616
ITM3	1,00	5,00	4,7222	.67245
ITM4	1,00	5,00	3,8646	.67230
ITM5	2,00	5,00	3,8222	0,5191

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Table 5. Descriptive Statistics				
Items	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
ITM6	1,00	5,00	4,0855	0,1587
Enabling Environment (ENN)				
ENN1	1,00	5,00	3,2569	1,26462
ENN2	1,00	5,00	3,2778	1,37648
ENN3	1,00	5,00	3,3576	1,29076
ENN4	1,00	5,00	3,4514	1,15267
ENN5	1,00	5,00	3,5313	1,33789
Knowledge Practices (KNP)				
KNP1	1,00	5,00	3,4271	1,14835
KNP2	1,00	5,00	3,4479	1,25942
KNP3	1,00	5,00	3,4583	1,30331
KNP4	1,00	5,00	3,4618	1,18877
KNP5	1,00	5,00	3,4340	1,24204
Knowledge Stock (KNS)				
KNS1	1,00	5,00	2,6042	1,02048
KNS2	1,00	5,00	3,6354	1,04384
KNS3	1,00	5,00	3,5486	1,05150

Note: ENN; enabling environment, ITM; integration management, KMN; knowledge management, KNP; knowledge practices, PMP; project management performance, SCR; social risk, TNR; technical risk.

Measurement Model Assessment

Construct Reliability and Validity

Reliability was confirmed with Cronbach's Alpha and rho_A values above 0,70 for all constructs. Convergent validity was established with average variance extracted (AVE) values above 0,50 (table 6).

Table 6. Construct Reliability and Validity				
	Cronbach's Alpha	**rho_A**	**CR**	**(AVE)**
ENN	0,886	0,888	0,917	0,688
ITM	0,861	0,874	0,906	0,707
KMN	0,776	0,856	0,803	0,656
KNP	0,867	0,869	0,910	0,718
KNS	0,782	0,784	0,873	0,696
PMP	0,893	0,893	0,934	0,825
SCR	0,904	0,909	0,926	0,677
TNR	0,789	0,805	0,860	0,606

Note: ENN; enabling environment, ITM; integration management, KMN; knowledge management, KNP; knowledge practices, PMP; project management performance, social risk, TNR; technical risk.

Discriminant Validity

Fornell-Larcker criteria were met, showing that the square root of AVE values is greater than the inter-construct correlations (table 7). Also, Figure 3 provides the output for the measurement model.

Table 7. Fornell-Larcker								
	ENN	**ITM**	**KMN**	**KNP**	**KNS**	**PMP**	**SCR**	**TNR**
ENN	0,830							
ITM	0,001	0,841						
KMN	0,648	0,028	0,801					
KNP	0,337	0,048	0,572	0,847				
KNS	0,041	0,022	0,209	0,116	0,834			
PMP	0,031	0,870	0,000	0,044	0,023	0,908		
SCR	0,058	0,848	0,089	0,084	0,048	0,834	0,823	
TNR	0,016	0,649	0,079	0,123	0,020	0,734	0,543	0,779

Note: ENN; enabling environment, ITM; integration management, KMN; knowledge management, KNP; knowledge practices, PMP; project management performance, SCR; social risk, TNR; technical risk.

Structural Model Assessment

Direct Relationships

Integration Management (ITM) -> Project Performance (PMP): Positive significant effect (β = 0,163, p < 0,01) (table 8).

Social Risk (SCR) -> PMP: Positive but insignificant effect (β = 0,121, p = 0,527) (table 8).

Technical Risk (TNR) -> PMP: Significant negative effect (β = -0,240, p < 0,05) (table 8).

Knowledge Management (KMN) -> PMP: Positive significant effect (β = 0,065, p < 0,05) (table 8).

Moderating Role of KMN

ITM and PMP: KMN positively moderates this relationship (β = 0,606, p < 0,01) (table 9).

SCR and PMP: KMN positively moderates this relationship (β = 0,131, p < 0,01) (table 9).

TNR and PMP: KMN has a negligible and insignificant moderating effect (β = -0,006, p = 0,986) (table 9).

Figure 3 provides the output for the measurement model.

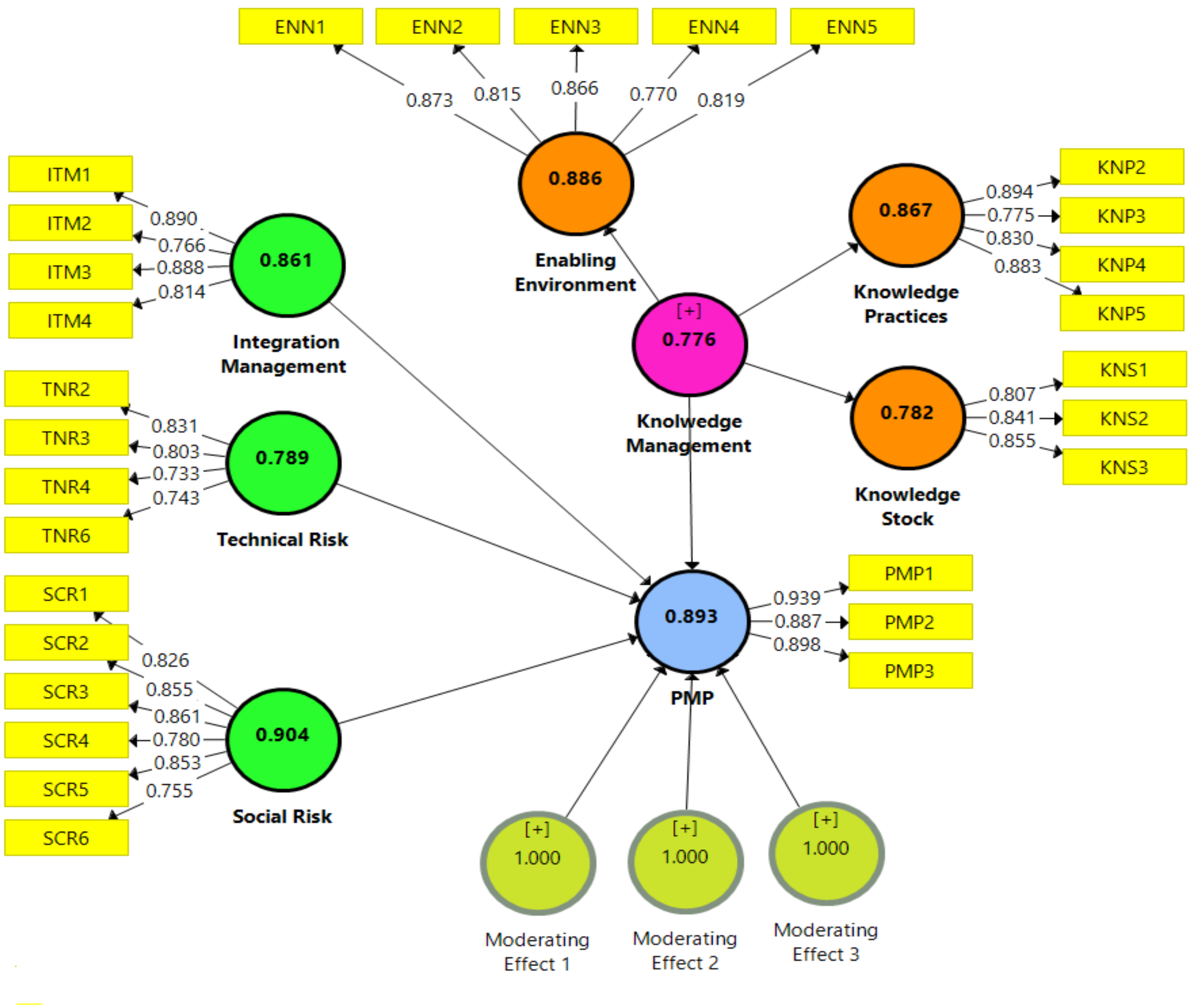

Figure 3. Measurement Model Output

DISCUSSION

The demographic analysis indicates a diverse range of professional backgrounds and experience levels among respondents, with a predominance of architecture and a substantial presence in the 10-20 years of industry experience. Expertise varies widely, with a significant focus on building and water structures.

The measurement model analysis confirms reliability and validity of the constructs. Discriminant validity was verified using Fornell-Larcker criteria, ensuring accurate measurement of constructs.

In terms of direct relationships, integration management significantly improves project performance, supporting its importance in the construction industry. The impact of social risk on project performance was found to be positive but not statistically significant, suggesting that while social risk may influence performance, its effect in this study is minimal. Technical risk has a significant negative effect on project performance, highlighting the need for effective risk management strategies. Knowledge management also positively affects project performance, emphasizing its role in enhancing project outcomes.

The moderating effects of knowledge management are notably significant in strengthening the relationships between integration management and project performance, as well as between social risk and project performance. However, knowledge management's moderating role on technical risk is not significant, indicating a potential gap in how knowledge management practices are applied to mitigate technical risks. Both elaborated as the following two figures.

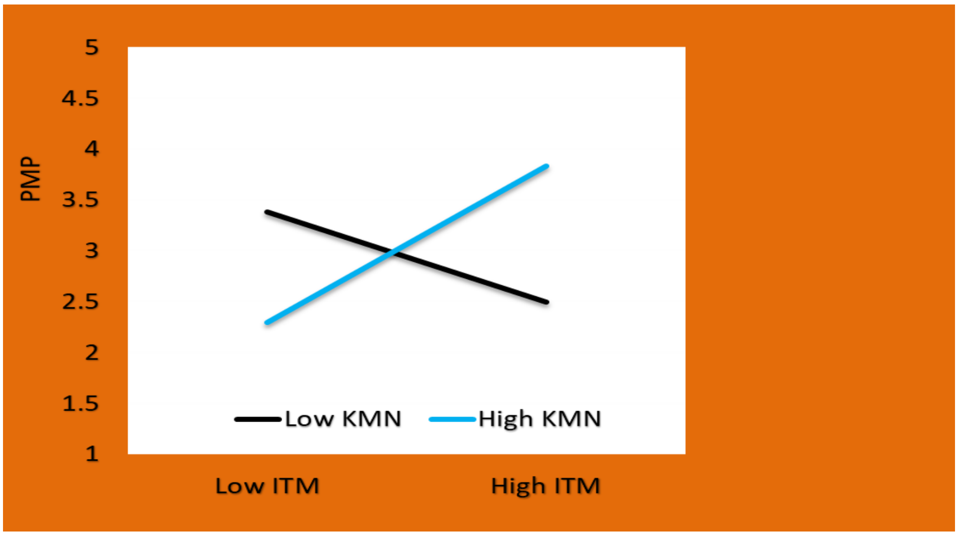

Figure 4. Moderating Effect of KMN between TNR and PMP

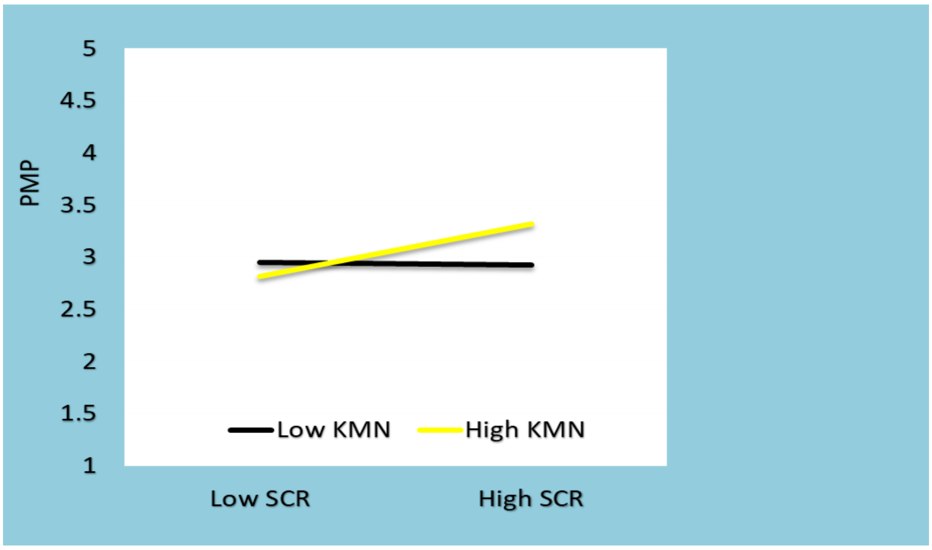

Figure 5. Moderating Role of KMN between SCR and PMP

Overall, these findings underscore the importance of integration management and knowledge management in improving project performance and suggest areas for further enhancement in managing technical risks.

CONCLUSION

This study explores the impact of technical risk, social risk, and integration management on project management performance in the UAE construction sector, with a focus on the moderating role of knowledge management. Using Structural Equation Modeling (SEM) with Smart PLS, and analyzing data from 288 valid questionnaires, the findings indicate that integration management, technical risk, and knowledge management significantly influence project performance. Knowledge management also plays a critical moderating role between integration management and project performance, as well as between social risk and project performance.

Key recommendations include implementing an effective project management system with centralized documentation and communication, fostering collaboration among stakeholders, and leveraging technology such as Building Information Modeling (BIM). Regular monitoring and aligning project schedules with budgets and quality controls are essential. To mitigate technical risks, developing contingency plans and engaging experts is advisable.

The study underscores the importance of knowledge management in enhancing project outcomes. It suggests that the construction industry should invest in employee training, promote knowledge sharing, and use both financial and non-financial incentives to support knowledge management practices. Strengthening knowledge management practices can lead to improved project performance and better coordination among stakeholders.

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