

LEADERSHIP DYNAMICS IN SUSTAINABLE PROJECT MANAGEMENT: INSIGHTS FROM THE ELECTRONICS INDUSTRY

ABSTRACT: Purpose: This study investigates the interconnection between sustainable project management (SPM) and project risk management. Additionally, it explores the correlation between SPM and transformational leadership behaviours, utilizing managers' transformational leadership as a mediating variable and decision-making quality as a moderating variable in the relationship between SPM and project risk management. Method: This study gathered data from 247 employees in the Saudi Arabian electronics industry. The collected data was analysed using the STATA software and a structural equation modelling (SEM) approach to achieve the research objectives. Findings: The study's results indicate a significant relationship between sustainable project management, project risk management, and transformational leadership behaviours. Furthermore, the findings support the proposed hypotheses, suggesting that the relationship between sustainable project management and project risk management is moderated by decision-making quality and mediated by managers' transformational leadership behaviours. Originality/ Implications: This study adds to the existing knowledge on sustainable project management and its relevance to electronics project management. It highlights the importance of understanding regulatory and mediating mechanisms for improving project sustainability and performance. The results emphasize the significance of incorporating sustainable project management strategies and transformational leadership for sustainable development in organizations.

Keywords: Project Risk Management, Leadership Behaviours, Decision-Making Processes, Sustainable Project Management, Electronics Industry Saudi Arabia.

1. Introduction

Organizing projects in a challenging economy poses risks for managers and stakeholders. Project risk management has evolved due to factors like changing organizational dynamics, globalization, and widespread technology adoption (Vrečko, Tominc, & Širec, 2023; Wei et al., 2023). Business procedures, globalization, and new technology integration are key considerations. Blak Bernat et al. (2023) note a shift in project management towards sustainability, reflecting a recognition of the impact of social, economic, and environmental factors on decision-making. Wu et al. (2023) highlight this shift as evidence of project management evolving to align with sustainability goals. This transformation, supported empirically by Mohite et al. (2024), is further detailed by Calderon-Tellez et al. (2024) as encompassing planning, implementation, and assessment at all stages in SPM. This approach minimizes environmental and social impact while maximizing economic benefits. Businesses need to understand the intricate connections among sustainable project management, leadership, decision-making, and project risk management to address current project challenges.

Furthermore, the intricate interplay between project risk management and sustainable project management has

been thoroughly investigated in academic research (Fajarwanto et al., 2023). The examination of the influence of these elements on project outcomes has been the focus of previous scholarly investigations, providing valuable insights. Blak Bernat et al. (2023) demonstrated that the integration of sustainable principles enhances project outcomes, emphasizing that SPM strategies mitigate risk and enhance business performance. Phung, Erdogan and Nielsen (2023) underscored the advantages of strategic project management, including increased resilience, stakeholder satisfaction, and socio-environmental protection. Their study underscores the pivotal role of sustainability in project management success and advocates for its incorporation into models. Abdulla and McCauley-Smith (2024) identified a correlation between eco-friendly project management approaches and environmentally conscious leadership styles. Additionally, Purohit, Chopra and Dangwal (2022) established that visionary, intellectually challenging, motivating, and tailored leadership styles contribute to improved project management operations. Maritim (2022) finds that leaders supportive of change enhance environmental and economic conservation. In conclusion, prior research emphasizes the necessity of effective leadership for the development of sustainable long-term project management plans.

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Despite the advancements made in the understanding of project risk management, sustainable project management, and transformational leadership through prior research, there are existing gaps in the field that warrant exploration. Calderon-Tellez et al. (2024) and Haloul, Bilema and Ahmad (2024) identified a knowledge gap regarding the influence of transformative leadership on both project risk management and sustainable outcomes. Additionally, Peng (2024) and Mohite et al. (2024) propose further investigation into the effects of transformational leadership strategies on long-term project and risk management. Takagi, Varajão and Ventura (2024) recommend additional research on the impact of decision-making on sustainable project management solutions. Research on decision-making and project risk management remains insufficient despite prior studies. Understanding the intricate relationship between project risk management and sustainable project management is crucial. Businesses can enhance sustainability and project risk management through further exploration in this area. This study investigates the impact of transformational leadership and decision-making skills on sustainable project management and project risk management. This study builds upon the decision-making and transformative leadership theories proposed by Blak Bernat et al. (2023) and Blak Bernat et al. (2022). It investigates how project managers' leadership styles influence sustainable project management and project risk management effectiveness. Additionally, the research analyses the impact of project team decision-making on the correlation between environmentally responsible project management and project risk management. By addressing gaps in existing literature, this study aims to enhance understanding of the relationship between project risk management and sustainable project management, offering guidance to firms and project managers for achieving sustainable project outcomes.

2. Literature Review

In today's dynamic business environment, effective project risk management is essential for success (Fajarwanto et al., 2023). Scholars and practitioners emphasize the significance of identifying, evaluating, and mitigating risks to safeguard project objectives (Mahmood et al., 2023). The aim is to minimize the impact of risks on project outcomes. Proficient risk management enables project managers to recognize both risks and opportunities (Mahmood et al., 2023). Enhancing stakeholder confidence and fortifying project resilience are critical outcomes. Various theoretical frameworks and models are instrumental in facilitating efficient risk

management practices among practitioners. These frameworks streamline the processes of identifying risk factors, assessing consequences, and devising appropriate countermeasures (Wu et al., 2023). Empirical evidence underscores the imperative of integrating risk management principles into both project planning and execution phases, a strategy that not only bolsters performance but also mitigates uncertainty (Vrečko et al., 2023). Businesses that actively manage risk can mitigate threats and enhance project success. Mwangi and Yusuf (2023) note that globalization, technology, and organizational dynamics have reshaped project risk management practices. Wei et al. (2023) suggest leveraging digital technology and analytics for risk assessment and decision-making. Blak Bernat et al. (2022) emphasize the need for comprehensive risk management systems considering social, political, and economic factors in complex project environments. Strong risk governance frameworks and effective communication are vital for fostering organizational risk awareness and accountability. Choi and Ha (2022) argue that business cultures and structures influence risk management strategies. The latest research underscores the importance of risk awareness and strategic planning for organizational resilience and adaptability in an unpredictable world (Purohit et al., 2022).

Ika and Pinto (2022) define sustainable project management (SPM) as integrating social, economic, and environmental factors into project decisions. Maritim (2022) emphasizes that project management frameworks should incorporate sustainability considerations, including stakeholder input, environmental impact assessments, and ethics. Project risk management involves identifying, assessing, and mitigating risks, while aligning with sustainability goals enhances project success (Stanitsas & Kirytopoulos, 2022). Ayier, Ogolla and Kitheka (2022) concludes that sustainable project management improves performance and reduces risk, while Orazulike (2022) finds that it addresses social and environmental issues, enhancing project resilience and stakeholder satisfaction. Chow et al. (2021) advocate for incorporating sustainability into project management to reduce risks and achieve long-term goals, supported by evidence suggesting that sustainable project management improves risk management effectiveness. Boateng (2021) discerns that sustainability elevates the domain of project risk management, as it furnishes project managers with tools to anticipate and address environmental, social, and financial risks. Silvius (2021) underscores that integrating sustainability concepts enhances project resilience and fosters sustainable development. The theoretical framework posits that sustainable project management

should concomitantly augment both risk management practices and project performance.

H1: Sustainable project management significantly influences project risk management.

Studies, including Ahmad, Bilal and Latif (2021), suggest that employing environmentally friendly project management methods cultivates transformative leadership qualities in managers. Micale et al. (2021) posit that sustainability in project management fosters cooperation and innovation, key traits of transformative leadership, based on their research findings. According to empirical studies like Sankaran, Jacobsson and Blomquist (2021), sustainable project management enhances managers' attitudes and leadership skills, thereby enhancing the quantity and durability of successful businesses. The theory posits that sustainable project management influences managers' transformative leadership, with significant implications. Woźniak (2021) presents enhanced empirical evidence supporting this perspective, indicating that sustainable project managers are more inclined toward transformative leadership, thereby enhancing their likelihood of success. Integrating sustainability into operations can foster ethical project management, as highlighted by Blak Bernat et al. (2022), who emphasize the importance of moral judgment, empowerment, and vision in this context (Vrečko et al., 2023). Transformative leadership traits such as trust and innovation necessitate stakeholder participation and engagement, a possibility facilitated by sustainable project management (Purohit et al., 2022). Research underscores that sustainable project management fosters managers' transformative leadership, thereby enhancing organizational performance and sustainability.

H2: Sustainable project management significantly influences the managers' transformational leadership skills.

Past empirical research, as indicated by Ika and Pinto (2022) and Maritim (2022), underscores the interconnectedness among project risk management, innovative leadership, and supply chain management. Mahmood et al. (2023) observed that innovative leaders enhance project risk management, emphasizing the significance of risk assessment and reduction. Fajarwanto et al. (2023) argue that sustainable project management decreases project risks, thereby enhancing stakeholder satisfaction and project predictability. Empirical data, including that of Blak Bernat et al. (2023), highlight the linkage between transformative leadership, long-term project management, and project risk management, urging further exploration of these connections. Abdulla

and McCauley-Smith (2024) and Yin, Caldas and de Oliveira (2024) demonstrate that transformational leadership by managers bridges project risk management and sustainability, offering solutions to mitigate risks. Takagi et al. (2024) suggest that transformational leaders can select sustainable development projects, advising project teams to adopt environmentally friendly and risk-reducing options. Fajarwanto et al. (2023) suggest that transformational leadership strategies, such as goal setting and empowering team members, enhance project team resilience and success by identifying and managing new hazards. According to the theory proposed by Stanitsas and Kirytopoulos (2022), transformational management influences long-term project management and project risk management, potentially altering risk management outcomes.

H3: Managers transformational leadership significantly mediates the relationship between sustainable project management and project risk management.

Empirical research has delved into the intricate relationship among project risk management, decision-making, and SPM (Chow et al., 2021). Various studies have explored how environmental practices impact decision-making and project-related risks, utilizing diverse contexts (Orazulike, 2022). Ika and Pinto (2022) propose that high-quality decision-making diminishes project risks and enhances project success, while Blak Bernat et al. (2023) assert that effective decision-making processes swiftly identify and mitigate project risks, particularly in environmentally conscious project management. Maritim (2022) highlights the significant association between decision-making quality and both sustainable project management and project risk management, supported by empirical evidence. Research indicates that the quality of project team decision-making significantly influences the efficacy of sustainable project management solutions in mitigating project risks (Orazulike, 2022). High-quality decision-making enables project teams to evaluate risks, gauge sustainability impacts, and mitigate potential hazards (Vrečko et al., 2023). Conversely, poor decision-making may impede the integration of sustainability into project and risk management (Choi & Ha, 2022). The hypothesis posits that decision-making quality affects the interplay between sustainable project management and project risk management (Blak Bernat et al., 2022), potentially influencing the effectiveness of sustainable strategies in risk management.

H4: Quality of decision making significantly moderates the relationship of sustainable project management and project risk management.

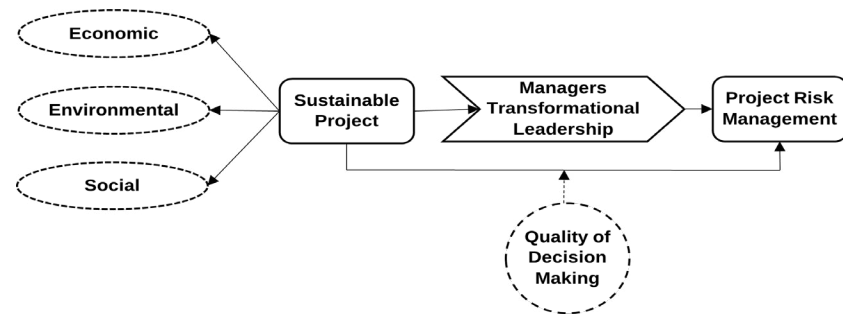


Figure 1: Research Model.

3. Methodology

The investigation explored the interrelations among SPM, leadership, decision-making processes, and project risk management within the electronic industry of the Kingdom of Saudi Arabia. A sample of 247 employees from various sectors within the electronics industry was collected through stratified random sampling, encompassing diverse organizational hierarchies and departments. The dataset will be analysed utilizing Stata's Structural Equation Modelling (SEM) to scrutinize the relationships between the variables under investigation. The study delved into intricate relationship analyses within the domain of electronics projects. Structural equation modelling, facilitated by Stata software, was instrumental in elucidating the foundational factors influencing project outcomes in this sector. The measurement instruments utilized in this research were rigorously examined and adopted from previous scholarly endeavours. Assessment of transformational leadership, project risk management, sustainable project management, and decision-making employed established scales, which were chosen in alignment with the study objectives and the specific context of Saudi Arabia's electronics sector. The measurement of sustainable project management was conducted utilizing an adapted scale (Chow et al., 2021). The scale comprised three sub-dimensions and nine items. Transformational leadership of managers was assessed using a nine-item scale adapted from Zaman, Nawaz and Nadeem (2020). A five-item scale from Caniels and Bakens (2012) was employed to gauge the quality of

decision-making. Project risk management was measured using a three-item scale developed by Chow et al. (2021).

Participants responded to standardized questionnaires utilizing Likert scales to provide their perspectives and experiences in the workplace. Stata SEM was employed to analyse the data, examining variable correlations, estimated path coefficients, mediation and moderation effects, and the fit of the structural equation model. The study in the Saudi Arabian electronics sector aimed to gather empirical data on leadership styles, decision-making processes, and project risk management outcomes, contributing to theoretical understanding and practical applications of project management approaches in the sector through structural equation modelling.

4. Results

Table 1 presents the study's findings regarding the validity and reliability of the variables. Cronbach's Alpha values assess the internal consistency of measurement scales, with values exceeding 0.7 indicating reliability. Sustainable project management demonstrates a Cronbach's Alpha of 0.789, signifying excellent internal consistency, indicating high coherence among the measurement items. Similarly, managers' transformational leadership (0.847), decision-making quality (0.790), and project risk management (0.773) all surpass the reliability threshold, enhancing the credibility of future investigations through the dependable measurement scales utilized for variable examination.

Table 1: Cronbach's Alpha, Validity and Reliability Confirmation.

Variable	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Sustainable project management	0.789	0.833	0.615
Managers transformational leadership	0.847	0.857	0.594
Quality of decision making	0.790	0.771	0.538
Project risk management	0.773	0.916	0.599

The data on CR & AVE illustrate the convergence of measurement scales. High composite reliability is evident, with composite reliability scores exceeding 0.7

indicating convergence of measurement scales. The study reports satisfactory composite reliability values ranging from 0.771 to 0.916 across all variables. Furthermore,

Average Variance Extracted values exceeding 0.5 signify that variables account for a substantial portion of concept variance. Sustainable project management, transformational manager leadership, decision-making quality, and project risk management exhibit average variances of 0.615, 0.594, 0.538, and 0.599, respectively. These results indicate robust measurement scale

convergent validity, confirming that measurement errors did not influence the observed connections. The findings from Table 1 support future assessments of sustainable project management, transformational manager leadership, decision-making quality, and project risk management, affirming the reliability of the study's scales.

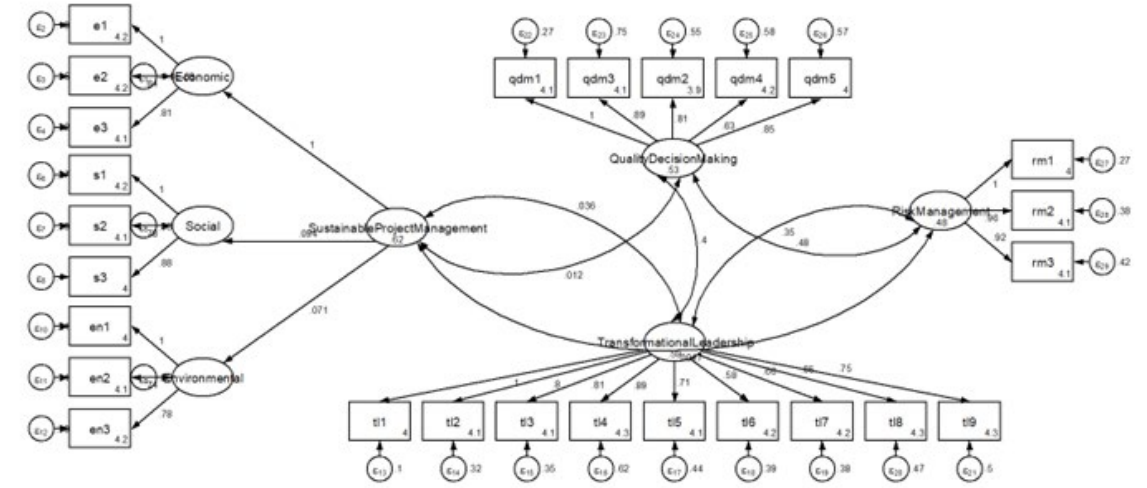


Figure 2: Estimated Model.

Table 2: Confirmatory Factor Analysis.

Measurement	OIM Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
E1	1		(constrained)			
E2	0.760	0.070	10.819	0.000	0.622	0.917
E3	0.559	0.062	8.923	0.000	0.436	0.696
S1	1		(constrained)			
S2	0.889	0.081	10.909	0.000	0.730	0.868
S3	0.731	0.066	10.528	0.000	0.601	0.881
En1	1		(constrained)			
En2	0.326	0.065	5.010	0.000	0.199	0.463
En3	0.865	0.081	12.216	0.002	0.713	0.898
QDM1	1		(constrained)			
QDM2	0.805	0.065	12.306	0.000	0.677	0.954
QDM3	0.326	0.058	8.543	0.000	0.703	0.919
QDM4	0.721	0.084	8.543	0.000	0.556	0.906
QDM5	0.909	0.071	12.755	0.000	0.770	0.868
TL1	1		(constrained)			
TL2	0.651	0.068	9.601	0.000	0.519	0.802
TL3	0.772	0.063	11.801	0.000	0.649	0.915
TL4	0.846	0.060	13.562	0.000	0.729	0.789
TL5	0.872	0.068	12.232	0.000	0.738	0.832
TL6	0.000	0.000	0.000	0.000	0.000	0.000
TL7	0.794	0.065	11.648	0.000	0.666	0.942
TL8	0.770	0.066	11.188	0.000	0.641	0.919
TL9	0.608	0.064	9.402	0.000	0.481	0.751
RM1	1		(constrained)			
RM2	0.803	0.066	11.609	0.000	0.673	0.954
RM3	0.831	0.066	12.126	0.000	0.703	0.786

Table 3 displays the data fit CFA results for the measurement model. It includes individual measurement item standardized coefficients (Std. Err.), z-values, p-values, and 95% confidence intervals. The CFA reveals that all items strongly load onto their latent components, affirming the validity of the measurement model. The items exhibit robust factor loadings ranging from 0.326 to 0.909, all with p-values below 0.001 for each latent construct. These findings underscore the reliability and validity of the measurement model, ensuring that the measurement scales accurately capture the study's components.

Table 4 presents the data fit Chi-square statistics of the structural equation model. The likelihood ratio chi-square is 11209.948, indicating a deviation from the saturated model; a lower score signifies better model fit. The p-value of 0.000 differentiates it from the saturated model, suggesting potential for model enhancement. Compared to the baseline model, the baseline chi-square value of 10565.478 shows a significant disparity with a p-value of 0.000. While the structural equation model adequately fits the data, these fit statistics suggest opportunities for improvement. Examination of modification indices and consideration of theoretical implications may refine model development and enhance data fit.

Table 3: Chi-square Fit Statistics.

Fit Statistic	Value	Description
Likelihood ratio	11209.948	model vs. saturated
p > chi2	0.000	
chi2_bs(2356)	10565.478	baseline vs. saturated
p > chi2	0.000	

Table 5 presents the goodness-of-fit for both the saturated and estimated models. The saturated model represents the theoretical model aligning with observed data, while the estimated model provides data estimations. The saturated model's SRMR is 0.055, whereas the estimated model's SRMR is 0.081. Lower SRMR values indicate better model fit by comparing observed correlations with model predictions. While the saturated model's SRMR (0.055) matches the observed data closely, the estimated model's SRMR (0.081) deviates slightly. Despite this difference, the estimated model's SRMR score remains within an acceptable range, indicating adequate model fit. Nevertheless, researchers may investigate discrepancies and fine-tune the anticipated model to align more closely with observed facts.

Table 4: Model Goodness of Fit Statistics.

	Saturated Model	Estimated Model
SRMR	0.055	0.081

Table 6 displays the R-square statistics for the structural equation model variables. These statistics illustrate the extent to which exogenous variables account for the variance in endogenous variables. Exogenous factors explain 53.2% of the variance in sustainable project management (R-square = 0.532), 69.6% in managers' transformational leadership (R-square = 0.696), and 27.5% in decision-making quality (R-square = 0.275). The R-square statistics in the structural equation model elucidate the degree to which external factors predict variance in endogenous variables, including sustainable project management, transformational leadership, and decision quality.

Table 5: R-square Statistics.

Variable	R Square
Sustainable project management	0.532
Managers transformational leadership	0.696
Quality of decision making	0.275

Table 7 presents the results of the direct path analysis for sustainable project management, project risk management, and managers' transformational leadership skills. Sustainable project management significantly influences project risk management with a standardized coefficient of 0.221 and a p-value below 0.05, suggesting that sustainable project management may enhance risk management and project outcomes. Additionally, sustainable project management has a notable effect on managers' transformational leadership skills, with a standardized coefficient of 0.630 and a p-value below 0.05. This indicates that sustainable project management practices support transformational leadership in managers, promoting innovation, collaboration, and ethical decision-making within project teams.

These findings underscore the significance of project and organizational sustainability. Businesses can enhance project risk management and transformational leadership by integrating sustainability concepts into decision-making and leadership development within a comprehensive project management approach. Sustainable project management facilitates risk management and managerial change, leading to improved project outcomes and organizational resilience. Future firms should prioritize sustainability in project management and leadership development to cultivate transformational project managers, enabling effective management of project complexity, risk mitigation, and achievement of sustainable development goals.

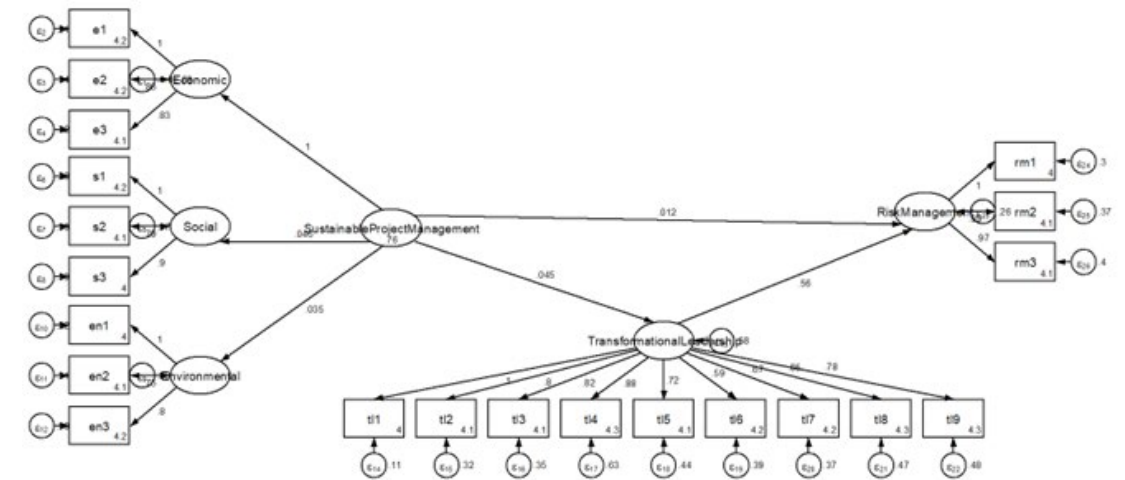


Figure 3: Structural Model for Direct and Mediated Path Analysis.

The structural equation model explores the mediation and moderation of sustainable project management, transformational leadership, decision quality, and project risk management (Table 8). Managers' transformational leadership mediates the connection between sustainable project management and risk management (standardized coefficient = 0.949, p-value < 0.05), highlighting the

importance of driving transformative change for successful project risk management within sustainable project management approaches. Through fostering creativity, teamwork, and ethical decision-making, transformational leaders assist project teams in risk management and sustainability adoption, ultimately improving project outcomes and organizational resilience.

Table 6: Direct Path Analysis.

	OIM Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Sustainable project management significantly influences project risk management.	0.221	0.107	2.177	0.000	0.398	0.307
Sustainable project management significantly influences the managers' transformational leadership skills.	0.630	0.073	10.493	0.005	0.486	0.801

The analysis reveals that decision-making quality moderates the link between sustainable project management and project risk management, with a standardized coefficient of 0.892 and a p-value below 0.05. This indicates that the decision-making procedures of project teams influence the effectiveness of sustainable project management practices in mitigating project risks. Sound decision-making enables

project teams to promptly identify and address project hazards, thereby enhancing risk management outcomes. Organizations can optimize the benefits of sustainable project management and project success by prioritizing effective decision-making procedures and supporting project teams in making informed and timely decisions.

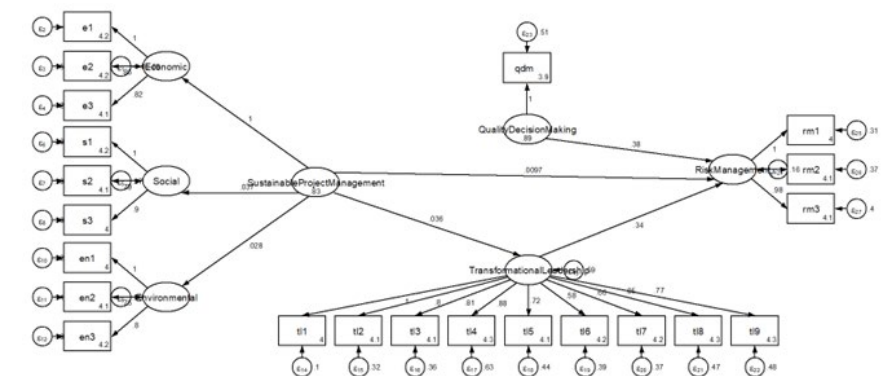


Figure 4: Structural Model for Moderating Path Analysis.

Table 8 underscores the significance of mediating and moderating variables in elucidating the connection between sustainable project management and project risk management outcomes. It delineates the mediating

role of transformational leadership and the moderating role of decision-making quality in the direct relationship variables, aiming to mitigate adverse project outcomes and ensure sustainability.

Table 7: Mediating and Moderating Path Analysis.

	OIM Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Managers transformational leadership significantly mediates the relationship between sustainable project management and project risk management.	0.949	0.097	2.124	0.001	0.179	0.547
Quality of decision making significantly moderates the relationship of sustainable project management and project risk management.	0.892	0.084	12.592	0.002	0.680	0.839

5. Discussion

Sustainable project management is crucial for addressing global challenges like climate change, social inequity, and resource depletion across industries. As organizations grapple with these issues, sustainability-focused project management offers solutions. The interconnected dynamics of decision-making, leadership, sustainable project management, and risk management necessitate further research. This study presents empirical findings regarding sustainable project management, transformational leadership, decision-making quality, and project risk management. It explores how sustainable practices, leadership behaviours, and decision-making impact project outcomes and organizational viability, as proposed in the research relationships.

The results reveal the intricate relationship between project risk management, transformational leadership in management, and sustainable project management, confirming the first and second hypotheses. Sustainable project management significantly influences project risk management, emphasizing the need for sustainability integration to mitigate risks and enhance resilience, as Mahmood et al. (2023) suggest. Sustainable project management aids in identifying and addressing social, environmental, and financial risks, enhancing stakeholder satisfaction and project performance. The second premise enhances our understanding of influential leadership and long-term initiative management among managers, shedding light on project leadership and sustainability. Transformational leadership, characterized by vision, inspiration, intellectual stimulation, and individualized consideration, influences project managers, as noted by Blak Bernat et al. (2023). Sustainable project management correlates positively with managers' transformational leadership abilities, encouraging the adoption of sustainability measures and goal achievement through creativity, teamwork, and ethics. The widespread

adoption of transformative leadership, sustainable project management, and project risk management underscores their interconnection, where management significantly affects both project risk and sustainable project management. Managers' leadership styles are influenced by environmentally responsible project management, highlighting the necessity of including sustainable practices and leadership behaviours in project management methods to ensure project success and long-term organizational viability. Prioritizing transformative leadership training and sustainable project management solutions advances sustainable development, mitigates hazards, and enhances project resilience.

The third hypothesis confirms the significant mediating role of managers' transformative leadership between sustainable project management and project risk management. It demonstrates how leadership and environmental responsibility influence project decision-making, with transformational leadership bridging sustainable project management principles into risk management systems. Transformational leaders promote risk management and sustainability in project teams, enabling them to make sustainable decisions and overcome challenges, ultimately contributing to sustainable development goals. The fourth hypothesis validation reveals the intricate interaction between eco-friendly behaviour, decision-making, and project outcomes. Decision-making quality influences project risk and sustainability, while sustainable project management techniques impact project risks and resilience, underscoring their importance for project success. Leadership and decision-making skills are essential for managing project risks and sustainability, with organizational guidance facilitating confident and timely decisions, leading to improved project results. Effective project management prioritizes innovative leadership, environmental responsibility, and collaborative problem-solving, with companies focusing on resilience, sustainability, and risk management to ensure

project success and sustained profitability.

This study underscores the significance of incorporating environmentally sustainable practices into project management systems for firms engaged in projects. It underscores the importance of innovative leadership and evidence-based decision-making to enhance project resilience and achieve sustainable development goals. Understanding the interrelationship between project components is essential for overcoming obstacles, as outlined in this report covering sustainability, leadership, decision-making, and risk management in projects. To effectively complete projects and enhance sustainability, businesses must prioritize transformative leadership, informed decision-making, proactive risk management, and sustainability initiatives.

This research illuminates project management sustainability, particularly in managing project-related hazards. It examines sustainability factors to mitigate risks, revealing that sustainable project management techniques enhance managerial transformational leadership and project risk management. The study advocates critical path analysis to explore decision-making quality, leadership styles, sustainable project management, and project risk management relationships. Quality decision-making and effective managerial leadership are pivotal for strategic project management and risk management success. The findings underscore the importance of managerial leadership and decision-making for project management success and sustainability, emphasizing the need for sustainable development goals integration into project management frameworks and transformative leadership development. The study's practical applications extend beyond academia, offering insights to improve project outcomes and sustainability in the electronics industry, promoting eco-friendly practices and positive impacts. Managing interwoven relationships efficiently, including sustainability, transformative leadership, and effective decision-making, is essential for success in modern project environments and achieving long-term sustainability goals.

Implications of the Study

This research offers significant implications for leadership, sustainability, and project management concepts. It enhances understanding in SPM, leadership, decision-making, and project risk management. The study reveals the influence of SPM on project risk management and managers' transformative leadership, highlighting the importance of integrating sustainable principles into project management frameworks for success. It underscores the mediating role of managers' transformative

leadership in SPM and project risk management, raising questions for leadership research. The study advocates for transformational leadership programs to improve sustainability-driven project outcomes. Moreover, it emphasizes the role of decision-making quality as a moderator in SPM-project risk management interactions, promoting evidence-based decision-making in project teams. These insights highlight the complexity of sustainable project management and its impact on leadership and decision-making, laying the groundwork for future research in this area and fostering more holistic and sustainable project management practices.

This research offers practical insights for businesses aiming for project success and sustainability. Integrating sustainability principles into project management frameworks reduces risks and enhances resilience. SPM aids in identifying and mitigating environmental, social, and economic risks, leading to improved project outcomes and stakeholder satisfaction. Transformational leadership connects strategic project management with project risk management, highlighting the impact of leadership development programs on sustainability project results. Leadership training enables project managers to cultivate visionary leadership, motivational inspiration, and tailored consideration, fostering creativity, collaboration, and ethical practices among project teams. Decision-making quality influences both SPM and project risk management, emphasizing the need for support mechanisms to facilitate informed decision-making among project teams. By prioritizing evidence-based decision-making and stakeholder engagement, organizations can achieve sustainable project management and maximize sustainability-focused initiatives. This research aids organizations in enhancing project outcomes, sustainability, and team innovation, underscoring the importance of transformative leadership, sustainable project management, and effective decision-making in navigating modern project settings and achieving sustainable development goals.

Limitations and Future Research Directions

This study explores the relationships among sustainable project management (SPM), leadership, decision-making, and project risk management outcomes. However, it faces limitations that warrant attention. The use of cross-sectional data limits the ability to establish causality. Longitudinal or experimental research could offer insights into temporal dynamics and causal mechanisms. Self-report measures may introduce bias, suggesting the need for objective measurements and diverse data sources to enhance accuracy. The study's focus on a single organization raises

concerns about generalizability. Future research could replicate the study across different contexts to assess generalizability and explore contextual factors. Despite these limitations, the study suggests avenues for future research, such as investigating how organizational culture influences SPM implementation and how stakeholder engagement impacts project success. Additionally, examining how project complexity affects SPM, leadership, decision-making, and risk management could offer valuable insights. Addressing these limitations and exploring these avenues can deepen our understanding of how SPM practices influence project success and organizational sustainability.

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Appendix 1 Sustainable Project Management

1. To what extent does your organization prioritize environmental sustainability in project planning and execution?
2. How often does your organization consider social responsibility factors when making project-related decisions?
3. How frequently does your organization integrate economic sustainability considerations into project management practices?
4. To what extent does your organization encourage stakeholder engagement in sustainable project initiatives?
5. How effectively does your organization monitor and evaluate the environmental impacts of its projects?
6. How proactive is your organization in identifying and mitigating sustainability-related risks in projects?
7. To what extent does your organization promote the use of renewable resources and energy-efficient technologies in project implementation?
8. How well does your organization adhere to sustainability standards and regulations in project management processes?
9. How committed is your organization to achieving long-term sustainability goals through its projects?

Managers' Transformational Leadership

1. To what extent does your manager inspire you to envision future possibilities for projects?
2. How often does your manager motivate you to exceed your own expectations in project work?
3. How frequently does your manager provide individualized support and encouragement to project team members?
4. To what extent does your manager promote a culture of innovation and creativity within project teams?
5. How effectively does your manager communicate a compelling vision for project success?
6. How well does your manager lead by example, demonstrating integrity and ethical behavior in project management?
7. How often does your manager foster a sense of trust and collaboration among project team members?
8. To what extent does your manager empower you to take ownership of project tasks and initiatives?
9. How supportive is your manager in developing your skills and capabilities as a project team member?

Quality of Decision Making

1. How well-informed are project decisions made by your team?

2. To what extent are project decisions based on thorough analysis and evaluation of available information?
3. How effectively does your team consider multiple perspectives and alternatives when making project-related decisions?
4. How efficiently does your team prioritize and allocate resources to support project goals?
5. How transparent and accountable is the decision-making process within your team?

Project Risk Management

1. How effectively does your organization identify potential risks and uncertainties in projects?
2. To what extent does your organization develop contingency plans to address identified project risks?
3. How well does your organization monitor and respond to changes in project risk factors over time?
- 4.

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