

Assessing the Impact of Risk Management Implementation on the Success of Industrial Projects: A Case Study Approach

Abstract

Objective: The goal of this study is to analyze the impact of risk management implementation on the success of an industrial project, with key practices such as risk identification, risk assessment, risk response, and risk monitoring.

Study Location: Various industrial sectors like construction, manufacturing, energy were included in the research which was conducted in Riyadh, Saudi Arabia.

Method: About 300 professionals, including project managers, engineers, risk officers among others participated in the study. The data was collected using two established instruments: the Project Risk Management Maturity Assessment (PRMMA) and the Project Success Questionnaire (PSQ). SPSS was used for descriptive and inferential statistical analyses for the assessment of risk management practices and project success.

Result: According to the findings, risk management practices display a significant positive correlation with project success and risk management implementation can significantly predict project success. High involvement in risk management actions was beneficial for project, customer and business performance.

Recommendation: Organizations must take up risk management structure and develop a risk-aware culture. Future studies ought to examine how digital devices and AI can amalgamate into risk management to produce the optimum results in future projects.

Keywords: Risk management, industrial projects, project success, Saudi Arabia, organizational culture.

تقييم أثر تطبيق إدارة المخاطر على نجاح المشاريع الصناعية: دراسة حالة

ملخص

الهدف: تهدف هذه الدراسة إلى تحليل أثر تطبيق إدارة المخاطر على نجاح المشاريع الصناعية، مع التركيز على الممارسات الأساسية مثل تحديد المخاطر، وتقييمها، والاستجابة لها، ومراقبتها.

موقع الدراسة: شملت الدراسة قطاعات صناعية متنوعة، كالبناء والتصنيع والطاقة، وأجريت في الرياض، المملكة العربية السعودية.

المنهجية: شارك في الدراسة نحو 300 متخصص، من بينهم مديرو مشاريع ومهندسون ومسؤولو مخاطر. جُمعت البيانات باستخدام أداتين معتمدتين: أداة تقييم نضج إدارة مخاطر المشاريع (PRMMA) واستبيان نجاح المشاريع (PSQ). استخدم برنامج SPSS لإجراء التحليلات الإحصائية الوصفية والاستدلالية لتقييم ممارسات إدارة المخاطر ونجاح المشاريع.

النتائج: أظهرت النتائج وجود ارتباط إيجابي قوي بين ممارسات إدارة المخاطر ونجاح المشاريع، كما أن تطبيق إدارة المخاطر يُمكن أن يتنبأ بنجاح المشاريع بشكل كبير. وكان للمشاركة الفعالة في إجراءات إدارة المخاطر أثر إيجابي على أداء المشاريع والعملاء والشركة.

التوصيات: يجب على المؤسسات تبني هيكل لإدارة المخاطر وتطوير ثقافة واعية بالمخاطر. ينبغي أن تتناول الدراسات المستقبلية كيفية دمج الأجهزة الرقمية والذكاء الاصطناعي في إدارة المخاطر لتحقيق أفضل النتائج في المشاريع المستقبلية.

الكلمات المفتاحية: إدارة المخاطر، المشاريع الصناعية، نجاح المشاريع، المملكة العربية السعودية، الثقافة التنظيمية.

1. Introduction

Industrial projects refer to projects which are large scale. Moreover, these projects involve many complex coordination problems and various stakeholders. Also, these projects require huge financial investments (Ajayi et al., 2022). Usually, these projects suffer from many risks that can be technical, logistical, environmental or regulatory. Focus on proper risk management to minimize risks as well as aid in completing a successful project within time, cost, and quality (Chen et al., 2022; Almusaed et al., 2024). Throughout the life cycle of the project, risk management of industrial projects is a systematic process of having the projects teams identify, analyze, and respond to risks. Moreover, it allows them to manage uncertainty and mitigate any negative impacts (Afzal et al., 2021; Thach et al., 2021). As industrial technologies have evolved and projects have become larger, it has become even more important but also more difficult to manage these risks, especially in construction, manufacturing and energy (El-Sayegh et al., 2021).

Studies have shown that the use of solid risk management strategies could improve the success of a project that is more likely. For example, in construction, systematic risk management improved project efficiency and reduction of delays and cost overruns (Shayan et al., 2022). Similarly, in a manufacturing project, the use of risk management framework will limit operational disruption and improve decision-making (Khalid et al., 2021; Nazir et al., 2024). As Shayan et al. (2022), risk identification, analysis, and response planning can help a project manager foresee potential occurrences of risks and address them beforehand to improve project outcomes (Etemadi et al., 2021).

Alongside these practices, the maturity level of the project's risk management system to which it adheres is one of those practices (Dugbartey & Kehinde, 2025). Organizations that have a higher risk management maturity level have the ability to handle risks better during various stages of the lifecycle of the project. Evidence indicates that firms with mature risk management processes tend to achieve superior outcomes on their projects, particularly in high-stakes industries

where the cost of failure is high (Ragas et al., 2023; Ajayi et al., 2022). A sound risk management culture builds organizational resilience resulting in effective adaptation to risks, enhanced control of project parameters, and the ability to embrace unforeseeable events without adverse consequences (Jääskä et al., 2022; Judijanto et al., 2024).

Risk management practices for industrial projects are being revolutionized with the advent of new technologies, particularly AI and Industry (Malek et al., 2021). This technology will support real-time analysis of data, predictive analysis, and automated risk assessment for enhancing accuracy and efficiency of risk identification and mitigation (Rane et al., 2021; Nenni et al., 2025). These technologies are expected to improve risk management systems and reduce uncertainty and complexity of large-scale industrial projects (Fritz-Morgenthal et al., 2022; Aladağ, 2023). This advancement can help organizations improve their risk management efforts and enhance the success of their projects.

2. Method

The study relied on a case study design method to examine the extent to which risk management influences the success of industrial projects in Riyadh, Saudi Arabia. The study's target population was the professionals in industrial projects, such as project managers, engineers, supervisors, and risk officers. A sample of 300 respondents was selected on convenience basis using G Power sample size calculator. To be included, participants needed to have a minimum of three years of experience in project management and formal risk management procedures. Consequently, administrative employees were excluded along with employees having less than one year of experience. To collect the data, a demographic sheet was used to gather information of the participants on the basis of their age, gender, education, position, years of experience, field of work, and use of procedures for risk management. According to Hillson and Murray-Webster (2007), the Project Risk Management Maturity Assessment (PRMMA) involved 30 questions answered via Likert Scale. There are four sub-scales of the PRMMA, namely, risk identification, risk assessment, risk response planning, and risk monitoring. The Cronbach's alpha reliability of the instrument is high at 0.91. The second instrument, the Project Success Questionnaire (PSQ) by Shenhar, Dvir and Levy (2001), which is composed based on their conceptualization of project success, include 20 questions assessing Project efficiency, Customer impact, Business success and Future potential. The PSQ has an internal consistency (i.e. coefficient alpha) of 0.88.

Data were analyzed using SPSS (Version 28) using the descriptive statistics to evaluate distribution, mean score, standard deviation, skewness, and kurtosis. The variations in demographic subgroups will be identified by inferential analyses such as Cronbach's alpha, Pearson Product-Moment Correlation, Linear Regression, Independent Sample t-test, and One-Way ANOVA. After gaining IRB approval and approval from participating organizations, data-collection began. Participants were informed about the purpose of the research, their confidentiality, the voluntary nature and obtained written informed consent. We provided survey both online and hard copy version for better response. The researchers ensured that ethical considerations such as confidentiality, informed consent, and voluntary-participation were all followed (19 words) although the research attempted to get comprehensive data, it was restricted to industrial projects of Riyadh. Similarly, the self-reported data probably impacted the results. Finally, there were some constraints in time and the number of participants available.

3. Results

Table 1 *Demographical Information of the study participants. (N=300)*

Variable	Category	<i>f</i>	%
Age	Below 30	54	18.0
	30–39	186	62.0
	40–49	44	14.7
	Above 50	16	5.3
Gender	Male	207	69.0
	Female	93	31.0
Education	Diploma	17	5.7
	Bachelor's Degree	173	57.7
	Master's Degree	99	33.0
	4.00	11	3.7
Job Title	Engineer	118	39.3
	Project Manager	8	2.7
	Manager	21	7.0
	Supervisor	74	24.7
	Risk Officer	30	10.0
	Government Relationship	3	1.0
	Audit Head	3	1.0
	Specialist Nurse	6	2.0
	Lawyer	3	1.0
	Family Medicine Doctor	20	6.7
	Laboratory Custodian	5	1.7

	Architect	9	3.0
Years of Professional Experience	0–5 years	36	12.0
	6–10 years	94	31.3
	11–15 years	120	40.0
	More than 15 years	49	16.3
Industrial Sector	Energy	99	33.0
	Manufacturing	83	27.7
	Construction	54	18.0
	Office work	1	0.3
	Aviation	8	2.7
	Government	8	2.7
	Health sector	12	4.0
	Law	5	1.7
	Storing	3	1.0
	Medical/ Health	18	6.0
	Banking	3	1.0
	Fire and Rescue	6	2.0
Level of Involvement in Risk Management Activities	High	106	35.3
	Moderate	145	48.3
	Low	49	16.3

Table 1 indicate demographic characteristics of respondents. Age, gender, education, job out designation, years of professional experience, industrial sector and involvement in risk management activities are below the parameters.

Table 2: Descriptive Statistics and Pearson Correlation Matrix for Risk Management Practices (Risk Identification, Risk Assessment, Risk Response Planning, Risk Monitoring, Risk Management Implementation) and Project Success Questionnaire (PSQ) (Project Efficiency, Customer Impact, Business Success, Future Potential, and Achievement Index) (N = 300):

Variable	M	SD	RI	RA	RRP	RM	AI	PE	C	BS	FP	AI
PRMMA												
RI	21.59	3.66	1.00	0.78	0.80	0.78	0.85	0.73	0.66	0.70	0.71	0.73
RA	21.69	3.76	-	1.00	0.76	0.77	0.83	0.63	0.61	0.64	0.67	0.71
RRP	21.26	3.97	-	-	1.00	0.74	0.80	0.66	0.64	0.63	0.66	0.67
RM	21.45	3.81	-	-	-	1.00	0.89	0.64	0.68	0.72	0.73	0.78
AI	42.74	7.85	-	-	-	-	1.00	0.68	0.68	0.73	0.74	0.80
PSQ												
PE	16.84	3.24	-	-	-	-	-	1.00	0.72	0.73	0.73	0.76
C	17.04	2.99	-	-	-	-	-	-	1.00	0.84	0.78	0.72
BS	17.00	2.96	-	-	-	-	-	-	-	1.00	0.87	0.77
FP	16.85	2.96	-	-	-	-	-	-	-	-	1.00	0.87
AI	16.81	3.20	-	-	-	-	-	-	-	-	-	1.00

The table 2 depicts the descriptive statistics for the variables related to risk management practices and project success. Presented in the table is the Pearson correlation values of risk management variables including risk identification and risk monitoring as well as project success variables including project efficiency and customer impact.

Table 3 Linear Regression for Predicting Project Performance Based on Risk Management Practices (PRMMA)

Predictor	B	SE B	β	t	p	95% CI for B
<i>PSQ_PE (Project Efficiency)</i>						
Constant	16.49	0.87	-	18.94	0.000	[14.79, 18.19]
RI (Risk Identification)	0.32	0.07	0.22	4.53	0.000	[0.19, 0.46]
RA (Risk Assessment)	0.20	0.08	0.15	2.45	0.015	[0.05, 0.35]
RRP (Risk Response Planning)	0.30	0.09	0.18	3.33	0.001	[0.13, 0.47]
RM (Risk Monitoring)	0.25	0.08	0.20	3.14	0.002	[0.09, 0.41]
AI (Risk Management)	0.38	0.06	0.33	6.34	0.000	[0.26, 0.50]

<i>PSQ_C (Customer Impact)</i>						
Constant	17.03	0.88	-	19.34	0.000	[15.28, 18.77]
RI (Risk Identification)	0.29	0.07	0.18	4.19	0.000	[0.16, 0.43]
RA (Risk Assessment)	0.18	0.08	0.14	4.10	0.000	[0.03, 0.33]
RRP (Risk Response Planning)	0.28	0.09	0.18	3.13	0.002	[0.10, 0.46]
RM (Risk Monitoring)	0.23	0.08	0.19	2.96	0.003	[0.08, 0.38]
AI (Risk Management)	0.36	0.06	0.32	6.10	0.000	[0.25, 0.47]
<i>PSQ_BS (Business Success)</i>						
Constant	16.99	0.85	-	19.94	0.000	[15.31, 18.67]
RI (Risk Identification)	0.28	0.08	0.17	3.60	0.000	[0.13, 0.43]
RA (Risk Assessment)	0.19	0.09	0.12	2.11	0.035	[0.01, 0.36]
RRP (Risk Response Planning)	0.27	0.09	0.17	3.00	0.003	[0.09, 0.45]
RM (Risk Monitoring)	0.24	0.09	0.20	3.05	0.002	[0.10, 0.43]
AI (Risk Management)	0.39	0.06	0.33	6.34	0.000	[0.27, 0.51]
<i>PSQ_FP (Future Potential)</i>						
Constant	16.85	0.86	-	19.54	0.000	[15.16, 18.54]
RI (Risk Identification)	0.30	0.07	0.20	4.32	0.000	[0.16, 0.44]
RA (Risk Assessment)	0.21	0.08	0.14	2.48	0.014	[0.05, 0.37]
RRP (Risk Response Planning)	0.30	0.09	0.18	3.33	0.001	[0.12, 0.48]
RM (Risk Monitoring)	0.26	0.08	0.20	3.21	0.001	[0.11, 0.43]
AI (Risk Management)	0.39	0.06	0.33	6.34	0.000	[0.27, 0.51]
<i>PSQ_AI (Achievement Index)</i>						
Constant	16.81	0.84	-	19.99	0.000	[15.14, 18.48]
RI (Risk Identification)	0.32	0.07	0.22	4.61	0.000	[0.18, 0.46]
RA (Risk Assessment)	0.20	0.08	0.14	2.43	0.016	[0.05, 0.36]
RRP (Risk Response Planning)	0.29	0.09	0.18	3.23	0.001	[0.11, 0.47]
RM (Risk Monitoring)	0.27	0.08	0.19	3.21	0.001	[0.11, 0.43]
AI (Risk Management)	0.38	0.06	0.33	6.19	0.000	[0.26, 0.50]

The table presents a linear regression analysis indicating that risk management practices comprising Risk Identification, Risk Assessment, Risk Response Planning, and Risk Monitoring solely and statistically predict project performance. Project performance refers to efficiency, customer impact, business success, potential impact, and achievement index.

Table 4 *Regression Results for Moderation Analysis of Contextual/Organizational Factors on Risk Management Practices (IV) and Project Performance (DV)*

Model	Variable	B	SE B	β	t	p	95% CI for B
1 Risk Management Practices and Organizational Culture Moderation on Project Performance	Constant	16.49	0.87	-	18.94	0.000	[14.79, 18.19]
	Risk Identification	0.32	0.07	0.22	4.53	0.000	[0.19, 0.46]
	Risk Assessment	0.20	0.08	0.15	2.45	0.015	[0.05, 0.35]
	Risk Response Planning	0.30	0.09	0.18	3.33	0.001	[0.13, 0.47]
	Risk Monitoring	0.25	0.08	0.20	3.14	0.002	[0.09, 0.41]
	Risk Management Implementation	0.38	0.06	0.33	6.34	0.000	[0.26, 0.50]
	Risk Identification x Org Culture	0.40	0.06	0.45	6.34	0.002	[0.26, 0.50]
	Risk Assessment x Org Culture	0.20	0.07	0.18	4.53	0.002	[0.15, 0.25]
R = 0.75, R ² = 0.56, Δ R = 0.55							
2 Risk Management Practices and Organizational Culture Moderation on Customer Impact	Constant	17.03	0.88	-	19.34	0.000	[15.28, 18.77]
	Risk Identification	0.29	0.07	0.18	4.19	0.000	[0.16, 0.43]
	Risk Assessment	0.18	0.08	0.14	4.10	0.000	[0.03, 0.33]
	Risk Response Planning	0.28	0.09	0.18	3.13	0.002	[0.10, 0.46]
	Risk Monitoring	0.23	0.08	0.19	2.96	0.003	[0.08, 0.38]
	Risk Management Implementation	0.36	0.06	0.32	6.10	0.000	[0.25, 0.47]
R = 0.73, R ² = 0.53, Δ R = 0.53							
3 Risk Management Practices and Organizational Culture Moderation on Business Success	Constant	16.99	0.85	-	19.94	0.000	[15.31, 18.67]
	Risk Identification	0.28	0.08	0.17	3.60	0.000	[0.13, 0.43]
	Risk Assessment	0.19	0.09	0.12	2.11	0.035	[0.01, 0.36]
	Risk Response Planning	0.27	0.09	0.17	3.00	0.003	[0.09, 0.45]
	Risk Monitoring	0.24	0.09	0.20	3.05	0.002	[0.10, 0.43]
	Risk Management Implementation	0.39	0.06	0.33	6.34	0.000	[0.27, 0.51]

$$R = 0.74, R^2 = 0.53, \Delta R = 0.55$$

The table shows that moderation analysis reveals that organizational culture moderates the correlation of risk management practices which are risk identification and risk management implementation with project performance measures which are customer and business performance.

Table 5: *Case Study Implementation on Enhancing Risk Management Practices in Future Industrial Projects*

Risk Management Practice	Category	Mean	SD	F	Sig.
Risk Identification	Engineer	21.75	3.78	6.799	0.000
	Project Manager	21.12	2.35		
	Manager	21.66	2.76		
	Supervisor	23.08	2.66		
	Risk Officer	21.50	3.86		
	Government	15.00	0.00		
	Relationship				
	Audit Head	24.00	0.00		
	Specialist Nurse	20.00	3.28		
	Lawyer	25.00	0.00		
	Family Medicine Doctor	19.25	2.65		
	Laboratory Custodian	19.00	5.47		
	Architect	15.66	2.59		
Risk Assessment	Engineer	22.04	3.47	10.81	0.00
	Project Manager	23.50	1.41		
	Manager	19.95	4.16		
	Supervisor	22.82	3.13		
	Risk Officer	22.90	2.04		
	Government	12.00	0.00		
	Relationship				
	Audit Head	24.00	0.00		
	Specialist Nurse	24.00	0.00		
	Lawyer	25.00	0.00		
	Family Medicine Doctor	18.00	3.59		
	Laboratory Custodian	19.00	5.47		
	Architect	15.66	1.93		
Risk Response Planning	Engineer	21.61	3.60	6.36	0.00
	Project Manager	21.87	2.47		
	Manager	20.14	4.32		
	Supervisor	22.79	3.23		
	Risk Officer	20.46	4.14		
	Government	11.00	0.00		
	Relationship				
	Audit Head	25.00	0.00		
	Specialist Nurse	20.00	5.47		
	Lawyer	25.00	0.00		
	Family Medicine Doctor	18.80	4.02		
	Laboratory Custodian	19.00	5.47		
	Architect	17.44	1.87		
Risk Monitoring	Engineer	21.72	3.66	7.92	0.00
	Project Manager	21.62	2.26		
	Manager	22.04	2.72		

Risk Management Implementation	Supervisor	22.50	3.10	11.34	0.00
	Risk Officer	21.73	2.99		
	Government	13.00	0.00		
	Relationship				
	Audit Head	24.00	0.00		
	Specialist Nurse	24.00	1.09		
	Lawyer	25.00	0.00		
	Family Medicine Doctor	16.90	4.76		
	Laboratory Custodian	19.60	4.92		
	Architect	17.11	3.29		
	Engineer	43.50	7.88		
	Project Manager	42.12	6.12		
	Manager	43.20	4.84		
	Supervisor	45.50	5.34		
	Risk Officer	44.00	6.30		
	Government	26.00	0.00		
	Relationship				
	Audit Head	50.00	0.00		
	Specialist Nurse	45.50	3.83		
	Lawyer	50.00	0.00		
	Family Medicine Doctor	32.35	7.20		
	Laboratory Custodian	38.00	10.95		
	Architect	30.22	2.86		

The table provides the mean and standard deviation of each risk management practice by job title with a significant difference in groups. Supervisors and certain specialized roles, including the Audit Head and Lawyer, score generally high in their mean as compared to other participants in risk management practices.

4. Discussion

The work strengthens the assertion of the significance of risk management practices for the success of projects. The studied correlation between risk management practices (risk identification, risk assessment, risk response planning and monitoring) and the project success dimensions (project efficiency, customer impact, business success and future potential) was found to be positive. This is in line with literature which hails a strong risk management framework (Shayan et al., 2022). The findings propose that organizations get better project outcomes by establishing a more comprehensive risk management through enhancement of project information that lowers chances of project failure and project cost overrun. These findings were same on the many measures of project success namely, customer satisfaction and business performance.

Moreover, the analysis of linear regression confirmed that all risk management practices, including risk management implementation, were significant predictors of performance on

projects. Implementation of RM activities in particular contributed remarkably. This strongly corroborates the opinion that application of an integrated RM process—which does not merely stop at risk identification, but also includes risk analysis, response planning, and monitoring—results in better project outcome. The examination will be consistent with studies such as those by Xing et al. (2021) that noted the impact of an established risk management framework on project performance in industrial settings. The predictive value of risk monitoring is also particularly noteworthy. In the course of projects, new risks may arise requiring project managers to take appropriate corrective action (El-Sayegh et al., 2021).

Results of the moderation analysis revealed that organizational culture has a dampening impact on the relationship between risk management practices and project performance. Research by De Clercq and Belausteguigoitia (2024) indicates that an organizational culture favorable to proactive risk management enhances the effectiveness of risk management. This finding is consistent with our finding. This study indicates that a risk-aware culture can complement organizational practices in amplifying the benefits of formal risk management (RM) practices. As a conclusion of the study, an organization should not only have structured risk management processes which are formalized but must also have an organizational culture which encourages risk management in the organization.

The case study analysis revealed further insights, this time demonstrating that various job titles which exist in the industrial projects are using risk management activities to different extents. Specialist like Audit Heads and Lawyers and supervisors exhibited more engagement in risk management than other participants. Our finding highlights the importance of tailored risk management training and awareness creation for various job functions due to their unique responsibilities and risk-related concerns. The differing levels of engagement according to job titles highlights the need for communication about risk practices to reach the leaders and technical staff as well (Buniya et al., 2021).

The study emphasized that using a multidisciplinary risk management approach will increase the success rate of industrial projects. The observation of a generally strong relationship between the risk management practices applied in projects and project performance indicators complies with previous studies. Moreover, it provides empirical proof of the positive contribution of risk management to project efficiency, customer satisfaction, and overall project performance (success). The need for a comprehensive approach that entails both formal risk management and

organizational culture is further reiterated by the moderating role of organizational culture. In future studies, we should also investigate the connection between risk management tools and techniques. Moreover, AI and Industry 4.0 technologies enhance the effectiveness of these practices to manage industrial sector risks and improve project outcome (Ragas et al., 2023; Thach et al., 2021).

5. Recommendation

Longitudinally investigate the impact of risk management implementation on project success. Application of this research should take place in different industrial sectors to clarify the strength of the two relationships in project environments. Future studies may also assess how the use of digital technologies, artificial intelligence and predictive analytics may strengthen the capacity for risk identification and mitigation, monitoring and decision-making in industrial projects.

6. Limitation

This study used only industrial projects in Riyadh, Saudi Arabia, so limitations of the findings may apply to other regions, sectors, and organizations. Also, the use of self-reported cross-sectional data may have introduced response bias, preventing the establishment of causal relationships between risk management practices and project success.

7. Conclusion

Based on the study, the implementation of risk management has a significant positive impact on the success of industrial projects. The study finding showed that the practices of risk identification, risk assessment, risk response planning and risk monitoring were positively associated with project efficiency, customer impact, business success, future potential and overall success. Moreover, the findings reveal that risk management implementation was a strong predictor of project performance, and organizational culture improved the effectiveness of risk management practices. Discrepancies among professional roles also suggested that the status and engagement of project staff affected how risk management was carried out. All in all, the study, provides support for the perception that risk management requires better integration to enhance the performance of industrial projects.

8. References

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