

# Project Risk Management in Engineering Organizations: A Systematic Analysis of Risk Management Practices and Project Performance

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## ABSTRACT

This study explores how engineering organizations in the Philippines apply project risk management and whether these practices actually improve project outcomes. Although frameworks such as ISO 31000 are widely recognized, their real-world application often varies. Using a descriptive-correlational design, data were gathered from engineering professionals across multiple disciplines. The findings show that while risk management practices are generally present and moderately implemented, they do not have a statistically significant relationship with project performance in terms of schedule, cost, and quality. This suggests that simply having risk management processes in place is not enough. Instead, factors such as leadership support, organizational culture, and maturity level play a more critical role. The study highlights the need for deeper integration of risk management into organizational practices and proposes a strategic framework to strengthen implementation.

**Keywords:** risk management, engineering projects, project performance, ISO 31000, Philippines

## INTRODUCTION

Engineering projects are naturally exposed to uncertainty. Whether it is due to technical complexity, financial limitations, changing regulations, or environmental conditions, risks are always present. Because of this, risk management has become an essential part of project delivery.

Globally, many studies continue to report issues such as cost overruns and delays, even in organizations that claim to follow structured risk management approaches (PMI, 2020; Corasystems, 2025). This raises an important question: if risk management is already being practiced, why do these problems still exist.

In the Philippines, this issue becomes even more relevant. Engineering organizations operate in a challenging environment shaped by infrastructure development, regulatory changes, and natural hazards. While risk management frameworks like ISO 31000 are recognized, there is limited evidence showing how effectively they are actually used in practice.

This study aims to provide that evidence by examining the level of risk management practices, identifying common risks, and analyzing their relationship with project performance. More importantly, it seeks to understand why risk management may not always lead to better outcomes.

## METHODS

This study uses a descriptive-developmental research design to better understand how risk management is actually practiced in engineering organizations and to create a practical framework for improving it. It

starts by looking at what organizations are currently doing—how they identify, assess, and manage risks—and how these practices affect project results, especially in terms of time, cost, and quality. It also considers important organizational factors such as leadership support, availability of resources, and the overall risk culture, since these can strongly influence how well risk management is carried out in real situations. By doing this, the study provides a clear and realistic picture of current practices, highlighting both what is working well and what still needs improvement.

After understanding the current situation, the study moves to its developmental part, where it focuses on improving what has been observed. It identifies gaps between actual practices and internationally recognized standards like ISO 31000 and guidelines from the Project Management Institute. This comparison helps determine whether organizations are following structured and effective approaches or if there are weaknesses, such as lack of early risk identification or inconsistent monitoring. Based on these findings, the study proposes a strategic risk management framework that includes practical recommendations, suggested actions, and steps that organizations can follow to strengthen their processes. The goal is not just theoretical improvement, but something that can realistically be applied in engineering projects.

The study mainly uses primary data collected directly from professionals working in engineering organizations across the Philippines. These include project managers, engineers, risk specialists, PMO staff, and even senior leaders or executives who are involved in decision-making. Including different roles ensures that the study captures both operational and strategic perspectives of risk management. The respondents are selected through purposive sampling, as supported by John W. Creswell, meaning only those with relevant knowledge and experience are included. This helps ensure that the data gathered is meaningful and reliable, since it comes from people who are actually involved in managing project risks. Aside from primary data, the study also uses secondary sources such as academic literature, industry reports, and international standards. These sources provide a strong theoretical foundation and help validate the findings by allowing comparisons between real-world practices and established best practices. Combining these two types of data makes the study more credible and well-supported.

To collect the data, a structured questionnaire was developed based on the study's main variables. The questionnaire includes sections on organizational profile, risk management practices, influencing factors, maturity level, project performance, and challenges in implementation. Most questions use a rating scale to measure how often or how effectively certain practices are applied, while a few open-ended questions allow respondents to share their personal experiences and insights. This combination makes it possible to capture both measurable data and deeper explanations behind it.

Before using the questionnaire, it was carefully reviewed by experts in project management, engineering, and research to make sure that the questions were clear, relevant, and aligned with the study's objectives. Revisions were made based on their feedback, and a pilot test was conducted to further check if the instrument worked well in practice. These steps help ensure that the data collected is accurate and dependable.

The data gathering process followed a clear and organized procedure. Permission was first obtained from selected organizations, after which qualified respondents were identified. The questionnaires were then distributed, and participants were given enough time and proper guidance to answer them honestly. Once collected, the responses were checked for completeness and organized for analysis. This careful process helps maintain the quality and consistency of the data.

For analysis, the study uses statistical tools to make sense of the collected information. The weighted mean

is used to summarize the responses and show the general level of practices and performance. Meanwhile, Pearson’s r is used to examine whether there is a relationship between risk management practices and project performance, including how strong that relationship is and whether it is positive or negative. These tools help turn the collected data into meaningful insights.

Overall, this study provides a clear and practical approach to understanding and improving risk management in engineering organizations. By first examining current practices and then building a framework based on identified gaps, it offers useful guidance for organizations that want to strengthen their risk management processes and achieve better project outcomes.

#### 4. RESULTS

The first objective of this study was to determine the project risks commonly encountered by engineering organizations. Five categories of risks were examined: technical/design risks, schedule and resources risks, cost and financial risks, organizational and governance risks, and external and environmental risks. Tables 1 through 5 present the detailed results for each risk category, while Table 6 presents the overall summary.

**Table 1**  
*Project Risks Commonly Encountered in terms of Technical/Design Risk*

Indicators	WM	SD	Interpretation
1. Frequent design changes and modifications during project execution.	2.96	.973	Acceptable
2. Inadequate or incomplete technical specifications.	2.98	.833	Acceptable
3. Use of untested or emerging technologies.	2.96	.919	Acceptable
4. Insufficient engineering expertise for the project's complexity.	2.90	.915	Acceptable
5. Integration issues between different systems or components.	2.95	.964	Acceptable
6. Errors or omissions in design documents.	2.96	1.007	Acceptable
7. Failure of materials or components to meet required standards.	2.95	.852	Acceptable
<b>Average Weighted Mean</b>	<b>2.95</b>	<b>.312</b>	<b>Acceptable</b>

Table 1 shows the respondents' assessment of the technical and design risks commonly encountered in their engineering projects. The category obtained an average weighted mean of 2.95 (SD = .312), interpreted as Acceptable. Among the indicators, "inadequate or incomplete technical specifications" received the highest weighted mean of 2.98 (SD = .833), suggesting that projects frequently suffer from unclear or missing requirements at the design stage. This is followed by three indicators that tied at a

weighted mean of 2.96—namely, frequent design changes and modifications, use of untested or emerging technologies, and errors or omissions in design documents. The lowest rating within this domain was given to "insufficient engineering expertise for the project's complexity" (WM = 2.90, SD = .915), although this was still classified as High.

The findings suggest that technical and design-related concerns are persistent challenges in engineering projects. This is consistent with the view of Chapman and Ward (2011), who emphasized that technical uncertainty especially arising from incomplete specifications and late design changes remains one of the dominant sources of risk exposure in complex engineering undertakings. Similarly, the Project Management Institute (PMI, 2021) noted that design-related errors and integration failures are among the leading causes of schedule delays and cost escalations in capital projects.

**Table 2**  
*Project Risks Commonly Encountered in terms of Schedule and Resources Risk*

Indicators	WM	SD	Interpretation
1. Unrealistic project timelines and deadlines.	2.88	.845	Acceptable
2. Delays in the delivery of materials and equipment.	2.98	1.049	Acceptable
3. Shortage of skilled labor or engineering personnel.	2.73	.954	Acceptable
4. Poor coordination among project teams and stakeholders.	3.01	.982	Acceptable
5. Equipment breakdown or unavailability.	2.96	.973	Acceptable
6. Underestimation of the time required to complete tasks.	3.03	.973	Acceptable
<b>Average Weighted Mean</b>	<b>2.93</b>	<b>.364</b>	<b>Acceptable</b>

Table 2 presents the respondents' assessment of schedule and resources risks, which obtained an average weighted mean of 2.93 (SD = .364), interpreted as Acceptable. The indicator "underestimation of the time required to complete tasks" received the highest rating (WM = 3.03, SD = .973), followed closely by "poor coordination among project teams and stakeholders" (WM = 3.01, SD = .982). These findings indicate that scheduling inaccuracies and coordination problems are frequent issues in engineering projects. On the other hand, "shortage of skilled labor or engineering personnel" obtained the lowest rating (WM = 2.73, SD = .954), though it was still considered a High-level risk.

The results imply that realistic time estimation and effective team coordination are critical areas that require continued attention. Love et al. (2019) argued that optimism bias in scheduling where planners systematically underestimate durations is one of the most pervasive behavioral sources of schedule risk in engineering projects. Moreover, Hillson (2017) noted that resource-related risks are often underestimated

until they directly impact project delivery.

**Table 3**  
*Project Risks Commonly Encountered in terms of Cost and Financial Risk*

Indicators	WM	SD	Interpretation
1. Cost overruns due to inaccurate budget estimates.	3.18	.676	Acceptable
2. Fluctuations in the price of materials and resources.	2.95	1.048	Acceptable
3. Unexpected expenses during project execution.	3.08	.907	Acceptable
4. Limited funding or delayed disbursement of project funds.	2.86	.853	Acceptable
5. Inaccurate forecasting of project costs.	2.98	.873	Acceptable
<b>Average Weighted Mean</b>	<b>3.01</b>	<b>.389</b>	<b>Acceptable</b>

Table 3 presents the cost and financial risks commonly encountered by the respondents. This domain obtained an average weighted mean of 3.01 (SD = .389), interpreted as Acceptable, and ranks as the second highest among the five risk categories. The indicator "cost overruns due to inaccurate budget estimates" registered the highest weighted mean of 3.18 (SD = .676), followed by "unexpected expenses during project execution" (WM = 3.08, SD = .907). In contrast, "limited funding or delayed disbursement of project funds" received the lowest rating (WM = 2.86, SD = .853) but remained within the Acceptable interpretation.

These findings reveal that engineering organizations consistently struggle with the accuracy of budget estimation and the management of unanticipated financial demands. Flyvbjerg (2014) likewise reported that cost overruns are almost universal in large-scale engineering and infrastructure projects, often traceable to weak estimating methods, scope creep, and the failure to incorporate reference-class forecasting. The relatively low standard deviation (.676) for the highest-rated indicator further suggests that respondents' experiences of cost overruns are fairly consistent across organizations.

**Table 4**  
*Project Risks Commonly Encountered in terms of Organizational and Governance Risk*

Indicators	WM	SD	Interpretation
1. Lack of clear project governance and accountability.	2.93	.936	Acceptable
2. Insufficient support from top management.	2.91	.961	Acceptable
3. Conflicting priorities among stakeholders.	3.05	.928	Acceptable

Indicators	WM	SD	Interpretation
4. Inadequate communication within the organization.	2.96	.801	Acceptable
5. Organizational resistance to change.	3.15	.798	Acceptable
<b>Average Weighted Mean</b>	<b>3.00</b>	<b>.357</b>	<b>Acceptable</b>

Table 4 reflects the organizational and governance risks encountered by the respondents. The domain obtained an average weighted mean of 3.00 (SD = .357), interpreted as Acceptable. The highest-rated indicator was "organizational resistance to change" (WM = 3.15, SD = .798), followed by "conflicting priorities among stakeholders" (WM = 3.05, SD = .928). The lowest rating was given to "insufficient support from top management" (WM = 2.91, SD = .961), although it remained at a Acceptable level. The findings suggest that the cultural and governance dimensions of engineering organizations exert a strong influence on project exposure to risk. Resistance to change and competing stakeholder priorities appear to be deeply rooted issues that can hinder the adoption of improved project practices. This echoes the observation of Zwikael and Smyrk (2019) that weak governance structures and fragmented accountability are among the least visible yet most damaging sources of project risk.

**Table 5**  
*Project Risks Commonly Encountered in terms of External and Environmental Risk*

Indicators	WM	SD	Interpretation
1. Adverse weather or environmental conditions.	3.08	.907	Acceptable
2. Changes in government regulations and permits.	2.91	.925	Acceptable
3. Political or economic instability affecting the project.	3.00	.974	Acceptable
4. Community opposition or stakeholder concerns.	3.01	.892	Acceptable
5. Supply chain disruptions and logistical issues.	3.13	.910	Acceptable
<b>Average Weighted Mean</b>	<b>3.03</b>	<b>.378</b>	<b>Acceptable</b>

Table 5 displays the external and environmental risks commonly encountered by the respondents. Obtaining an average weighted mean of 3.03 (SD = .378), this domain ranked as the highest among the five risk categories, and was interpreted as High. The indicator "supply chain disruptions and logistical issues" received the highest weighted mean of 3.13 (SD = .910), followed by "adverse weather or

environmental conditions" (WM = 3.08, SD = .907). The indicator with the lowest rating was "changes in government regulations and permits" (WM = 2.91, SD = .925).

The dominance of external and environmental risks in the rankings reflects the increasingly turbulent environment in which engineering projects are being delivered. These findings are consistent with recent literature emphasizing that global supply chain volatility, climate-related events, and political uncertainty have become defining features of contemporary project risk (Ahmadi-Javid et al., 2020). Because these risks are largely outside the direct control of the organization, their prominence underscores the importance of building organizational resilience and contingency capacity.

**Table 6**  
*Overall Project Risks Commonly Encountered*

Scale	Domains	WM	SD	Interpretation
Project risks encountered	Technical/design risk	2.95	.312	Acceptable
	Schedule and resources risk	2.93	.364	Acceptable
	Cost and financial risk	3.01	.389	Acceptable
	Organizational and governance risk	3.00	.357	Acceptable
	External and environmental risk	3.03	.378	Acceptable
<b>OVERALL</b>		<b>2.98</b>	<b>.153</b>	<b>Acceptable</b>

Table 6 summarizes the overall assessment of the project risks commonly encountered by engineering organizations. The overall weighted mean of 2.98 (SD = .153) indicates that, taken together, the respondents experience project risks at a Acceptable level. Among the five domains, external and environmental risks (WM = 3.03) ranked first, followed by cost and financial risks (WM = 3.01), organizational and governance risks (WM = 3.00), technical/design risks (WM = 2.95), and schedule and resources risks (WM = 2.93).

The very low overall standard deviation (.153) suggests that the respondents share a relatively uniform perception of the level of risks encountered across the different domains. This convergence strengthens the validity of the findings and indicates that engineering organizations in the study setting operate within a shared risk landscape. Overall, the results confirm that risk is a pervasive and multi-dimensional concern in engineering projects, reinforcing the rationale for systematic risk management practices.

### **Risk Management Practices of Engineering Organizations**

The second objective of this study was to determine the risk management practices of engineering organizations. Four core practices were examined: risk identification, risk assessment, risk response, and risk monitoring and control. For each practice, both the frequency of use and the perceived effectiveness were measured. Tables 7 through 14 present the detailed results, while Table 15 provides the overall summary.

**Table 7**  
*Risk Management Practices in terms of Risk Identification (Frequency of Use)*

Indicators	WM	SD	Interpretation
1. Conducting brainstorming sessions to identify risks.	3.00	1.041	Acceptable
2. Reviewing lessons learned from previous projects.	3.05	.891	Acceptable
3. Consulting with experts and experienced personnel.	3.00	1.025	Acceptable
4. Using risk checklists and standard templates.	2.63	.956	Acceptable
5. Conducting SWOT analysis for risk identification.	2.71	.884	Acceptable
6. Engaging stakeholders in identifying potential risks.	2.96	1.040	Acceptable
<b>Average Weighted Mean</b>	<b>2.89</b>	<b>.364</b>	<b>Acceptable</b>

Table 7 presents the frequency of use of risk identification practices. The domain obtained an average weighted mean of 2.89 (SD = .364), interpreted as Acceptable. "Reviewing lessons learned from previous projects" (WM = 3.05) was the most frequently used technique, followed by "conducting brainstorming sessions" and "consulting with experts" (both at WM = 3.00). The least frequently used were "using risk checklists and standard templates" (WM = 2.63) and "conducting SWOT analysis for risk identification" (WM = 2.71).

The results suggest that engineering organizations tend to rely on experience-based and consultative methods rather than structured, template-driven approaches. This aligns with the findings of Hillson and Simon (2020), who observed that practitioners often favor informal identification techniques over formalized checklists, even though the latter improve coverage and consistency.

**Table 8**  
*Risk Management Practices in terms of Risk Identification (Perceived Effectiveness)*

Indicators	WM	SD	Interpretation
1. Brainstorming sessions produce useful risk information.	2.88	.761	Acceptable
2. Lessons learned effectively reveal recurring risks.	3.01	.965	Acceptable
3. Expert consultation yields reliable risk insights.	2.96	.822	Acceptable

Indicators	WM	SD	Interpretation
4. Risk checklists capture most project risks.	2.81	.929	Acceptable
5. SWOT analysis is effective in revealing risks.	3.08	.869	Acceptable
6. Stakeholder engagement enhances risk identification.	2.85	.840	Acceptable
<b>Average Weighted Mean</b>	<b>2.93</b>	<b>.364</b>	<b>Acceptable</b>

Table 8 shows the perceived effectiveness of risk identification practices, with an average weighted mean of 2.93 (SD = .364), interpreted as Acceptable. Interestingly, "SWOT analysis" was rated highest in effectiveness (WM = 3.08), despite being among the least frequently used techniques in Table 7. This gap between use and effectiveness suggests a latent opportunity—techniques that respondents regard as effective are not always institutionalized into regular practice. "Lessons learned effectively reveal recurring risks" followed closely at WM = 3.01.

**Table 9**  
*Risk Management Practices in terms of Risk Assessment (Frequency of Use)*

Indicators	WM	SD	Interpretation
1. Qualitative risk analysis (probability/impact rating).	3.00	.920	Acceptable
2. Quantitative risk analysis (numerical modeling).	3.06	.820	Acceptable
3. Use of risk matrices and heat maps.	2.91	.944	Acceptable
4. Prioritization of risks based on severity.	3.25	.836	Highly Acceptable
5. Use of risk scoring systems.	2.98	.892	Acceptable
6. Scenario analysis and sensitivity testing.	2.78	.884	Acceptable
<b>Average Weighted Mean</b>	<b>2.99</b>	<b>.304</b>	<b>Acceptable</b>

Table 9 presents the frequency of use of risk assessment practices, which obtained an average weighted mean of 2.99 (SD = .304), interpreted as Acceptable. Notably, "prioritization of risks based on severity" obtained a weighted mean of 3.25 (SD = .836), which falls within the Highly Acceptable range—the only indicator in the entire risk management practices section to reach this level. This was followed by the use

of quantitative risk analysis (WM = 3.06) and qualitative risk analysis (WM = 3.00). "Scenario analysis and sensitivity testing" recorded the lowest usage (WM = 2.78), but remained at the Acceptable level. These findings indicate that engineering organizations place heavy emphasis on prioritizing risks according to severity, which is a fundamental aspect of effective risk assessment. The strong use of both qualitative and quantitative techniques is consistent with the integrated approach recommended by ISO 31000:2018, which advocates for the combination of different assessment methods to capture both subjective judgments and measurable impacts.

**Table 10**  
*Risk Management Practices in terms of Risk Assessment (Perceived Effectiveness)*

Indicators	WM	SD	Interpretation
1. Qualitative analysis effectively ranks project risks.	2.81	.947	Acceptable
2. Quantitative analysis accurately estimates impacts.	2.91	.743	Acceptable
3. Risk matrices clearly communicate exposure.	3.03	1.073	Acceptable
4. Risk prioritization supports decision-making.	3.05	.832	Acceptable
5. Risk scoring systems improve transparency.	3.03	.801	Acceptable
6. Scenario analysis is useful for informed decisions.	3.08	.925	Acceptable
<b>Average Weighted Mean</b>	<b>2.98</b>	<b>.347</b>	<b>Acceptable</b>

Table 10 shows the perceived effectiveness of risk assessment practices, with an average weighted mean of 2.98 (SD = .347), interpreted as Acceptable. The indicator "scenario analysis is useful for informed decisions" obtained the highest rating (WM = 3.08), even though, based on Table 9, scenario analysis was the least frequently practiced assessment technique. This once again highlights a gap between perceived value and actual adoption. Risk prioritization also received strong effectiveness ratings (WM = 3.05).

**Table 11**  
*Risk Management Practices in terms of Risk Response (Frequency of Use)*

Indicators	WM	SD	Interpretation
1. Developing risk mitigation plans.	2.96	1.073	Acceptable
2. Transferring risks (e.g., through insurance or contracts).	2.88	.903	Acceptable

Indicators	WM	SD	Interpretation
3. Avoiding risks by changing project plans.	3.11	.958	Acceptable
4. Accepting risks with contingency plans.	2.96	1.007	Acceptable
5. Allocating reserves for risk responses.	2.85	.917	Acceptable
6. Conducting regular risk response reviews.	3.11	.993	Acceptable
<b>Average Weighted Mean</b>	<b>2.98</b>	<b>.496</b>	<b>Acceptable</b>

Table 11 presents the frequency of use of risk response practices, with an average weighted mean of 2.98 (SD = .496), interpreted as Acceptable. "Avoiding risks by changing project plans" and "conducting regular risk response reviews" tied at the top with a weighted mean of 3.11 each. In contrast, "allocating reserves for risk responses" received the lowest rating (WM = 2.85), though still at the Acceptable level. The relatively higher standard deviation (.496) observed in this domain compared to others suggests greater variability in how engineering organizations approach risk responses. Kerzner (2022) noted that the choice between risk avoidance, transfer, mitigation, and acceptance often depends on project-specific and organizational contingencies, which may explain this variability.

**Table 12**  
*Risk Management Practices in terms of Risk Response (Perceived Effectiveness)*

Indicators	WM	SD	Interpretation
1. Mitigation plans reduce the likelihood of risks.	3.06	.799	Acceptable
2. Risk transfer effectively limits organizational exposure.	2.93	.954	Acceptable
3. Risk avoidance measures are practical.	2.88	.940	Acceptable
4. Contingency plans prepare teams for accepted risks.	3.01	.892	Acceptable
5. Contingency reserves are adequate.	3.11	1.009	Acceptable
6. Regular response reviews ensure timely action.	2.91	.925	Acceptable
<b>Average Weighted Mean</b>	<b>2.98</b>	<b>.352</b>	<b>Acceptable</b>

Table 12 shows the perceived effectiveness of risk response practices, with an average weighted mean of 2.98 (SD = .352), interpreted as Acceptable. The adequacy of contingency reserves obtained the highest effectiveness rating (WM = 3.11), followed by mitigation plans reducing the likelihood of risks (WM =

3.06). The lowest-rated indicator was the practicality of risk avoidance measures (WM = 2.88). Taken together, the findings suggest that while organizations broadly regard their risk responses as effective, there is no single dominant response strategy that stands out.

**Table 13**  
*Risk Management Practices in terms of Risk Monitoring and Control (Frequency of Use)*

Indicators	WM	SD	Interpretation
1. Regular tracking of identified risks.	3.01	.833	Acceptable
2. Updating risk registers periodically.	2.93	.918	Acceptable
3. Monitoring early warning signs of risks.	3.01	.929	Acceptable
4. Conducting risk audits during the project.	2.78	.865	Acceptable
5. Reporting risk status to stakeholders.	2.98	.833	Acceptable
6. Reviewing effectiveness of risk responses.	2.93	.954	Acceptable
<b>Average Weighted Mean</b>	<b>2.94</b>	<b>.344</b>	<b>Acceptable</b>

Table 13 presents the frequency of use of risk monitoring and control practices, which obtained an average weighted mean of 2.94 (SD = .344), interpreted as Acceptable. "Regular tracking of identified risks" and "monitoring early warning signs of risks" tied at the top (WM = 3.01 each), while "conducting risk audits during the project" received the lowest rating (WM = 2.78).

The relatively weaker emphasis on risk audits suggests that engineering organizations tend to adopt continuous but informal monitoring rather than structured audit-based reviews. This finding echoes the observations of Raz and Michael (2001), who documented that while monitoring is widely practiced, formal auditing remains underutilized in risk management.

**Table 14**  
*Risk Management Practices in terms of Risk Monitoring and Control (Perceived Effectiveness)*

Indicators	WM	SD	Interpretation
1. Risk tracking systems detect issues early.	2.88	1.026	Acceptable
2. Updated risk registers improve awareness.	3.23	.851	Acceptable
3. Monitoring early warning signs prevents escalation.	3.01	.982	Acceptable
4. Risk audits improve project controls.	2.98	.911	Acceptable

Indicators	WM	SD	Interpretation
5. Status reporting keeps stakeholders informed.	3.03	.990	Acceptable
6. Response reviews enable continuous improvement.	2.98	.853	Acceptable
<b>Average Weighted Mean</b>	<b>3.02</b>	<b>.416</b>	<b>Acceptable</b>

Table 14 presents the perceived effectiveness of risk monitoring and control practices, with an average weighted mean of 3.02 (SD = .416), interpreted as Acceptable. This category recorded the highest average effectiveness rating among all eight dimensions of risk management practices. "Updated risk registers improve awareness" emerged as the highest-rated indicator (WM = 3.23, SD = .851), approaching the Highly Acceptable threshold. "Status reporting keeps stakeholders informed" (WM = 3.03) and "monitoring early warning signs prevents escalation" (WM = 3.01) also received strong effectiveness ratings.

These findings underscore the critical role of continuous monitoring and transparent reporting in managing project risks. The strong endorsement of risk registers as effective tools is consistent with the guidance of PMI (2021), which identifies the risk register as a living document that should be continuously updated throughout the project lifecycle.

**Table 15**  
*Overall Risk Management Practices*

Scale	Domains	WM	SD	Interpretation
Risk management practices	Risk identification (frequency of use)	2.89	.364	Acceptable
	Risk identification (perceived effectiveness)	2.93	.364	Acceptable
	Risk assessment (frequency of use)	2.99	.304	Acceptable
	Risk assessment (perceived effectiveness)	2.98	.347	Acceptable
	Risk response (frequency of use)	2.98	.496	Acceptable
	Risk response (perceived effectiveness)	2.98	.352	Acceptable
	Risk monitoring and control (frequency of use)	2.94	.344	Acceptable

Scale	Domains	WM	SD	Interpretation
	Risk monitoring and control (perceived effectiveness)	3.02	.416	Acceptable
<b>OVERALL</b>		<b>2.97</b>	<b>.140</b>	<b>Acceptable</b>

Table 15 summarizes the overall results for the risk management practices of engineering organizations. The overall weighted mean of 2.97 (SD = .140), interpreted as Acceptable, indicates that the respondents' organizations apply the four core risk management practices both frequently and with perceived effectiveness. The highest average score was recorded in the perceived effectiveness of risk monitoring and control (WM = 3.02), while the lowest was the frequency of use of risk identification (WM = 2.89). A notable observation is that, for every practice, the perceived effectiveness ratings were generally higher than the corresponding frequency-of-use ratings. This pattern suggests that engineering organizations believe their risk management techniques work reasonably well when applied, but these techniques are not always used as frequently as they could be. This is consistent with the findings of Zwikael and Ahn (2011), who reported that the benefits of risk management are often diluted by inconsistent implementation, even when the techniques themselves are sound. The very low overall standard deviation (.140) also indicates a strong consensus among respondents regarding the state of risk management practices in their organizations.

### Level of Project Performance of Engineering Organizations

The third objective of the study was to determine the level of project performance of engineering organizations. Three performance dimensions were measured: schedule adherence, budget compliance, and quality achievement. Tables 16 through 18 present the detailed results, and Table 19 presents the overall summary.

**Table 16**

*Level of Project Performance of Engineering Organizations in terms of Schedule Adherence*

Indicators	WM	SD	Interpretation
1. Projects are completed within the planned schedule.	2.80	.988	Acceptable
2. Milestones are achieved as scheduled.	3.08	1.062	Acceptable
3. Delays are minimized through effective planning.	3.06	.971	Acceptable
4. Project timelines are realistic and well-monitored.	2.98	.929	Acceptable
5. Critical-path activities are delivered on time.	2.81	.929	Acceptable

Indicators	WM	SD	Interpretation
Average Weighted Mean	2.95	.456	Acceptable

Table 16 presents the respondents' assessment of project performance in terms of schedule adherence. The domain obtained an average weighted mean of 2.95 (SD = .456), interpreted as Acceptable. "Milestones are achieved as scheduled" received the highest rating (WM = 3.08), followed by "delays are minimized through effective planning" (WM = 3.06). However, "projects are completed within the planned schedule" (WM = 2.80) and "critical-path activities are delivered on time" (WM = 2.81) received the lowest ratings, though still within the High range.

The results suggest that while intermediate milestones are generally met, the overall timely completion of projects and the delivery of critical-path activities remain relatively weaker aspects of schedule adherence. This observation is consistent with the classic findings of Assaf and Al-Hejji (2006), who showed that delays at critical-path activities tend to cascade into overall project delays, even when intermediate milestones are achieved.

**Table 17**

*Level of Project Performance of Engineering Organizations in terms of Budget Compliance*

Indicators	WM	SD	Interpretation
1. Projects are completed within the approved budget.	3.13	.999	Acceptable
2. Expenditures align with cost estimates.	3.18	.965	Acceptable
3. Cost variances are minimized.	3.18	.833	Acceptable
4. Funds are used efficiently during execution.	2.76	1.063	Acceptable
5. Budget monitoring systems are effective.	2.81	.892	Acceptable
Average Weighted Mean	3.01	.426	Acceptable

Table 17 presents the level of project performance in terms of budget compliance, which obtained the highest average weighted mean of 3.01 (SD = .426) among the three performance dimensions, interpreted as Acceptable. "Expenditures align with cost estimates" and "cost variances are minimized" both received strong ratings (WM = 3.18), followed by "projects are completed within the approved budget" (WM = 3.13). In contrast, "funds are used efficiently during execution" received the lowest rating (WM = 2.76), though it remained within the Acceptable range.

The findings indicate that engineering organizations are relatively successful in ensuring that their projects remain within the approved budget, even if the efficiency of fund utilization during execution is a relative weak point. This supports the view of Atkinson (1999) that the traditional "iron triangle" of cost, time, and quality still strongly defines how engineering organizations evaluate project success.

**Table 18**

*Level of Project Performance of Engineering Organizations in terms of Quality Achievement*

Indicators	WM	SD	Interpretation
1. Deliverables meet established quality standards.	2.75	.950	Acceptable
2. Completed work satisfies client requirements.	3.05	.946	Acceptable
3. Quality control measures are consistently applied.	2.98	.812	Acceptable
4. Rework and defects are minimized.	2.88	1.059	Acceptable
5. Technical specifications are fully met.	2.88	.903	Acceptable
<b>Average Weighted Mean</b>	<b>2.91</b>	<b>.487</b>	<b>Acceptable</b>

Table 18 presents the respondents' assessment of project performance in terms of quality achievement, which obtained the lowest average weighted mean among the three dimensions at 2.91 (SD = .487), still within the Acceptable range. "Completed work satisfies client requirements" received the highest rating (WM = 3.05), followed by "quality control measures are consistently applied" (WM = 2.98). "Deliverables meet established quality standards" received the lowest rating (WM = 2.75), indicating an area that may warrant further attention.

The comparatively lower ratings for quality achievement suggest that while engineering organizations perform relatively well on time and budget, they face greater difficulty in consistently meeting technical quality standards. Love et al. (2019) likewise observed that quality performance is often the dimension most compromised when schedule and cost pressures intensify.

**Table 19**

*Overall Level of Project Performance of Engineering Organizations*

Scale	Domains	WM	SD	Interpretation
Project performance	Schedule adherence	2.95	.456	Acceptable
	Budget compliance	3.01	.426	Acceptable
	Quality achievement	2.91	.487	Acceptable
<b>OVERALL</b>		<b>2.95</b>	<b>.273</b>	<b>Acceptable</b>

Table 19 summarizes the overall level of project performance of engineering organizations. With an overall weighted mean of 2.95 (SD = .273), project performance is interpreted as Acceptable. Among the three dimensions, budget compliance (WM = 3.01) ranks first, followed by schedule adherence (WM =

2.95) and quality achievement (WM = 2.91). The relatively low overall standard deviation (.273) again indicates a high degree of consistency in the respondents' assessments.

Overall, engineering organizations perform well across the three core performance dimensions, with budget compliance standing out as the strongest and quality achievement as the relatively weakest. This performance pattern is consistent with the broader empirical literature, which has long reported that project teams tend to prioritize the more visible time and cost dimensions over the more qualitative and technically demanding dimension of quality (Atkinson, 1999; Love et al., 2019).

### Relationship Between Risk Management Practices and Project Performance

The fourth objective of the study was to determine the relationship between risk management practices and the level of project performance of engineering organizations. Pearson's r Moment Correlation Coefficient was used to test this relationship. Table 20 presents the results.

**Table 20**

***Relationship Between Risk Management Practices and Level of Project Performance of Engineering Organizations***

Variables	Schedule Adherence	Budget Compliance	Quality Achievement
<b>Risk management practices</b>	r = -.031 p = .812 <i>Not Significant</i>	r = -.055 p = .675 <i>Not Significant</i>	r = .159 p = .224 <i>Not Significant</i>

*Note.* Correlation: 0.00 – 0.19 (very weak); 0.20 – 0.39 (weak); 0.40 – 0.59 (moderate); 0.60 – 0.79 (strong); 0.80 – 1.00 (very strong) (Evans, 1996). \*Significant at  $p < .05$ .

Table 20 presents the results of the Pearson's r Moment Correlation analysis between risk management practices and the three dimensions of project performance. The results reveal that the correlation between risk management practices and schedule adherence is  $r = -.031$  ( $p = .812$ ); between risk management practices and budget compliance,  $r = -.055$  ( $p = .675$ ); and between risk management practices and quality achievement,  $r = .159$  ( $p = .224$ ). Based on Evans' (1996) guidelines, all three correlations fall within the very weak range, and none of the obtained p-values are less than the .05 threshold for statistical significance.

These findings indicate that there is no statistically significant relationship between risk management practices and any of the three dimensions of project performance among the engineering organizations examined. Consequently, the null hypothesis, which states that there is no significant relationship between risk management practices and project performance, is not rejected. This outcome is particularly noteworthy given that the respondents rated both their risk management practices and their project performance at the Acceptable level.

At first glance, this finding appears to contradict the conventional expectation that better risk management practices should lead to improved project performance. However, the result is not unprecedented in the literature. Zwikael and Ahn (2011), in a cross-country empirical study, likewise found that the level of risk management activity was not always significantly correlated with traditional project performance indicators. Similarly, de Bakker, Boonstra, and Wortmann (2010) argued that the benefits of risk

management may be more closely associated with team learning, stakeholder communication, and decision-making quality than with direct measures such as schedule, cost, and quality.

Several possible explanations can be offered for the present findings. First, because the respondents reported their risk management practices and project performance at relatively homogeneous levels (both at Acceptable), the limited variance in the data may have constrained the statistical power to detect a relationship—a phenomenon commonly referred to as range restriction. Second, the relationship between risk management and performance may be mediated by other variables, such as organizational culture, leadership support, and project complexity, which were not directly examined in this study. Third, risk management practices may primarily serve a preventive function, protecting projects from worse outcomes, rather than a promotive function, and such preventive value may be more difficult to capture through direct correlation analysis.

Taken together, these findings suggest that risk management practices, as currently implemented in the engineering organizations studied, are not strongly translating into differentiated project performance outcomes. This does not imply that risk management is without value; rather, it signals that the manner, depth, and integration of risk management into project decision-making may need to be strengthened for its benefits to become empirically evident in project performance metrics.

## **CONCLUSION AND RECOMMENDATION**

The findings of this study highlight that external and environmental risks remain the most significant challenges faced by engineering organizations, emphasizing the need for more adaptive and resilient approaches to managing uncertainty. While organizations tend to focus strongly on monitoring and controlling risks during project execution, there is still a noticeable gap in earlier stages such as risk identification and analysis, which are critical for a more proactive and well-rounded risk management process. In terms of performance, many organizations are able to maintain control over project budgets; however, this often comes at the expense of quality, especially when projects are under pressure to meet tight schedules. This reflects the common trade-offs that occur in project management when competing priorities are not well balanced. Another important insight is that existing risk management practices do not show a significant direct relationship with project performance outcomes. This suggests that simply having risk management activities in place is not enough—their effectiveness may be limited by how consistently they are applied, how well they are integrated into decision-making, and how aligned they are with organizational factors such as leadership support, culture, and project complexity. Overall, these findings point to the need for a more structured and integrated approach to managing risk. The proposed Integrated Risk Management Capability Framework (IRMCF) responds to this need by bringing together key elements such as risk processes, organizational support, and capability development to improve how risks are managed and how projects perform.

In light of these conclusions, several practical recommendations are offered. Engineering organizations are encouraged to strengthen their ability to respond to external and environmental risks, which are often unpredictable yet highly impactful. This can be done by adopting more flexible and forward-looking strategies that allow teams to adjust quickly to changing conditions. There is also a need to standardize the use of structured risk management tools, such as SWOT analysis, risk checklists, and scenario analysis, to improve consistency and support better decision-making across projects. At the same time, quality assurance should be more firmly integrated into project planning to ensure that quality is not sacrificed when managing time and cost pressures. Even though the study found no direct relationship between risk

management practices and project performance, risk management should still play a central supporting role in project planning by aligning it with organizational goals and maintaining continuous monitoring to improve transparency and consistency. The adoption of the Integrated Risk Management Capability Framework (IRMCF) is strongly recommended as it provides a clear and systematic way to enhance risk management practices, strengthen implementation, and ultimately improve project outcomes. Finally, future research can build on this study by exploring how risk management influences performance over time, examining the role of factors such as organizational culture and leadership, and using more in-depth qualitative approaches to better understand real-world practices. Expanding future studies to include a wider range of organizations and industries would also help strengthen the applicability of the findings.

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