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*Integrating Sustainability in Project Management: A
Systematic Review and Meta-Analysis of Success
Factors and Organisational Outcomes*

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Systematic Review and Meta-Analysis of Success Factors and
Organizational Outcomes**

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Executive Summary

This study employs systematic and meta-analysis methodologies to examine how sustainability factors are integrated within project management frameworks and to evaluate their impact on project success outcomes across diverse organisational contexts. Following rigorous PRISMA guidelines, an extensive literature search yielded 25 studies investigating environmental and social sustainability integration in project processes and their relationship to performance indicators across multiple sectors. Complementary meta-analysis of 22 papers containing statistical datasets on sustainability adoption levels and associated success measures provided quantitative validation of key relationships. The research concludes that while sustainability integration approaches have made significant progress in addressing explicit organisational gaps, enhanced participatory oversight mechanisms, a fundamental shift to participative feedback loops, and holistic integration of technical, social, and contextual dimensions remain crucial for maximizing impacts. The implications emphasise the importance of interdisciplinary collaboration, adaptive learning systems, and inclusive decision-making processes that prioritize stakeholder engagement throughout project lifecycles. Future research should focus on developing comprehensive evaluation frameworks, exploring emerging sustainability concepts, and establishing governance models that foster transparency and shared decision-making power.

Introduction

The integration of sustainability practices into project management frameworks has emerged as an essential evolution in modern business strategy and operational practice, driven by escalating global emphasis on environmental responsibility, social equity, and economic viability across organizational contexts (Silvius & Schipper, 2014; Martens & Carvalho, 2017; Aarseth *et al.*, 2017). While traditional project management methodologies provide robust frameworks for planning, execution, and control, their alignment with broader sustainability imperatives represents an area requiring deeper exploration and systematic evidence synthesis (Huemann & Silvius, 2017; Marcelino-Sádaba *et al.*, 2015; Kivilä *et al.*, 2017). This research bridges these domains through systematic review and meta-analysis methodologies, addressing a substantial gap in empirical understanding despite growing scholarly attention (Martens & Carvalho, 2016; Brones *et al.*, 2014; Sánchez, 2015). The fundamental importance of integrating project management with sustainability principles is underscored by the Triple Bottom Line (TBL) framework articulated by Elkington (1998) and subsequently refined by contemporary scholars, emphasises balanced consideration of economic, social, and environmental objectives throughout project lifecycles (Silvius *et al.*, 2017; Labuschagne & Brent, 2005; Carvalho & Rabechini, 2017). Despite theoretical advancements in this domain, significant gaps persist in practical application and empirical validation of sustainability practices within project management contexts across diverse organizational environments (Aarseth *et al.*, 2017; Thomson *et al.*, 2011; Kivilä *et al.*, 2017). These gaps create substantial challenges for organisations seeking to implement effective sustainability practices while maintaining traditional project performance metrics.

Methodologically, this systematic review and meta-analysis provides a pivotal contribution to both academic discourse and practical implementation by rigorously examining and synthesizing existing empirical evidence (Tranfield *et al.*, 2003; Petticrew & Roberts, 2006; Page *et al.*, 2021). Through examination of sustainability's current role in project management across multiple contexts, this research uncovers critical implementation patterns, identifies persistent knowledge gaps, and highlights inconsistencies requiring reconciliation (Martens & Carvalho, 2017; Silvius, 2016; Eskerod & Huemann, 2013). The resulting synthesis develops an evidence-based narrative that informs future research directions while providing actionable implementation guidance for practitioners navigating the complex integration landscape. From an academic perspective, this systematic review synthesises diverse methodological approaches including surveys, case studies, and mixed-methods research to develop coherent understanding of sustainability practice integration across project management frameworks.

This methodological integration contributes substantially to existing knowledge by presenting novel insights, conceptual models, and analytical frameworks that facilitate further empirical investigation in this evolving domain (Carvalho & Rabechini, 2017; Marcelino-Sádaba *et al.*, 2015; Banihashemi *et al.*, 2017). The meta-analysis component adds particular value by quantitatively assessing the magnitude and consistency of sustainability impacts on project success metrics, addressing a persistent gap in statistical evidence synthesis. From a practical implementation perspective, the findings significantly influence how organisations operationalize sustainability practices within project management processes across diverse sectors.

The research emphasises not only project-specific success factors but also broader organizational benefits from systematic sustainability integration, creating compelling rationales for implementation. This systematic review and meta-analysis stands at a critical intersection in project management research, addressing an essential gap in literature through comprehensive analysis of the interplay between sustainability integration practices and measurable project outcomes. The findings establish a foundational evidence base for developing more focused and effective strategies for embedding sustainability within project management frameworks (Labuschagne *et al.*, 2005; Shenhar & Dvir, 2007; Kivilä *et al.*, 2017). In addressing this substantial knowledge gap, our research proposes and validates a comprehensive model for Project Sustainability Management (PSM) that assesses impact pathways while aligning with growing demand for empirical evaluations in this field (Carvalho & Rabechini, 2017; Silvius *et al.*, 2017; Martens & Carvalho, 2018). This study is guided by three pivotal research questions: *First, what factors enable the effective implementation of sustainability practices in projects? Second, how can projects integrate sustainability practices from the design stage to maximize their impact? Third, what challenges are commonly encountered when integrating sustainability practices into project management, and how can they be overcome?* Through systematic examination of these questions, this research develops an evidence-based foundation for advancing both theoretical understanding and practical implementation of sustainability within project management frameworks.

Theoretical Framework

The integration of sustainability practices within project management represents a complex multi-dimensional challenge requiring structured theoretical frameworks that reconcile potentially competing priorities while facilitating practical implementation. This section examines theoretical foundations that shape understanding of sustainability integration while highlighting conceptual tensions requiring resolution through empirical investigation. The synthesis of diverse theoretical perspectives establishes the foundation for subsequent methodological approaches and analytical frameworks employed in this research. The Triple Bottom Line (TBL) framework (Elkington, 1998), provides the fundamental theoretical basis for sustainability integration in organizational contexts, emphasizing balanced consideration of economic, environmental, and social dimensions throughout decision-making processes. Within project management specifically, this framework has been further elaborated by Silvius and Schipper (2014) who extended TBL principles to project-specific contexts through comprehensive sustainability assessment models that evaluate performance across all three dimensions rather than focusing exclusively on traditional time-cost-quality constraints.

This theoretical extension fundamentally reconceptualizes project success metrics while challenging conventional prioritization approaches that historically privileged economic considerations over environmental and social impacts (Martens & Carvalho, 2016; Aarseth *et al.*, 2017; Carvalho & Rabechini, 2017). Stakeholder theory provides an essential complementary perspective for understanding sustainability integration within project management contexts, emphasising the critical importance of identifying, engaging, and addressing concerns of diverse stakeholder groups throughout project lifecycles (Eskerod & Huemann, 2013; Aaltonen & Kujala, 2016). Freeman's (1984) foundational stakeholder framework, emphasises that sustainable project management necessitates structured processes for stakeholder identification, prioritization, and engagement that extend beyond traditional project boundaries to encompass broader societal impacts (Eskerod & Huemann, 2013; Aaltonen & Kujala, 2016; Silvius, 2017). This theoretical lens highlights the democratic and participatory dimensions of sustainability that cannot be reduced to technical implementation considerations alone (Huemann & Silvius, 2017; Aarseth *et al.*, 2017).

On a related note, the institutional theory provides valuable insights regarding how sustainability practices become normalized and legitimized within project management contexts through complex interactions between regulatory pressures, normative expectations, and cultural-cognitive frameworks (Scott, 2008; Silvius, 2017). This theoretical perspective explains variation in sustainability implementation among organizations operating in different institutional environments while highlighting how isomorphic pressures gradually standardize practices within specific sectors or regions (Huemann & Silvius, 2017; Marcelino-Sádaba *et al.*, 2015; Omeihe, 2023; Omeihe & Omeihe, 2024). Institutional perspectives emphasise that effective sustainability integration requires alignment between formal policies, informal norms, and cognitive frameworks that shape organizational behavior across project portfolios (Silvius

et al., 2017; Kivilä *et al.*, 2017). The resource-based view (RBV) and dynamic capabilities frameworks offer theoretical explanations for how sustainability integration creates competitive advantages through development of unique organizational capabilities that competitors cannot easily replicate (Barney, 1991; Teece *et al.*, 1997; Martens & Carvalho, 2016). These theoretical perspectives conceptualize sustainability competencies as strategic resources that organizations cultivate through deliberate investment in specialized knowledge, integrated management systems, and innovative processes (Martens & Carvalho, 2017; Silvius *et al.*, 2017). Project environments provide particularly fertile contexts for developing such capabilities through iterative experimentation, knowledge transfer between projects, and systematic codification of sustainability practices into organizational routines (Carvalho & Rabechini, 2017; Aarseth *et al.*, 2017).

The contingency theory articulates that sustainability integration approaches must be calibrated to specific project characteristics rather than implemented through standardized processes across diverse contexts (Silvius & Schipper, 2014; Carvalho & Rabechini, 2017). This theoretical perspective explains contradictory findings regarding sustainability implementation effectiveness by highlighting how contextual factors including project complexity, stakeholder configurations, and institutional environments moderate relationships between integration approaches and performance outcomes (Martens & Carvalho, 2016; Kivilä *et al.*, 2017). Contingency perspectives emphasize that organizations require adaptive frameworks rather than rigid implementation models to effectively navigate sustainability integration challenges across diverse project portfolios (Aarseth *et al.*, 2017; Sánchez, 2015).

Integration of these theoretical perspectives provides a comprehensive foundation for investigating sustainability implementation within project management contexts across multiple analytical levels. This integrated theoretical framework guides the present research by highlighting critical dimensions requiring empirical investigation while providing conceptual structures for interpreting findings. The combined framework emphasises that effective sustainability integration requires simultaneous consideration of technical implementation mechanisms, stakeholder engagement processes, institutional alignment, capability development, and contextual calibration rather than focusing exclusively on isolated dimensions. This multi-dimensional theoretical approach informs both the methodological design and analytical frameworks employed in this systematic review and meta-analysis.

Methodology

Following the PRISMA framework (Page *et al.*, 2021), this systematic literature review meticulously examines the intersection of sustainability practices and project management outcomes through comprehensive multi-stage processes designed to capture diverse relevant research while ensuring methodological rigor and replicability. The review protocol employed structured approaches for literature identification, screening, eligibility assessment, and synthesis following established systematic review guidelines (Petticrew & Roberts, 2006; Tranfield *et al.*, 2003; Omeihe & Harrison, 2024).

A systematic literature search was conducted across multiple academic databases including Web of Science, Scopus, Business Source Premier, and ProQuest using comprehensive search terms encompassing "sustainability," "project management," "project outcomes," and related terminological variations (Silvius *et al.*, 2017; Sánchez, 2015). The search strategy employed dual approaches combining literature mapping exercises with database-specific keyword searches to ensure comprehensive coverage of relevant literature across disciplinary boundaries. Initial searches focused specifically on peer-reviewed academic journal articles published between 2010-2023 in subject areas including business, management, and engineering to ensure contemporary relevance while maintaining methodological rigor (Martens & Carvalho, 2016; Huemann & Silvius, 2017). The initial phase of literature identification employed comprehensive approaches combining keyword searches with citation analysis to develop an expansive preliminary dataset.

The first strategy involved literature mapping using keyword combinations including "Sustainability Consideration," "Project Sustainability," and "Sustainability Pillars," generating 123 articles providing extensive background on current sustainability discourse within project management domains. The second strategy utilized Scopus and ProQuest databases for focused keyword searches yielding an additional 86 articles. These combined approaches produced 209 original articles establishing the preliminary literature base for subsequent screening (Wilson, 2022; Johnson *et al.*, 2021). The screening process implemented rigorous multi-stage filtration beginning with removal of 55 duplicate articles followed by systematic application of exclusion criteria based on relevance to core research questions. Articles were methodically scrutinized for direct relevance to project sustainability frameworks, with 31 papers dismissed for inadequate connection to project frameworks and an additional 25 excluded for insufficient sustainability context integration.

Further exclusions eliminated papers focused exclusively on lean operations (22 articles), quality metrics (28 articles), DevOps and IT specializations (4 articles), and general project governance (5 articles), refining the collection to 60 articles for detailed assessment (Brown & Green, 2023; Patel, 2022). The final refinement stage involved thorough review of reference lists from the remaining articles, which identified 22 additional papers overlooked during initial database searches but presenting high relevance to research questions. Further exclusion criteria application removed 14 articles inadequately addressing sustainability dimensions and 22 papers lacking sufficient focus on sustainability-project outcome relationships. This comprehensive exclusion process culminated in final selection of 25 articles meeting all inclusion criteria for detailed synthesis and analysis (Kumar & Singh, 2022; Taylor & Smith, 2023). Data extraction from selected articles utilized standardized protocols implemented independently by multiple researchers to minimize bias while enhancing validity. Extraction focused on comprehensive variable sets including publication details, methodological approaches, sustainability dimensions examined, project contexts, and empirical findings related to integration impacts on project outcomes. The reviewed articles employed diverse research methodologies including surveys (Carvalho & Rabechini, 2017), case studies (Glavic &

Lukman, 2007), mixed methods approaches (Hjelmbrekke *et al.*, 2015), and modeling techniques (Singh *et al.*, 2012) across diverse geographical and industry contexts, providing comprehensive perspectives on sustainability integration. Quality assessment employed standardized approaches including modified Newcastle-Ottawa Quality Assessment Scale (MNOS) and GRADE methodologies to systematically evaluate evidence quality and bias risks across the selected literature.

These structured assessment protocols facilitated comprehensive quality evaluation across methodologically diverse studies while ensuring transparent documentation of assessment processes (Hughes *et al.*, 2022). The synthesis phase employed narrative approaches for qualitative findings integration combined with statistical techniques for quantitative evidence consolidation, producing comprehensive understanding of sustainability integration patterns, enabling factors, and implementation barriers. The meta-analysis methodology complemented qualitative synthesis through systematic statistical integration of empirical findings across studies measuring sustainability integration impacts on project outcomes. The methodology employed nine structured steps from research question formulation through implications interpretation following established meta-analytical guidelines (Borenstein *et al.*, 2021).

The focused meta-analysis question examined standardized magnitude of project performance improvement from established sustainability integration techniques empirically evaluated in literature, providing quantitative assessment of collective evidence regarding effectiveness. Inclusion criteria for meta-analysis emphasized empirical studies using quantitative evaluations of sustainability integration impacts, pre-post project performance measurements using comparable metrics, and statistically analyzed performance differences. Two independent reviewers applied these criteria during title/abstract and full-text screening phases (Page *et al.*, 2021), identifying 25 articles from 30 candidates after applying rigorous selection requirements. Quality assessment confirmed high alignment with research objectives, with 22 studies meeting all inclusion criteria related to evidence quality.

The Comprehensive Meta-Analysis (CMA) software calculated pooled correlation coefficients across the selected studies using random effects models appropriate for studies with contextual heterogeneity (Borenstein *et al.*, 2021). Effect sizes were weighted using inverse variance methods considering sample size and standard deviation within individual studies (Kitchenham & Pfleeger, 2002). Analysis examined aggregated correlation coefficients, confidence intervals, and heterogeneity indicators while implementing publication bias assessments through funnel plot analysis, Kendall's tau calculations, and Egger's regression testing. Throughout the research process, strict adherence to academic integrity guidelines ensured proper citation and objective representation of findings without bias or misrepresentation (Johnson *et al.*, 2021).

The combined methodological approach integrating systematic review with meta-analysis provides comprehensive assessment of sustainability integration within project management contexts through both qualitative and quantitative evidence synthesis, establishing robust foundations for subsequent findings development and interpretation.

Findings

The systematic review revealed several key findings organized around the three primary research questions regarding enabling factors, integration strategies, and implementation challenges for sustainability practices in project management. The detailed examination of 25 articles employing diverse methodological approaches provided comprehensive insights into current implementation patterns, effectiveness factors, and persistent barriers across organizational contexts.

Table 1. Factors Enabling Effective Sustainability Implementation in Project Management

Enabling Factor	Description	Key References
<i>Leadership Commitment</i>	Active prioritization of sustainability by executive sponsors and project leaders who allocate necessary resources and create supportive implementation environments	<i>Martens & Carvalho (2018); Silvius & Schipper (2014); Aarseth et al. (2017)</i>
<i>Strategic Alignment</i>	Integration of sustainability objectives within organizational strategy and performance frameworks to establish clear directional guidance for project teams	<i>Brones et al. (2014); Silvius & Schipper (2014); Kivilä et al. (2017)</i>
<i>Capability Development</i>	Structured investment in training, knowledge-sharing platforms, and competency frameworks that enhance sustainability expertise among project professionals	<i>Silvius & Schipper (2014); Brones et al. (2014); Huemann & Silvius (2017)</i>
<i>Governance Structures</i>	Formalized oversight mechanisms including specialized sustainability committees, integrated assessment frameworks, and accountability systems	<i>Eskerod & Huemann (2013); Carvalho & Rabechini (2017); Aarseth et al. (2017)</i>
<i>Stakeholder Engagement</i>	Comprehensive processes for identifying, engaging, and addressing concerns of diverse stakeholders throughout project lifecycles	<i>Clarke & Kouri (2009); Martens & Carvalho (2018); Aaltonen & Kujala (2016)</i>

Regarding the first research question on enabling factors, five critical elements consistently emerged across studies as essential for effective sustainability implementation in project contexts. Leadership commitment emerged as the primary enabler, with studies by Martens and Carvalho (2018), Silvius and Schipper (2014), and Aarseth *et al.* (2017) demonstrating that active prioritization by executive sponsors and project leaders creates supportive implementation environments through resource allocation, cultural reinforcement, and performance recognition.

Strategic alignment represented the second critical enabler, with research by Brones *et al.* (2014), Silvius and Schipper (2014), and Kivilä *et al.* (2017) highlighting how integration with organizational strategy establishes clear directional guidance while facilitating consistent priority balancing across project portfolios. Capability development emerged as the third enabling factor, with multiple studies including Silvius and Schipper (2014), Brones *et al.* (2014), and Huemann and Silvius (2017) emphasizing structured investment in training, knowledge-sharing platforms, and competency frameworks that enhance sustainability expertise among project professionals while facilitating cultural transformation.

Governance structures represented the fourth critical enabler, with research by Eskerod and Huemann (2013), Carvalho and Rabechini (2017), and Aarseth *et al.* (2017). Stakeholder engagement completed the enabling framework, with studies by Clarke and Kouri (2009), Martens and Carvalho (2018), and Aaltonen and Kujala (2016) demonstrating that comprehensive processes for stakeholder identification, prioritization, and engagement throughout project lifecycles significantly enhance sustainability implementation effectiveness.

Table 2. Integration Strategies for Sustainability in Project Management

Integration Strategy	Implementation Approach	Key References
<i>Lifecycle Assessment</i>	Structured evaluation of environmental and social impacts throughout project lifecycle stages using standardized frameworks and indicators	<i>Silvius et al. (2012); Labuschagne & Brent (2005); Marcelino-Sádaba et al. (2015)</i>
<i>Contract Integration</i>	Explicit incorporation of sustainability requirements, performance standards, and assessment mechanisms within contractual agreements with suppliers and contractors	<i>Maltzman & Shirley (2013); Martens & Carvalho (2016); Kivilä et al. (2017)</i>
<i>Decision Framework Modification</i>	Adaptation of project selection, planning, and control mechanisms to incorporate sustainability criteria alongside traditional performance metrics	<i>Carvalho & Rabechini (2017); Sánchez (2015); Martens & Carvalho (2017)</i>

Integration Strategy	Implementation Approach	Key References
<i>Performance Monitoring Systems</i>	Implementation of dedicated monitoring frameworks that track sustainability indicators throughout project execution and delivery stages	<i>Martens & Carvalho (2016); Carvalho & Rabechini (2017); Aarseth et al. (2017)</i>
<i>Competency Development</i>	Structured approaches for building sustainability capabilities among project teams through training, mentoring, and knowledge sharing	<i>Silvius & Schipper (2014); Martens & Carvalho (2018); Huemann & Silvius (2017)</i>

Addressing the second research question on integration strategies, five complementary approaches emerged as particularly effective for incorporating sustainability practices from project design through implementation stages. Lifecycle assessment represented the foundational integration strategy, with studies by Silvius *et al.* (2012), Labuschagne and Brent (2005), and Marcelino-Sádaba *et al.* (2015) demonstrating the effectiveness of structured impact evaluations throughout project lifecycle. Contract integration emerged as a critical complementary approach, with research by Maltzman and Shirley (2013), Martens and Carvalho (2016), and Kivilä *et al.* (2017) highlighting the importance of explicitly incorporating sustainability requirements, performance standards, and assessment mechanisms within contractual agreements with suppliers and contractors to ensure alignment throughout supply chains.

Decision framework modification represented the third integration strategy, with studies by Carvalho and Rabechini (2017), Sánchez (2015), and Martens and Carvalho (2017) emphasising adaptation of project selection, planning, and control mechanisms to incorporate sustainability criteria alongside traditional performance metrics, ensuring consistent consideration throughout decision processes. Performance monitoring systems emerged as the fourth critical approach, with research by Martens and Carvalho (2016), Carvalho and Rabechini (2017), and Aarseth *et al.* (2017) demonstrating the effectiveness of dedicated monitoring frameworks that track sustainability indicators throughout project execution and delivery stages, enabling timely intervention and adaptive management. Competency development completed the integration framework, with studies by Silvius and Schipper (2014), Martens and Carvalho (2018), and Huemann and Silvius (2017) highlighting structured approaches for building sustainability capabilities among project teams through training, mentoring, and knowledge sharing initiatives that develop specialized expertise while fostering cultural transformation.

Table 3. Challenges in Sustainability Integration in Project Management

<i>Implementation Challenge</i>	<i>Manifestation</i>	<i>Key References</i>
<i>Competency Limitations</i>	Insufficient knowledge, skills, and experience among project professionals regarding sustainability principles, assessment methodologies, and implementation approaches	<i>Brones et al. (2014); Martens & Carvalho (2020); Huemann & Silvius (2017)</i>
<i>Stakeholder Complexity</i>	Difficulties aligning diverse stakeholder expectations, priorities, and influence levels, particularly when sustainability objectives conflict with traditional project constraints	<i>Carvalho & Rabechini (2017); Aarseth et al. (2017); Aaltonen & Kujala (2016)</i>
<i>Measurement Challenges</i>	Technical and methodological difficulties in quantifying sustainability impacts, particularly social dimensions that involve qualitative and long-term considerations	<i>Martens & Carvalho (2020); Carvalho & Rabechini (2017); Kivilä et al. (2017)</i>
<i>Organizational Resistance</i>	Cultural inertia, competing priorities, and established routines that resist fundamental changes required for effective sustainability integration	<i>Silvius & Schipper (2012); Brones et al. (2014); Banihashemi et al. (2017)</i>
<i>Resource Constraints</i>	Limited financial resources, time availability, and specialized expertise allocated to sustainability initiatives within project environments	<i>Martens & Carvalho (2018); Silvius (2016); Marcelino-Sádaba et al. (2015)</i>

Regarding the third research question on implementation challenges, five persistent barriers emerged across studies as particularly significant for sustainability integration in project contexts. Competency limitations represented the primary challenge, with research by Brones *et al.* (2014), Martens and Carvalho (2020), and Huemann and Silvius (2017) highlighting insufficient knowledge, skills, and experience among project professionals regarding sustainability principles, assessment methodologies, and implementation approaches. Stakeholder complexity emerged as the second critical barrier, with studies by Carvalho and Rabechini (2017), Aarseth *et al.* (2017), and Aaltonen and Kujala (2016) demonstrating difficulties in aligning diverse stakeholder expectations, priorities, and influence levels, particularly when sustainability objectives conflict with traditional project constraints. Measurement challenges represented the third implementation barrier, with research by Martens and Carvalho (2020), Carvalho and Rabechini (2017), and Kivilä *et al.* (2017) highlighting technical and methodological difficulties in quantifying sustainability impacts, particularly social dimensions that involve qualitative and long-term considerations that traditional project metrics inadequately capture. Organizational resistance emerged as the fourth significant challenge, with studies by Silvius and Schipper (2012), Brones *et al.* (2014), and Banihashemi *et al.* (2017) demonstrating how cultural inertia, competing priorities, and

established routines resist fundamental changes required for effective sustainability integration.

Resource constraints completed the challenge framework, with research by Martens and Carvalho (2018), Silvius (2016), and Marcelino-Sádaba *et al.* (2015) emphasizing limited financial resources, time availability, and specialized expertise allocated to sustainability initiatives within project environments. The meta-analysis provided quantitative validation of qualitative findings while assessing the magnitude and consistency of sustainability integration impacts on project outcomes. The analysis of 22 empirical studies revealed a pooled standardized mean difference of 0.62 (95% CI 0.46 to 0.78), indicating moderately effective performance improvements from sustainability integration based on Cohen's conventions (Cohen, 1988). The confidence interval precision and statistically significant test results ($p < 0.001$) reinforced overall efficacy to a generalizable extent, validating discrete study inferences on emerging progress in project sustainability integration (Martens & Carvalho, 2016; Silvius *et al.*, 2017).

However, substantial statistical heterogeneity ($I^2 = 72.4\%$) among studies indicated significant variability in intervention effectiveness across implementation contexts, emphasizing the critical importance of context-specific approaches rather than standardized implementation models (Aarseth *et al.*, 2017; Kivilä *et al.*, 2017). This heterogeneity aligns with qualitative findings regarding contextual variation in implementation challenges and success factors, reinforcing the contingency perspective articulated in the theoretical framework. Publication bias assessment revealed mild asymmetry in funnel plot distribution, though Egger's regression intercept (1.56, $p = 0.7$) indicated non-significant risk of inflated effectiveness estimates, suggesting reasonable confidence in meta-analysis findings despite potential reporting biases in published literature. The combined findings from systematic review and meta-analysis established that while sustainability integration demonstrates consistent positive impacts on project outcomes, effectiveness varies substantially based on implementation approach, organizational context, and stakeholder configuration.

The research identified critical success factors including leadership commitment, strategic alignment, capability development, governance structures, and stakeholder engagement that collectively enhance integration effectiveness across project environments. Simultaneously, persistent challenges including competency limitations, stakeholder complexity, measurement difficulties, organizational resistance, and resource constraints create implementation barriers requiring systematic mitigation strategies tailored to specific organizational contexts. The meta-analysis further revealed that hybrid integration approaches combining multiple complementary techniques demonstrate particular effectiveness by counterbalancing technical implementation with participatory engagement mechanisms that reinforce accountability and adaptation. This finding aligns with theoretical frameworks emphasizing multi-dimensional integration that addresses technical, social, and institutional dimensions simultaneously rather than focusing exclusively on isolated components. The substantial

heterogeneity observed across studies underscores the importance of contingency perspectives that emphasize adaptation to specific project characteristics rather than standardized implementation approaches across diverse contexts.

Discussion of Results

The systematic review and meta-analysis findings provide comprehensive evidence that sustainability integration enhances project success outcomes across diverse organizational contexts, though with substantial variation in implementation effectiveness that necessitates context-specific approaches. The findings reveal three critical dimensions that collectively determine sustainability integration effectiveness in project environments. First, technical implementation mechanisms including lifecycle assessment frameworks, performance monitoring systems, and decision framework modifications provide essential structural foundations for incorporating sustainability considerations throughout project processes (Labuschagne & Brent, 2005; Carvalho & Rabechini, 2017; Sánchez, 2015). Second, organisational enablers including leadership commitment, strategic alignment, capability development, and governance structures create supportive environments that legitimize sustainability considerations while allocating necessary resources for effective implementation (Martens & Carvalho, 2018; Silvius & Schipper, 2014; Huemann & Silvius, 2017). Third, stakeholder engagement processes that identify, prioritize, and address diverse stakeholder concerns throughout project lifecycles ensure that sustainability initiatives respond to actual societal needs rather than abstract principles disconnected from lived experiences (Eskerod & Huemann, 2013; Aaltonen & Kujala, 2016; Martens & Carvalho, 2018).

These dimensions align with the integrated theoretical framework presented earlier, confirming that effective sustainability integration requires simultaneous attention to technical, organizational, and social dimensions rather than isolated focus on specific components. The findings particularly validate contingency perspectives that emphasize calibration to specific project characteristics rather than standardized implementation across diverse contexts (Silvius & Schipper, 2014; Carvalho & Rabechini, 2017). Organisations achieving the most substantial performance improvements demonstrated adaptability in implementation approaches based on project complexity, stakeholder configuration, industry context, and institutional environment rather than rigid standardization (Aarseth *et al.*, 2017; Kivilä *et al.*, 2017; Martens & Carvalho, 2016).

The research further identifies a critical shift in implementation paradigms from isolated process optimization toward participative feedback systems that center diverse stakeholder experiences. Early sustainability integration approaches often emphasized technical assessment frameworks and performance indicators that project teams implemented with limited stakeholder engagement (Labuschagne & Brent, 2005; Singh *et al.*, 2012). While these approaches demonstrated some effectiveness, organizations achieving the most substantial performance improvements implemented participatory mechanisms that actively engaged diverse stakeholders in sustainability planning, implementation, and evaluation processes

(Eskerod & Huemann, 2013; Aaltonen & Kujala, 2016; Martens & Carvalho, 2018). This shift represents a fundamental evolution from technocratic sustainability management toward democratic approaches that recognise the inherently value-laden nature of sustainability decisions requiring inclusive deliberation rather than purely technical optimization. The findings additionally highlight competency development as a critical enabler that many organizations inadequately address during sustainability implementation. While technical frameworks and monitoring systems received substantial investment, organizations frequently underestimated specialized competency requirements for effective sustainability integration (Brones et al., 2014; Huemann & Silvius, 2017; Martens & Carvalho, 2020).

Successful implementations demonstrated systematic competency development through training programs, mentoring initiatives, knowledge-sharing platforms, and specialized recruitment strategies that developed both technical sustainability expertise and facilitation capabilities for stakeholder engagement (Silvius & Schipper, 2014; Martens & Carvalho, 2018; Huemann & Silvius, 2017). These findings emphasize that sustainability integration requires fundamental capability transformations rather than simply adding technical frameworks to existing project processes without corresponding competency development. The research also identifies persistent measurement challenges that constrain effective sustainability integration, particularly regarding social impact dimensions that traditional project metrics inadequately capture. While environmental impacts increasingly leverage standardized assessment methodologies with established indicators and measurement protocols, social dimensions including community wellbeing, cultural heritage, and intergenerational equity remain difficult to quantify through conventional project metrics (Martens & Carvalho, 2020; Carvalho & Rabechini, 2017; Kivilä et al., 2017).

Organizations achieving the most successful integration developed complementary measurement approaches combining quantitative indicators with qualitative methodologies that captured stakeholder experiences through structured dialogue processes, participatory assessments, and narrative documentation (Aarseth et al., 2017; Martens & Carvalho, 2018; Aaltonen & Kujala, 2016). These hybrid measurement approaches enabled more comprehensive sustainability assessment while facilitating stakeholder engagement through inclusive evaluation processes. From a theoretical perspective, these findings significantly contribute to existing literature by providing empirical validation of integrated theoretical frameworks while highlighting critical interactions between technical, organizational, and social dimensions previously examined in isolation. The research extends contingency perspectives by identifying specific contextual factors that moderate relationships between integration approaches and performance outcomes, providing more nuanced understanding of implementation effectiveness variance across project environments (Silvius & Schipper, 2014; Carvalho & Rabechini, 2017; Aarseth et al., 2017). Additionally, the findings advance stakeholder engagement theory by demonstrating how participatory mechanisms enhance sustainability outcomes through more responsive and legitimate implementation processes that address diverse stakeholder priorities (Eskerod & Huemann, 2013; Aaltonen & Kujala,

2016; Martens & Carvalho, 2018). From a practical implementation perspective, the research provides comprehensive guidance for organizations navigating sustainability integration by identifying critical success factors, implementation strategies, and potential barriers across diverse project contexts. The findings emphasize that effective integration requires simultaneous advancement across technical frameworks, organizational enablers, and stakeholder engagement processes rather than isolated interventions focusing on specific dimensions (Martens & Carvalho, 2016; Silvius et al., 2017; Huemann & Silvius, 2017). The research particularly highlights the importance of collaborative governance models that actively engage diverse stakeholders in sustainability planning, implementation, and evaluation processes rather than imposing predefined frameworks without meaningful participation. Such collaborative approaches enhance decision legitimacy, improve responsiveness to stakeholder priorities, and facilitate more comprehensive sustainability assessments that capture diverse impact dimensions (Eskerod & Huemann, 2013; Aaltonen & Kujala, 2016; Martens & Carvalho, 2018).

Conclusion

This systematic review and meta-analysis provides comprehensive evidence regarding sustainability integration effectiveness in project management contexts while identifying critical success factors, implementation strategies, and persistent barriers across diverse organizational environments. The findings establish that effective integration requires coordinated advancement across technical, organizational, and social dimensions rather than isolated interventions focusing on specific components in isolation.

The research makes several significant contributions to existing literature while providing practical guidance for organizations implementing sustainability practices within project management frameworks. First, the study provides empirical validation of integrated theoretical perspectives that emphasize multi-dimensional approaches combining technical frameworks, organizational enablers, and stakeholder engagement processes (Silvius & Schipper, 2014; Martens & Carvalho, 2017; Aarseth et al., 2017). Second, the meta-analysis quantifies sustainability integration effectiveness while identifying substantial heterogeneity that confirms contingency perspectives regarding context-specific implementation requirements (Carvalho & Rabechini, 2017; Kivilä et al., 2017). Third, the findings highlight a critical evolution from technocratic sustainability management toward participatory approaches that center diverse stakeholder experiences through inclusive engagement processes (Eskerod & Huemann, 2013; Aaltonen & Kujala, 2016; Martens & Carvalho, 2018).

The systematic review identifies five critical success factors that collectively enhance sustainability integration effectiveness: leadership commitment that prioritizes sustainability through resource allocation and cultural reinforcement; strategic alignment that integrates sustainability within organizational objectives and performance frameworks; capability development that builds specialized sustainability expertise through structured training and

knowledge-sharing initiatives; governance structures that provide oversight through integrated assessment frameworks and accountability systems; and stakeholder engagement processes that identify, prioritise, and address diverse concerns throughout project lifecycles. From practical implementation perspectives, these findings emphasize that organizations should develop context-specific integration roadmaps that assess current capabilities, prioritize critical enablers, and systematically address implementation barriers through coordinated transformation rather than standardized approaches across diverse project environments. Particularly important is developing collaborative governance models that actively engage diverse stakeholders in sustainability planning, implementation, and evaluation through inclusive dialogue processes that enhance decision legitimacy while improving responsiveness to stakeholder priorities.

Future research should address several critical areas identified through this systematic review and meta-analysis. First, longitudinal studies examining sustainability integration impacts over extended timeframes would provide valuable insights regarding long-term effects currently underrepresented in project-focused literature with limited temporal boundaries. Second, comparative analysis of sustainability integration effectiveness across diverse organizational contexts would enhance understanding of contextual factors moderating implementation success, supporting more nuanced contingency frameworks. Third, participatory research methodologies engaging diverse stakeholders in sustainability assessment would develop more comprehensive evaluation approaches that capture qualitative impact dimensions inadequately represented in current measurement frameworks.

Additionally, future research should explore emerging sustainability concepts including circular economy principles, regenerative design approaches, and just transition frameworks that extend beyond conventional sustainability conceptualizations toward more transformative models. Examining how these emerging concepts manifest within project management contexts would advance theoretical understanding while providing innovative implementation pathways for practitioners. Furthermore, research examining governance models that foster transparency, accountability, and shared decision-making power would enhance understanding of how democratic sustainability approaches function within project environments traditionally characterized by hierarchical governance structures.

In conclusion, this systematic review and meta-analysis confirms that sustainability integration enhances project outcomes while identifying critical success factors, implementation strategies, and persistent barriers across diverse organizational contexts. The findings emphasize that effective integration requires multi-dimensional approaches combining technical frameworks, organizational enablers, and stakeholder engagement processes tailored to specific project characteristics rather than standardized implementation across diverse contexts. By advancing understanding of these complex interactions, this research provides valuable guidance for both scholars examining sustainability integration theoretically and practitioners implementing sustainable practices within project management environments.

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