

The Mediation Role of Supply Chain Integration and Moderation of Supply Chain Risk Management in Relationship Between Project Planning and Project Performance in The Logistic Sector

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ABSTRACT

This study examines the relationship between logistics project planning and performance using supply chain risk management and supply chain integration as moderators and mediators, respectively. Logistics projects are characterised by high complexity, uncertainty, and multi-stakeholder coordination, making effective planning and integration essential. However, prior studies have largely examined these variables independently, with limited attention paid to their combined roles in logistics project contexts. This study uses a quantitative methodology, analysing survey data from 303 logistics project experts using AMOS and Structural Equation Modelling (SEM). The findings demonstrate that supply chain integration and project planning significantly improve project performance. Nevertheless, the link between project planning and project performance is neither mediated by supply chain integration nor is it significantly impacted by project planning. Furthermore, this link is not substantially moderated by supply chain risk management. These findings indicate that planning and integration function as independent mechanisms for improving project performance. This study contributes by clarifying the context-dependent role of integration and risk management in logistics projects.

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INTRODUCTION

Logistics projects play an important role in supporting industrial, construction, and infrastructure activities by ensuring the reliable and timely transportation of materials, equipment, and specialised cargo. Owing to their operational complexity, logistics projects often involve multiple stakeholders, tight schedules, and high levels of uncertainty. These conditions frequently lead to challenges such as delays, cost overruns, coordination problems, and supply chain disruptions, which may reduce the overall

project effectiveness (Harake, 2023). Therefore, effective project management practices are essential for managing the complexity and dynamic nature of logistics projects.

Complexity, ambiguity, and a host of other modern project hallmarks are on the rise, along with interorganizational collaboration. In many project-based environments, successful project delivery requires effective coordination among multiple stakeholders, subsystems, and organizational units. System integration plays an important role in ensuring that different components of a project function together as a unified system. As projects become more technologically and organizationally complex, integration activities across organizational boundaries have become increasingly important for managing uncertainty and ensuring project success (Whyte & Davies, 2021). In such an environment, project managers must coordinate diverse knowledge, technologies, and operational processes to ensure that the project activities are properly aligned.

Project planning is widely recognised as a critical component of successful project management. Planning helps define project objectives, allocate resources, establish schedules, and identify potential risks that may influence project implementation (Dionsio et al., n.d.). Previous studies have shown that effective project planning significantly improves project performance in terms of time, cost, and quality outcomes (Yang et al., 2020). In logistics projects, planning becomes even more important because project activities involve shipment scheduling, route planning, equipment coordination, and preparation for unexpected disruptions (Urbański et al., 2024). Effective planning also helps project teams develop a shared understanding of project objectives and facilitates coordination among the multidisciplinary stakeholders involved in project implementation.

In addition to effective planning, coordination among organisations involved in the supply chain is essential. Logistics projects typically involve multiple parties, including project owners, logistics service providers, transportation companies, suppliers, and regulatory authorities. Supply chain integration enables organisations to share information, coordinate activities, and collaborate more effectively, which can improve operational performance and project outcomes (Malik et al., 2023). In addition, supply chain integration can be understood as a strategic mechanism that includes working together with external partners like suppliers and customers in addition to coordinating internal procedures. This includes customer, supplier, and internal integration, which collectively enhance coordination and operational effectiveness in complex project environments. In project-based organisations, where activities are temporary and highly interdependent, effective integration is essential to ensure that project objectives can be achieved efficiently and reliably (Jabarzadeh et al., 2021).

Empirical studies also demonstrate that stronger integration across supply chain partners can enhance responsiveness, reliability, and operational efficiency in complex project environments (Lin et al., 2024). Similarly, coordination mechanisms across project stakeholders play an important role in aligning activities and managing the interdependencies that arise during project implementation (Wang et al., 2018). Furthermore, logistics projects are highly exposed to risks such as transportation delays, supplier disruptions, regulatory changes, and operational uncertainties. Supply chain risk management is crucial for locating, evaluating, and reducing possible hazards that may interfere with project operations (El Baz & Ruel, 2021). Effective risk management

practices can increase supply chain resilience and help organisations better manage uncertainties within project-based environments.

However, notwithstanding the expanding corpus of literature on project planning, supply chain integration has been the primary focus of previous studies and project performance separately or in other industry contexts, such as manufacturing and construction. Research on the joint function of risk management in the supply chain and supply chain integration as a mediating mechanism is still scarce, particularly in logistics project environments characterised by high uncertainty and inter-organisational complexity.

Based on this research gap, by taking into account the moderating function of managing risks in the supply chain and how supply chain integration acts as a mediator, this study seeks to investigate how project planning affects project performance in logistics initiatives. The overarching goal of this study is to bolster existing literature on project management and supply chain management by examining these connections and offering useful advice for enhancing project performance in the logistics industry.

LITERATURE REVIEW

The relationships among project planning, supply chain integration, and supply chain risk management are explored in this study's conceptual framework and project performance in logistics projects based on the research gap mentioned in the preceding section. In order to facilitate the development of the research hypothesis, this section examines pertinent literature and theoretical underpinnings. In line with the characteristics of logistics projects, which involve high levels of uncertainty and inter-organisational coordination, this study emphasises the role of planning, integration, and risk management as key mechanisms influencing project outcomes.

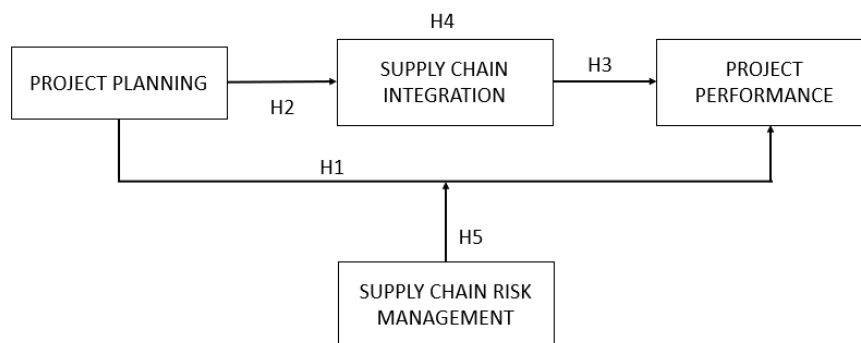


Figure 1. Conceptual Framework

Project performance has been widely discussed in project management and supply chain management literature as it reflects the extent to which a project achieves its objectives related to time, cost, quality, and stakeholder satisfaction. In project-based industries, such as logistics, project performance is strongly influenced by the effectiveness of managerial practices that address operational uncertainty, coordination complexity, and supply chain disruptions. Logistics projects typically involve multiple stakeholders, including logistics service providers, transportation operators, contractors, and suppliers, which increases the need for effective coordination among project participants (Harake, 2023). Therefore, understanding factors that influence project performance is essential for improving the effectiveness of logistics project implementation.

H₁: “Project planning has a positive effect on project performance.”

Project planning is widely considered to be a crucial part of any project management strategy. According to project management theory, planning provides a structured framework for defining project objectives, allocating resources, scheduling activities, and preparing responses to potential risks. Effective planning reduces uncertainty and ensures that project execution aligns with the established objectives.

Empirical studies consistently demonstrate that comprehensive planning improves project outcomes by facilitating coordination, efficient resource allocation, and proactive risk management (Yang et al., 2020). In logistics projects, where activities involve shipment scheduling, route planning, and coordination among multiple stakeholders, planning plays a crucial role in ensuring efficient execution (Urbański et al., 2024).

Therefore, effective project planning is expected to positively influence project performance.

H₂: “Project planning has a positive effect on supply chain integration.”

Project planning not only supports internal execution but also facilitates coordination across organizational boundaries. Through structured planning processes, stakeholders can establish shared schedules, align operational objectives, and define responsibilities across supply chain partners. These mechanisms support collaboration and coordination in complex project environments.

From a coordination perspective, planning acts as a mechanism that aligns stakeholders and enables collaborative decision-making. Previous studies indicate that structured planning enhances communication and information sharing, thereby strengthening supply chain integration (Malik et al., 2023).

In logistics projects, where coordination among multiple organisations is essential, planning provides a common framework that supports inter-organizational alignment. Therefore, project planning is expected to positively influence supply chain integration.

H₃: “Supply chain integration has a positive effect on project performance.”

The level of cooperation, information exchange, and coordination between organisations participating in supply chain operations is called supply chain integration. According to information processing theory, organisations operating in complex and uncertain environments require enhanced information processing capabilities to manage uncertainty. Supply chain integration facilitates information flow and coordination among partners, enabling better decision-making and operational efficiency.

Theoretically, Integration of the supply chain is sometimes considered as a way of strategic cooperation that synchronises internal and external supply chain operations (Flynn et al., 2010). Integration with suppliers and customers collectively enhances coordination and operational performance.

Empirical evidence shows that Supply chain integration at higher levels enhances performance, dependability, and responsiveness project-based environments (Urbański et al., 2024). Furthermore, supply chain integration has been shown to enhance supply chain resilience and performance by improving coordination and information sharing among supply chain partners in complex environments (Zhang et al., 2024).

In logistics projects, integration enables better coordination of shipments, schedules, and resources, thereby improving project outcomes. Therefore, supply chain integration is expected to positively influence project performance.

H₄: “Supply chain integration mediates the relationship between project planning and project performance.”

Project planning may influence project performance both directly and indirectly through coordination mechanisms. Supply chain integration acts as an intermediate mechanism that links planning processes with performance outcomes by enabling coordination, exchanging data and working together to complete tasks along the supply chain.

From a mediation perspective, planning establishes the structure for project execution, whereas integration ensures that these plans are effectively implemented across organizational boundaries. Through this process, planning is translated into operational performance through integration mechanisms.

Previous research suggests that supply chain integration may moderate the relationship between management practices and performance by enhancing stakeholder engagement and coordination (Yang et al., 2020). Logistics performance is influenced by supply chain tactics, and empirical data shows that integration of the supply chain mediates this relationship (Dağdeviren & Erturgut, 2024).

In logistics projects, where coordination among multiple organizations is critical, supply chain integration is anticipated to act as a go-between when it comes to project planning and performance.

H₅: “Supply chain risk management moderates the relationship between project planning and project performance.”

The methodical process of locating, evaluating, reducing, and managing hazards that may interfere with supply chain operations is known as SCRM. Modern supply chains are increasingly exposed to disruptions, making risk management critical for maintaining operational stability. SCRM is conceptualised as a capability that enhances supply chain resilience by enabling organisations to anticipate, absorb, and respond to disruptions in uncertain environments (Emrouznejad & Abbasi, 2023). According to risk management theory, such capabilities support decision-making under uncertainty and help maintain coordination among supply chain partners.

Empirical studies show that effective risk management improves supply chain resilience and reduces the negative impact of disruptions on performance (El Baz & Ruel, 2021). In addition, integration and risk management jointly contribute to improving supply chain resilience and operational performance in complex environments (Zhang et al., 2024). In logistics projects, risk management practices help maintain stable collaboration and coordination despite uncertainties. In addition, effective supply chain risk management enables organisations to mitigate potential risks during project execution more effectively. By minimising disruptions and ensuring operational stability, risk management practices enhance the effectiveness of project planning in achieving project outcomes.

Therefore, supply chain risk management is expected to improve the connection between project management and the final product by acting as a moderating variable.

RESEARCH METHODS

This study aims to evaluate the connection between project planning and project performance in logistics projects by taking supply chain risk management and supply chain integration into consideration as moderating and mediating variables, respectively. A quantitative research approach based on a survey methodology was employed to collect data from professionals involved in logistics projects.

A Google Forms-distributed online questionnaire was used to gather data from individuals engaged in logistics project activities, including those responsible for project planning, coordination, and risk management. Purposive sampling was applied to select respondents who met specific criteria, namely, individuals who were directly involved in logistics projects and had experience in at least one logistics project. Screening questions were included at the beginning of the questionnaire to ensure that only eligible respondents participated in the study. Data analysis was conducted using a total of 303 valid replies. Structural Equation Modelling (SEM) requires a large enough sample to provide stable and trustworthy parameter estimation; hence, this sample size is deemed suitable.

Both primary and secondary data sources were used in this study. To support the development of the research framework and assessment components, secondary data were gathered from international journals, books, and project management standards. Primary data came from respondents' views as assessed by a structured questionnaire. Project planning was the independent variable in the research, project performance was the dependent variable, supply chain integration was the mediating variable, and supply chain risk management was the moderating variable. Each idea was evaluated using a five-point Likert scale, where 1 signifies "strongly disagree" and 5 means "strongly agree." The content's legitimacy may be assured by the measuring items were created and modified using accepted theories and earlier empirical research.

Project planning refers to the process of defining project objectives, allocating resources, scheduling activities, and identifying potential risks prior to project implementation. In this study, project planning is operationalised through several indicators that reflect the effectiveness of planning practices. Project plan development represents the extent to which formal planning documents are prepared to guide project execution. The use of planning documents as a basis for project control reflects how planning is used to monitor and control project activities. Monitoring project progress based on established plans indicates the degree to which the actual implementation follows predefined schedules and targets. The identification of potential risks during the planning stage reflects a proactive effort to anticipate uncertainties. In addition, the coordination of planning activities with project stakeholders reflects the extent to which planning processes involve collaboration among relevant parties.

Supply chain integration reflects the degree of coordination, collaboration, and information sharing among organisations involved in project activities. This construct is measured through indicators that capture inter-organizational interaction and alignment. Coordination with supply chain partners reflects the extent to which project activities are aligned across organisations. Collaborative decision making represents the joint involvement of stakeholders in making operational and strategic decisions. Joint project monitoring indicates a shared responsibility for overseeing project progress. Information sharing among stakeholders reflects the openness and timeliness of communication across

organisations. Furthermore, the development of cooperative working relationships represents the strength of long-term collaboration and trust among project participants.

The term "supply chain risk management" describes a methodical approach to finding, evaluating, and controlling potential threats in the supply chain. Indicators reflecting critical steps in risk management procedures are used to operationalise supply chain risk management in this study. When businesses are good at seeing possible problems with their supply chains, they engage in risk identification. An appraisal of the possibility and consequences of potential dangers is what a risk assessment is all about. Risk mitigation strategies involve the implementation of actions to reduce or prevent disruptions. Risk monitoring practices reflect continuous efforts to track and manage risks throughout project execution.

Project performance represents the extent to which project objectives are achieved in terms of progress, quality, and overall outcomes. The achievement of project progress targets reflects the ability of the project to meet scheduled timelines, whereas the ability to meet project quality standards indicates the extent to which project outputs comply with predefined specifications and requirements. These indicators collectively represent the effectiveness of project execution.

SEM with AMOS software was used to analyse the data. SEM was chosen because it allows for the simultaneous examination of several interactions among variables, including direct, mediating, and moderating effects. Validity and reliability tests were used to assess the measuring equipment' quality prior to testing the study hypotheses. Validity was assessed by examining the correlation between each indicator and the total construct score, where an indicator was considered valid if the correlation significance value (p-value) was less than or equal to 0.05. Reliability testing was conducted using Cronbach's alpha, where a coefficient value of 0.60 or higher indicated acceptable reliability.

The SEM analysis included an evaluation of model fit and structural relationships to examine direct, mediating, and moderating effects among the variables. To ensure ethical research practices, participation in the survey was voluntary, respondents remained anonymous, and all collected data were treated confidentially and used solely for academic purposes.

RESULTS AND DISCUSSION

Results

Respondent's Data Profile

This study is based on primary data obtained through an online questionnaire completed by project management professionals. A total of 303 valid responses were collected and analysed to provide the research data.

Table 1. Respondent Profile

Respondent Profile	Frequency	Percentage (%)
Gender		
Male	160	52.8
Female	143	47.2
Total	303	100
Age		
20 - 30 Years	83	27.4
31 - 40 Years	179	59.1
41 - 50 Years	40	13.2
>50 Years	1	0.3
Total	303	100
Educational Background		
Diploma degree (D3/D4)	9	3.0
Bachelor's degree	163	53.8
Master's degree	129	42.6
Doctoral degree	2	0.7
Total	303	100
Job Title		
Staff	30	9.9
Supervisor	183	60.4
Manager	69	22.8
Senior Manager	21	6.9
Total	303	100
Length of Working		
1 - 5 Years	47	15.5
6 - 10 Years	176	58.1
11 - 15 Years	61	20.1
>15 Years	19	6.3
Total	303	100

When broken down by gender, the majority of replies were men, accounting for 52.8% of the 303 respondents, while female respondents represented 47.2%. In terms of age group, respondents aged 31–40 years formed the largest proportion at 59.1%, followed by those aged 20–30 years at 27.4%. The remaining respondents were aged 41–50 years (13.2%) and above 50 years (0.3%). Regarding educational background, 53.8% of those who participated in the survey had at least a bachelor's degree (S1). S2 responders, who have a master's degree, make up 42.6% of the total. Only 3.0% of people who took the survey held a diploma (D3/D4), while those with a doctoral degree (S3) represented the smallest group at 0.3%. Based on job position, the majority of respondents worked as supervisors, accounting for 60.4% of the total sample. This was followed by respondents holding managerial positions (22.8%), staff positions (9.9%), and senior manager positions (6.9%). In terms of work experience, most respondents had been working for 6–10 years (58.1%), followed by those with 11–15 years of experience (20.1%), respondents with 1–5 years of experience (15.5%), and those with more than 15 years of experience (6.3%).

Result of Validity and Reliability Test

Validity testing was conducted to determine whether the measurement indicators used in this study accurately measured the intended variables. In this research, validity was evaluated using item–total correlation, which analyses the correlation between all indicators and the measured variable's total score.

The decision rules for the validity test are as follows:

- If the p-value of the correlation between the indicator and the variable is ≤ 0.05 , then H_0 is rejected.
- If the p-value of the correlation between the indicator and the variable is > 0.05 , then H_0 is accepted.

The consistency of the measured items was examined using reliability testing. A Cronbach's Alpha score of 0.60 or above indicates that the variable in question is trustworthy; this reliability measure was used to evaluate the variables in this study. The Project Planning variable's validity and reliability test findings are presented in the next section.

Table 2. Validity and Reliability Testing of Project Planning Indicators

Items	Validity Testing		Reliability Testing	
	p-value correlation	Conclusion	Cronbach Alpha	Conclusion
Develop a project plan that integrates managerial control mechanisms for effective implementation.	0,656**	Valid		
Using project planning documents and results as a basis for implementing project control.	0,686**	Valid		
Monitor the project implementation process based on the established project plan.	0,658**	Valid		
Systematically identify potential project risks during the project planning stage.	0,523**	Valid		
Include the results of potential risk evaluations in project planning documents.	0,722**	Valid	0,766	Reliable
Able to respond effectively to risks that arise during project implementation through project planning.	0,626**	Valid		
Together with the relevant parties, analyze and divide project activities at the planning stage.	0,538**	Valid		
Agree and implement the project baseline plan jointly with stakeholders.	0,429**	Valid		
Implement the project in accordance with the stages and procedures set out in the project plan.	0,481**	Valid		

Note(s): *= α 10% **= α 5% (Lin et al., 2024)

From the processing results, it can be seen that all nine measurement indicators of the Project Planning variable are proven valid because they produce a p-value from the correlation of each question item ≤ 0.05 , and are reliable because they have a Cronbach alpha value of $0.766 > 0.6$.

Table 3. Validity and Reliability Testing of Supply Chain Risk Management Indicators

Item	Validity Testing		Reliability Testing	
	p-value correlation	Conclusion	Cronbach Alpha	Conclusion
Risk Identification				
Have comprehensive information regarding the basic risks that may occur in our supply chain.	0,723**	Valid		
Continuously identifies short-term risks in the supply chain.	0,819**	Valid		
In the risk analysis of suppliers and supply chain partners, we define relevant observation areas to identify supply chain risks.	0,718**	Valid	0,713	Reliable
During risk analysis across all supply chain partners, early warning indicators are established to anticipate potential risks.	0,698**	Valid		
Risk Assessment				
As part of the risk analysis process, the primary sources of risk within the supply chain are identified.	0,580**	Valid		
Evaluate the likelihood of risk occurrence within the supply chain.	0,767**	Valid		
Assess the potential impact of risks that may arise in the supply chain.	0,705**	Valid	0,613	Reliable
Classify and prioritize supply chain risks according to their level of significance.	0,700**	Valid		
Risk Mitigation				
In the risk analysis process, various response or mitigation strategies are established for supply chain risks.	0,861**	Valid		
Evaluate the effectiveness of planned risk mitigation strategies.	0,916**	Valid	0,705	Reliable
Supply chain risk management is considered a critical activity and a strategic priority within our organization.	0,538**	Valid		
Risk Control				
Employees have a high level of awareness regarding potential supply chain risks.	0,668**	Valid		
The risk management process is designed and executed professionally.	0,837**	Valid		
The frequency of supply chain risks has been successfully reduced over the past three years.	0,800**	Valid	0,685	Reliable
The impact of supply chain risks has been effectively minimized during the past three years.	0,601**	Valid		

Note(s): * =alpha 10% ** =alpha 5% (Duong & Ha, 2021)

Table 3 displays the outcomes of the validity testing conducted on the Supply Chain Risk Management variable. This variable has four dimensions and 15 indicators. Information from the table shows that all indicators that form the four dimensions are proven valid

because they produce a p-value of correlation ≤ 0.05 . All indicators that measure the dimensions are also proven reliable (consistent) because they produce a Cronbach's alpha value > 0.6 .

Table 4. Validity and Reliability Testing of Supply Chain Integration Indicators

Item	Validity Testing		Reliability Testing	
	p-value correlation	Conclusion	Cronbach Alpha	Conclusion
Dimension: Coordinative				
Formally establish project objectives together with supply chain partners (clients/consultants/contractors).	0,691**	Valid		
Implement project risk management jointly with supply chain partners.	0,779**	Valid		
Regularly coordination meetings to monitor and follow up on project progress.	0,794**	Valid	0,682	Reliable
Continuous improvement and/or benchmarking with project partners during project implementation.	0,639**	Valid		
Dimension: Collaborative				
Collaborate with project partners in the best interests of project success.	0,735**	Valid		
Resolve disagreements with project partners constructively.	0,789**	Valid		
Establish open and trusting working relationships with project partners.	0,641**	Valid	0,638	Reliable
Collaborate with project partners in accordance with our expectations in project implementation.	0,607**	Valid		

Note(s): *= α 10% **= α 5% (Eriksson et al., 2023)

The validity testing findings for the Supply Chain Integration variable, which has two dimensions and eight indicators, are displayed in Table 4. Information from the table shows that all indicators that form two dimensions are proven valid because they produce a p-value from the correlation of each indicator item ≤ 0.05 , and are proven reliable (consistent) because they produce a Cronbach's alpha of > 0.6 for both dimensions of the supply chain integration variable.

Table 5. Validity and Reliability Testing of Project Performance Indicators

Item	Validity Testing		Reliability Testing	
	p-value correlation	Conclusion	Cronbach Alpha	Conclusion
Successfully achieved project progress targets according to plan.	0,915	Valid	0,607	Reliable
Successfully meet the project quality and quality standards as planned.	0,789	Valid		

Note(s): * =alpha 10% ** =alpha 5% (Lin et al., 2024)

Table 5 displays the results of the validity test conducted on the project performance factors. Information from the table shows that two indicators are proven to be valid and reliable, namely successfully achieved project progress targets according to plan and successfully meet the project quality and quality standards as planned.

Model Fit Evaluation

Before conducting the hypothesis testing, the overall model fit of the SEM model presented in Figure 2 was evaluated.

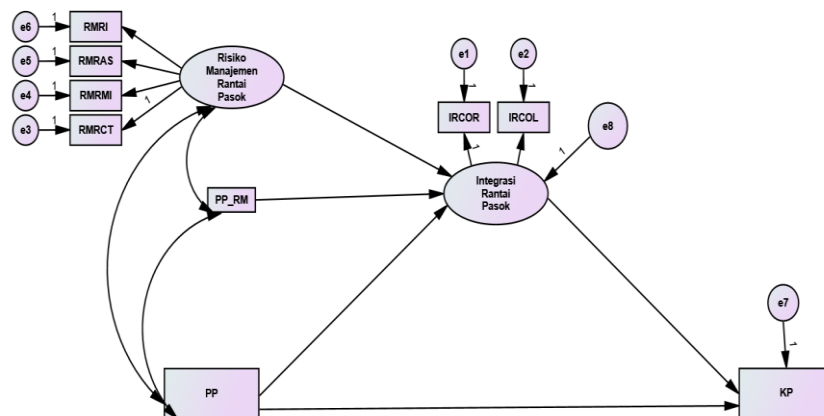


Figure 2. SEM Research Model

According to the findings, seven of the goodness-of-fit criteria were considered, and three indicators met the criteria for a good model fit. These metrics include the GFI, which is greater than the minimum threshold of 0.90 at 0.949; the Root Mean Square Residual (RMR), which is less than the maximum acceptable level of 0.05 at 0.019; and the RMSEA, which is still within the acceptable limit of 0.10 at 0.092. Based on these three indicators, the model demonstrated an acceptable level of fit.

In addition, three more indicators suggest a marginal fit, since their values are somewhat lower than the required criterion of 0.90. At 0.853, NFI, 0.890, and 0.887, respectively, we obtain IFI and CFI. Additionally, the chi-square test yielded a p-value of 0.000, < 0.05 level of significance, indicating that the model falls into the poor fit category. However, because most of the model fit indicators show acceptable results, the overall model can be considered acceptable. Although some fit indices are below the recommended threshold, the model is still considered acceptable as several key indices (such as GFI,

RMR, and RMSEA) meet acceptable criteria, which is commonly accepted in complex SEM models (Jr et al., 2019).

Hypothesis Testing

Based on data processing using SEM-AMOS testing using P-Value with limits below 0.05 The study's hypothesis test yielded the following results:

Table 6. Hypothesis Testing

	Hypothesis	Coefficient	T _{statistic}	P-value	Decision
H ₁	Project Planning is positively associated with Project Performance.	0,212	1,846	0,032	Hypothesis Supported
H ₂	Project Planning is positively related to Supply Chain Integration.	-7.159	-0,466	0,320	Hypothesis Not Supported
H ₃	Supply Chain Integration positively affects Project Performance.	0.343	2,154	0,015	Hypothesis Supported
H ₄	Supply Chain Integration serves as a mediating variable in the relationship between Project Planning and Project Performance.	-2,455	-0,455	0,324	Hypothesis Not Supported
H ₅	Supply Chain Risk Management positively moderates the relationship between Project Planning and Project Performance.	0,066	0,442	0,329	Hypothesis Not Supported

According to Table 6, there is a strong correlation between project planning and project performance (H₁), and supply chain integration significantly influences project performance (H₃). However, project planning does not influence supply chain integration (H₂), and there is no significant mediation (H₄) or moderation (H₅) effect.

Discussion

Discussion of H₁: The Effect of Project Planning on Project Performance

Project planning significantly improves project performance according to the hypothesis testing results. A positive coefficient value of 0.212 suggests that well-developed project planning contributes to improved project outcomes. Projects supported by clear schedules, defined objectives, effective resource allocation, and structured monitoring processes tend to achieve higher performance levels.

According to the theory of project management, which stresses the importance of planning in directing project execution and minimising uncertainty throughout the project lifetime, this result is in line with that philosophy. Effective planning provides a structured framework that allows project managers to coordinate tasks, allocate resources efficiently, and anticipate potential risks. Previous studies have also demonstrated that well-developed planning practices improve project outcomes by facilitating knowledge integration and coordination among project stakeholders (Yang et al., 2020).

In logistics projects, planning becomes even more critical due to the complexity of operational activities such as shipment scheduling, equipment coordination, and route

planning. These activities require careful preparation to ensure that logistics operations are executed efficiently. Therefore, the results of this study confirm that effective project planning is a key determinant of the performance of logistics projects

Discussion of H₂: The Effect of Project Planning on Supply Chain Integration

The results show that project planning does not have a significant effect on supply chain integration, as indicated by the negative coefficient value (-7.159) and the non-significant statistical result. This finding suggests that improvements in project planning do not necessarily lead to stronger integration between supply chain partners.

One possible explanation is that project planning is often conducted internally within an organisation and may focus primarily on internal project activities rather than on coordination with external supply chain partners. In many logistics projects, planning processes are developed by the project owner or the main contractor and are not always fully integrated with the operational planning of logistics providers or suppliers. As a result, even well-developed project planning practices may not automatically translate into stronger collaboration or information sharing among supply chain partners.

Another explanation relates to the organizational structure of logistics projects, which often involves multiple independent organisations with different operational systems, objectives, and decision-making processes. These differences may limit the effectiveness of project planning in strengthening supply chain integration. Previous studies suggest that supply chain integration requires not only formal planning mechanisms but also collaborative governance structures, trust among partners, and shared information systems (Eriksson et al., 2023). Without these supporting mechanisms, planning activities alone may not be sufficient to improve the integration between supply chain partners. Therefore, the findings indicate that although project planning is important for internal project coordination, it does not necessarily guarantee stronger supply chain integration in logistics projects. The unusually large negative coefficient may indicate variability in respondents' perceptions or differences in organizational practices across logistics projects, which could influence how planning activities are translated into supply chain integration.

Discussion of H₃: The Effect of Supply Chain Integration on Project Performance

This study's findings show that supply chain integration greatly improves project outcomes. Project results are enhanced when supply chain partners work together more closely and share more information, as indicated by the positive coefficient value of 0.343.

This finding supports the theoretical perspective that supply chain integration enhances organizational performance by improving information flow and coordination across organizational boundaries. Previous studies indicate that supply chain integration enhances collaboration, coordination, and information sharing across organisations, which ultimately improves supply chain performance (Le, 2025). Supply chain integration facilitates the exchange of information among project stakeholders, enabling more effective decision-making and coordination.

In logistics projects, where multiple organisations are involved in project implementation, effective coordination among supply chain partners is essential to ensure smooth project execution. Integration allows project stakeholders to align their schedules, coordinate shipment activities, and respond more effectively to operational disruptions. Previous studies have also shown that supply chain integration improves project performance by

enhancing collaboration among project participants and reducing operational inefficiencies (Urbański et al., 2024). In addition, collaboration among supply chain partners has been identified as a key factor in improving logistics performance, as it enables organisations to share information, coordinate activities, and achieve greater operational efficiency and flexibility. This highlights the importance of integration strategies in improving project performance (Malebby et al., 2023). Consequently, the results validate that supply chain integration is essential for enhancing logistics project success.

Discussion of H4: The Mediating Role of Supply Chain Integration

According to the results, supply chain integration does not play a significant mediating role between project planning and project performance. A non-significant coefficient value of -2.455 and a p-value of 0.324 suggest that the mediating impact is not supported by the statistical data.

This finding suggests that project planning might have an immediate impact on project outcomes without going via the linkages in the supply chain. One possible explanation is that planning practices in logistics projects primarily affect internal project management processes, such as scheduling, resource allocation, and risk identification, which directly contribute to project performance outcomes. In this case, the benefits of planning may be realised through internal managerial control rather than through improvements in supply chain coordination.

Another explanation may be related to the nature of logistics projects, which often involve temporary collaboration among multiple organisations. In such project-based environments, integration among supply chain partners may depend more on contractual arrangements, operational agreements, and communication practices rather than on formal planning processes. As a result, even though supply chain integration contributes to project performance, it may not necessarily act as the mechanism through which project planning improves performance.

This result contradicts earlier research that found supply chain integration to play a major mediating influence (Dağdeviren & Erturgut, 2024), suggesting that the mediating effect may depend on the specific context of logistics projects. This indicates that the effectiveness of supply chain integration as a mediating mechanism may vary depending on the level of inter-organizational coordination and project complexity.

Discussion of H5: The Moderating Role of Supply Chain Risk Management

The findings show that the connection between supply chain risk management does not mitigate the relationship between project planning and performance. With a coefficient of 0.066 and a non-significant p-value of 0.329, the statistical analysis shows that the moderating impact is not justified.

One possible explanation is that risk management practices may operate independently of the planning and integration processes within logistics projects. In many organisations, identifying possible risks and creating mitigation plans are the main goals of supply chain risk management, which is carried out as a distinct managerial activity. While risk management is essential for maintaining supply chain resilience, it may not necessarily strengthen the relationship between planning and integration.

Another possible explanation is that risk management practices are often reactive rather than proactive in many logistics projects. Instead of strengthening coordination among

supply chain partners, risk management activities may focus on responding to disruptions after they occur. In such cases, risk management practices may not significantly influence the relationship between planning and performance.

Furthermore, the effectiveness of supply chain risk management may depend on factors such as organizational maturity, technological capabilities, and collaborative governance among supply chain partners. Therefore, although supply chain risk management remains important for managing uncertainty in logistics projects, the findings suggest that it does not significantly strengthen the relationship between project planning and performance.

CONCLUSION

The findings provide insight into the interplay between logistics project planning, project performance, supply chain risk management, and supply chain integration. Although there is no statistical evidence to support the correlations between supply chain risk management and project performance, the results of the hypothesis testing demonstrate that both project planning and supply chain integration significantly affect project performance. These results highlight the different roles of managerial planning practices, coordination mechanisms, and risk management practices in influencing logistics project outcomes.

With a coefficient value of 0.212, t-value of 1.846, and p-value of 0.032, the results of Hypothesis 1 demonstrate that project planning significantly improves project performance. This finding implies that better project outcomes in logistics initiatives are a result of organised project planning. Project managers may set project objectives, distribute resources effectively, create clear timetables with the aid of effective planning, and anticipate potential risks that may arise during project execution. In the context of logistics projects, where operations involve complex coordination among multiple stakeholders and activities, such as shipment scheduling and equipment coordination, effective planning provides a structured framework that supports efficient project implementation. This finding supports previous research suggesting that project planning improves project performance by facilitating coordination, resource allocation, and risk management throughout the project lifecycle (Yang et al., 2020). Therefore, the results confirm that project planning serves as an important managerial capability that directly improves project performance.

However, the results of Hypothesis 2 indicate that project planning does not significantly influence supply chain integration. Statistical analysis shows a negative coefficient value of -7.159 with a p-value of 0.320, indicating that the relationship between these variables is not supported. This finding suggests that improvements in project planning do not necessarily strengthen coordination and collaboration among supply chain partners. One possible explanation is that project planning activities are often internally oriented within organisations and primarily focus on internal project management functions, such as scheduling, budgeting, and operational control. Although these activities improve internal project coordination, they may not directly facilitate collaboration with external supply chain partners. In logistics projects, supply chain integration typically requires additional mechanisms, such as shared information systems, relational governance, and trust among stakeholders. Previous research indicates that integration among supply chain partners is strongly influenced by collaborative structures and communication mechanisms rather than solely by internal planning practices (Urbański et al., 2024). Therefore, the findings

suggest that project planning alone may not be sufficient to strengthen supply chain integration in complex logistics project environments.

With a coefficient value of 0.343, a t-value of 2.154, and a p-value of 0.015, the results of Hypothesis 3 demonstrate that supply chain integration significantly improves project performance. This finding indicates that stronger coordination and collaboration among supply chain partners contribute to improved project performance. In logistics projects, integration among stakeholders, such as logistics service providers, contractors, and suppliers, allows for better information sharing, improved coordination of operational activities, and faster responses to unexpected disruptions. Supply chain integration facilitates this process by enabling project stakeholders to share information, synchronise schedules, and align operational decisions. As a result, higher levels of supply chain integration improve the efficiency and reliability of project implementation, which ultimately leads to better project performance.

Despite the significant relationships observed in H1 and H3, according to the findings of Hypothesis 4, supply chain integration does not influence the relationship between project planning and project performance. With a p-value of 0.324 and coefficient value of -2.455, the statistical results show that the mediating effect is not supported. This study found that, contrary to popular belief, supply chain integration does not have any indirect effect on project performance. To rephrase, although supply chain integration contributes to improved project outcomes, it does not function as a mechanism through which planning practices improve performance. One possible explanation is that planning activities primarily improve internal project management processes such as scheduling accuracy, resource coordination, and risk identification, which directly affect project outcomes. In contrast, supply chain integration depends on inter-organisational collaboration mechanisms that may not necessarily be influenced by internal planning processes. Therefore, planning and integration may operate as two independent managerial mechanisms that contribute to project performance.

Finally, according to the results of Hypothesis 5, supply chain risk management does not significantly modify the relationship between project planning and project performance. With a p-value of 0.329 and coefficient of 0.066, the analysis does not lend credence to the moderating impact. Supply chain risk management has little effect on the correlation between project planning and performance, according to this finding. One possible explanation is that risk management practices are often implemented as independent organizational functions focused on identifying and mitigating potential disruptions rather than directly influencing coordination processes among supply chain partners. In many logistics organisations, risk management activities focus on monitoring potential disruptions and implementing mitigation strategies rather than strengthening collaboration mechanisms across supply chain networks. Furthermore, the effectiveness of supply chain risk management may depend on organizational maturity, technological capabilities, and collaborative governance structures. Without these supporting mechanisms, risk management practices may have a limited influence on the relationship between planning and integration.

Overall, the results of this study indicate that both project planning and supply chain integration SCI play important but independent roles in improving logistics project performance. Project planning directly contributes to improved project outcomes through better coordination of internal project activities, while supply chain integration improves

performance through enhanced collaboration among project stakeholders. However, the results also imply that supply chain integration is not always strengthened by planning, and that the connection between planning and performance is not mediated by integration. Similarly, the link between planning and performance is not moderated considerably by supply chain risk management. These results highlight the complexity of managing logistics projects in which different managerial practices may influence project outcomes through distinct mechanisms.

RESEARCH CONTRIBUTION

Theoretical Contribution

This study contributes to the existing literature on project and supply chain management by providing new empirical evidence on the relationships between logistics project performance, project planning, supply chain integration, and supply chain risk management. Many people think that supply chain risk management and integration mediate the relationship between the two variables; however, this study disproves that idea. Specifically, neither supply chain integration nor supply chain risk management moderated the relationship between project planning and performance, according to the results.

These findings extend existing theories by highlighting that the roles of supply chain integration and risk management may not always function as indirect mechanisms linking project planning to performance outcomes. Instead, project planning and supply chain integration appear to operate as independent factors that directly influence project performance. This suggests that the effectiveness of commonly assumed mediation and moderation relationships is context-dependent, particularly in logistics project environments characterised by high uncertainty, temporary organizational structures, and complex inter-organisational coordination.

Furthermore, this study enriches the understanding of supply chain integration theory by emphasising that integration alone may not serve as a transmission mechanism for planning effectiveness unless supported by strong collaboration practices, information sharing, and alignment among project stakeholders. In this regard, this study contributes to the ongoing discussion on the boundary conditions of supply chain integration and risk management theories in project-based contexts.

Practical Implication

This study offers valuable information for practitioners participating in logistics initiatives from a practical standpoint. According to the results, companies should not depend only on risk management and supply chain integration to improve project planning efficacy. Instead, project planning should be strengthened as a standalone managerial capability, focusing on clear scheduling, resource allocation, and risk identification processes to directly improve project performance.

In addition, although supply chain integration does not act as a mediating variable, it remains an important factor that independently contributes to project success. Therefore, organisations should continue to improve coordination, information sharing, and collaboration among supply chain partners, but not necessarily expect these practices to automatically translate planning efforts into better performance outcomes.

Moreover, the results indicate that supply chain risk management may function more as a supporting or controlling mechanism than as a moderating factor. This implies that

organisations should focus on implementing risk management practices to maintain operational stability and resilience rather than expecting risk management to strengthen the relationship between planning and performance.

Overall, this study highlights the importance of aligning managerial practices with the specific characteristics of logistics projects, where high uncertainty and multi-organizational involvement require more direct and context-sensitive approaches to improving project performance.

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