DOI:10.5937/IIZS26279I

PROJECT PERFORMANCE MEASUREMENT: KEY PERFORMANCE INDICATORS (KPIs) AND SUCCESS METRICS FOR SUSTAINABLE INDUSTRIAL PROJECTS – A REVIEW AND CONCEPTUAL FRAMEWORK

Review paper

Dejan Igov[1*], Duško Čučković[2], Verica Gluvakov[3], Ivana Denčić[4]
[1,2] Faculty of Project and Innovation Management Prof. Dr. Petar Jovanović, Belgrade, R. of Serbia
[3,4] Technical Faculty "Mihajlo Pupin" Zrenjanin, R. of Serbia

Abstract: The growing integration of sustainability into industrial development has broadened the conventional understanding of project performance and project success. Although conventional project measurement is centered on time, cost, scope, and quality, sustainable industrial projects require a broader evaluation that also considers economic value, operational and technical outcomes, environmental effects, stakeholder and safety considerations, and longer-term benefits. This paper identifies, analyses, and classifies key performance indicators (KPIs) and success metrics relevant to sustainable industrial projects and proposes a conceptual framework for their integrated assessment. A structured literature review and qualitative content analysis were conducted using Google Scholar and ScienceDirect, with the main search period limited to 2020-2026. The synthesis distinguishes project performance, which primarily reflects execution efficiency, from broader project success, which includes benefits, stakeholder value, sustainability, and long-term outcomes. Six recurring performance dimensions were identified and organized into a three-level framework linking project delivery performance, multidimensional project outcomes, and strategic and long-term project success. The framework offers a literature-based structure for selecting project-specific indicators without imposing universal weights and provides a basis for future empirical validation in industrial project environments.
Key words: project performance, key performance indicators, project success, success metrics, sustainable industrial projects, sustainability, project management

INTRODUCTION

Measuring project performance is essential for assessing progress, detecting deviations, and supporting managerial decision-making. Conventional evaluation emphasizes time, cost, scope, and quality, although the limitations of the traditional cost-time-quality triangle were recognized early (Atkinson, 1999). De Wit (1988) distinguished project success from the success of the project-management effort. Contemporary research extends this distinction across multiple dimensions and time horizons: Ika and Pinto (2022) broaden the meaning of project success, while Korhonen et al. (2023) connect project-level measures with wider organizational success.

This distinction matters for sustainable industrial projects. In this study, sustainable industrial projects are defined as temporary initiatives in manufacturing, energy, process industries, infrastructure, and industrial construction assessed across delivery, economic/value, operational/technical, environmental, social/stakeholder/safety, and strategic or long-term sustainability dimensions. The boundary covers initiation through handover, with post-completion effects included when benefits realization is assessed. Accordingly, project-level and industrial sustainability studies combine delivery measures with financial, environmental, social, safety, governance, and resource-efficiency indicators (Bochtler et al., 2024; Contini & Peruzzini, 2022; Ibrahim et al., 2024; Mengistu & Panizzolo, 2023; Zheng et al., 2026).

The primary challenge is not a lack of indicators but their fragmentation across the project management, sustainability assessment, and industrial performance literatures. Meeting schedule and budget objectives does not guarantee environmental, stakeholder, or long-term value outcomes. Accordingly, reviews and project-level frameworks in PPP and green-

[1] Corresponding author: dejan.igov@pmc.edu.rs, ORCID: 0009-0000-7921-4527
[2] dusko.cuckovic@pmc.edu.rs, ORCID: 0000-0003-4835-2075
[3] verica.gluvakov@tfzr.rs, ORCID: 0000-0003-1083-0203
[4] ivana.dencic@tfzr.rs

building contexts call for broader indicator systems that go beyond conventional delivery criteria (Akomea-Frimpong et al., 2022; Ikudayisi et al., 2022; Shokouhi & Bachari, 2025).
The aim of this paper is to identify, analyse, and classify KPIs and success metrics relevant to sustainable project management and related industrial and engineering projects, and to organize them into a multidimensional conceptual framework. The research questions addressed are: RQ1 - Which KPIs and success metrics are used in sustainable industrial projects? RQ2 - To what extent are traditional project indicators integrated with environmental, economic, operational, and stakeholder-related sustainability dimensions? RQ3 - How can the identified indicators be structured into an integrated framework for multidimensional project performance measurement?

METHODOLOGY

This study uses a structured literature review combined with qualitative content analysis. The methodology is intentionally characterized as structured and exploratory rather than a fully systematic review, because the objective is to synthesize heterogeneous project-performance and sustainability measures into a conceptual framework. The primary publication period was 2020-2026. Seminal pre-2020 publications were used selectively to establish the conceptual background of project success and multidimensional performance measurement and were not counted in the 29-study analytical corpus.
The literature search was conducted on 11 September 2026 using Google Scholar and ScienceDirect. Three predefined Google Scholar queries were used: (1) "What key performance indicators (KPIs) and success metrics are used to measure project performance in sustainable industrial projects?"; (2) "What performance indicators and success criteria are used to evaluate sustainable project management?"; and (3) "How are project performance and project success measured using key performance indicators (KPIs) and success metrics?". The queries returned 50, 50, and 40 records, respectively. All returned records were screened, and exact-title deduplication resulted in 133 unique Google Scholar records.
ScienceDirect was searched in title, abstract, and keyword fields using three queries: "project performance" AND sustainability, "project success" AND "sustainable project management", and "industrial projects" AND sustainability. These returned 106, 5, and 38 records, respectively. After internal exact-title deduplication, 147 unique ScienceDirect records remained. Merging both sources and removing one exact-title cross-source duplicate produced 279 unique records for screening.
Records underwent combined title and abstract relevance screening, followed, where necessary, by full-text or detailed publisher-record verification. Because exclusions based solely on titles or abstracts were not prospectively logged, phase-specific exclusion counts could not be reconstructed. Of the 279 unique records, 250 were excluded as out of scope, background-only, non-project-level, duplicate/alternative versions, or insufficient for KPI extraction; 29 studies were retained (24 core project-level and five supporting industrial-sustainability studies). Grey literature and formal backward/forward snowballing were not used as separate identification streams. Eligible 2026 studies were formally published or publisher-recognized advance online/online-first by 11 September 2026.

Table 1. *Inclusion and exclusion criteria used for study screening*

Inclusion criteria	Exclusion criteria
2020–2026; earlier seminal studies only for conceptual foundations.	Organizational/product/process/technical performance without an explicit project-management perspective.
Project-level performance, project success, or project-level sustainability assessment.	Duplicate records across searches or sources.
Measurable KPIs, performance indicators, success metrics, or success criteria.	Non-academic, commercial, or insufficiently documented sources for the primary corpus.
Sustainable, industrial, infrastructure, or engineering projects; peer-reviewed sources prioritized.	No extractable project-level indicators, metrics, or criteria relevant to the research questions.

A pragmatic quality/relevance appraisal assessed each core study against four criteria: peer-reviewed and traceable source; explicit project-level performance, success or sustainability focus; transparent empirical, review, or conceptual method; and extractable indicators or success criteria supported by a measurement basis, validation procedure, or traceable evidence. Studies meeting at least three criteria were eligible for the core corpus. Because designs were heterogeneous, appraisal informed interpretive weighting rather than a single formal risk-of-bias score; systematic reviews, validated indicator systems and transparent empirical studies received greater weight.

For each retained study, information was extracted on project context, indicators or success criteria, sustainability dimension, measurement focus, evidence basis, evaluation time horizon, and the distinction between project performance and broader project success. Recurring indicators were coded into six analytical dimensions. No numerical weights were assigned because the present study does not include expert elicitation or empirical project data.

Figure 1 summarizes the literature identification, screening, and synthesis procedure used in this review. The flow diagram reports the numbers of records identified, duplicates removed, records screened, studies excluded, and studies retained for qualitative synthesis.

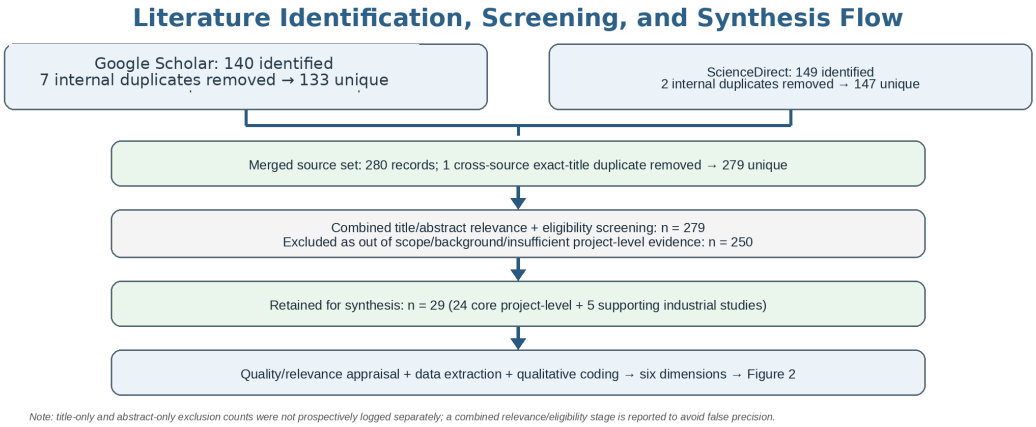


Fig.1. *Literature identification, screening, and synthesis flow*

RESULTS AND DISCUSSION

The synthesis identifies six interrelated dimensions. Non-exclusive coding of the 24 core project-level studies revealed coverage of project delivery performance (17 studies), economic and value performance (20), operational and technical performance (5), environmental performance (20), social, stakeholder, and safety performance (21), and

strategic and long-term project success (11). Individual studies could address more than one dimension. Five supporting industrial studies primarily reinforced the operational/technical and environmental indicator categories.

Addressing RQ1, traditional delivery indicators remain at the core of project performance evaluation. Time, cost, scope, and quality are consistently used to assess whether project execution conforms to planned objectives. Cruz Villazón et al. (2020) identify time, cost, resources, scope, and quality as core project-management measures, whereas Bochtler et al. (2024) describe cost, time, and scope as the dominant traditional focus. He et al. (2022) and Ibrahim et al. (2024) likewise show that project-level performance measurement increasingly supplements conventional measures with broader non-financial criteria.

Economic and value-related metrics form a second recurring group. In addition to cost performance, studies use Net Present Value (NPV), Internal Rate of Return (IRR), Life-Cycle Cost (LCC), benefit-cost measures, profitability and benefits realization. Ma et al. (2020) incorporate profitability and NPV into sustainable project selection, while Tareemi (2025) combines traditional financial metrics with LCC and a resilience benefit-cost measure. Hussain et al. (2026) further demonstrate a tri-objective structure based on NPV, environmental score, and social score, illustrating the integration of economic and sustainability objectives.

Environmental, operational, and social indicators broaden the measurement scope to energy and materials, GHG emissions, water, waste, resource efficiency, productivity, safety, stakeholder satisfaction, and community effects. Díaz Caselles and Guevara (2024) report environmental, social, and economic KPIs, while Zheng et al. (2026) include workplace safety, management efficiency, compliance, local procurement, and schedule controllability. Project applications combine schedule, cost, and carbon metrics (Kaewunruen et al., 2020), OHS and green-building performance (Iga Istri et al., 2025), and wider sustainability assessment metrics (Fallah & Moini, 2026; Ikudayisi et al., 2022). Industrial studies reinforce resource, emissions, waste, energy, and safety indicators (Iannaccone et al., 2020; Mengistu & Panizzolo, 2023; Saxena et al., 2020; Sherif et al., 2022).

An important finding in relation to RQ2 is that project performance and project success are related but not identical. Ika and Pinto (2022) distinguish performance measures associated with management processes from broader success criteria linked to project goals, benefits, stakeholder perceptions, timing, and sustainability. Korhonen et al. (2023) similarly show that the interpretation of project measures depends on their connection to wider organizational success. Consequently, sustainable project success extends beyond effective delivery to include value, stakeholder outcomes, and long-term sustainability.

The degree of integration varies by context, but the direction is consistent. Project success was already framed as a multidimensional strategic concept by Shenhar et al. (2001), while Müller and Jugdev (2012) show how success criteria and critical success factors evolved with context. Recent studies extend this logic to SDG impacts, stakeholder value, future readiness, sustainability, and value creation (Ferrarez et al., 2023; Mansell, Philbin, & Broyd, 2020; Mansell, Philbin, & Konstantinou, 2020; Moreno-Monsalve et al., 2023). Wu et al. (2023), Sanad et al. (2026), and Son et al. (2023) further demonstrate integration across construction, infrastructure, and eco-industrial projects.

Table 2. *Classification and indicative operationalization of project performance and success measures*

Performance dimension	Representative KPIs / success metrics, operationalization, data source, and timing	Representative sources
Project delivery performance	Schedule variance/SPI; cost variance/CPI; scope acceptance/change rate; defects/nonconformities. Data: schedule, cost, change, QA records. Timing: weekly/monthly; confirm at handover.	Ika & Pinto (2022); Cruz Villazón et al. (2020)
Economic and value performance	NPV; IRR; ROI; LCC; benefit-cost measures; realized financial savings/value. Data: business case, finance/ERP, benefits register. Timing: appraisal/stage gates; 6–36 months post-implementation.	Ma et al. (2020); Tareemi (2025)
Operational and technical performance	Energy intensity; productivity; availability; resource utilization; reliability. Data: SCADA/ERP/maintenance. Timing: commissioning; monthly/quarterly.	Ibrahim et al. (2024); Contini & Peruzzini (2022)
Environmental performance	Energy use; GHG emissions; water/material use; waste; recycling/resource efficiency. Data: meters, LCA, environmental logs. Timing: by phase/month; lifecycle for major impacts.	Bochtler et al. (2024); Díaz Caselles & Guevara (2024)
Social, stakeholder, and safety performance	Stakeholder satisfaction/participation; LTIFR/TRIR; incidents; local employment/community effects. Data: surveys, HSE/HR records. Timing: monthly/quarterly; handover/post-project.	Zheng et al. (2026); Wu et al. (2023)
Strategic and long-term project success	Benefits realization; strategic alignment; SDG contribution; resilience/future readiness; long-term value. Data: benefits register, strategic/SDG scorecards, post-implementation review. Timing: 6–12 months; where relevant, 2–5 years.	Ika & Pinto (2022); Moreno-Monsalve et al. (2023)

Table 2 links representative measures to indicative units, data sources, and measurement horizons. Realized financial savings/value are treated as economic outcomes, whereas benefits realization in the strategic dimension refers to broader planned business, stakeholder, and sustainability benefits achieved after handover. The specifications are guidance rather than universal thresholds and should be adapted to project type, lifecycle stage, data availability, and stakeholder priorities.

RQ3 is addressed through the three-level structure illustrated in Figure 2. The analytical core of the framework consists of the six dimensions identified in the review. Level 1 represents project delivery performance through time, cost, scope, and quality. Level 2 integrates four outcome dimensions—economic and value, operational and technical, environmental, and social, stakeholder, and safety performance. Level 3 represents strategic and long-term project success through benefits realization and sustainable value creation, strategic alignment, future readiness, and long-term societal and environmental impact. The figure translates the review findings into a progression from execution efficiency to broader project outcomes and, ultimately, to sustainable long-term success.

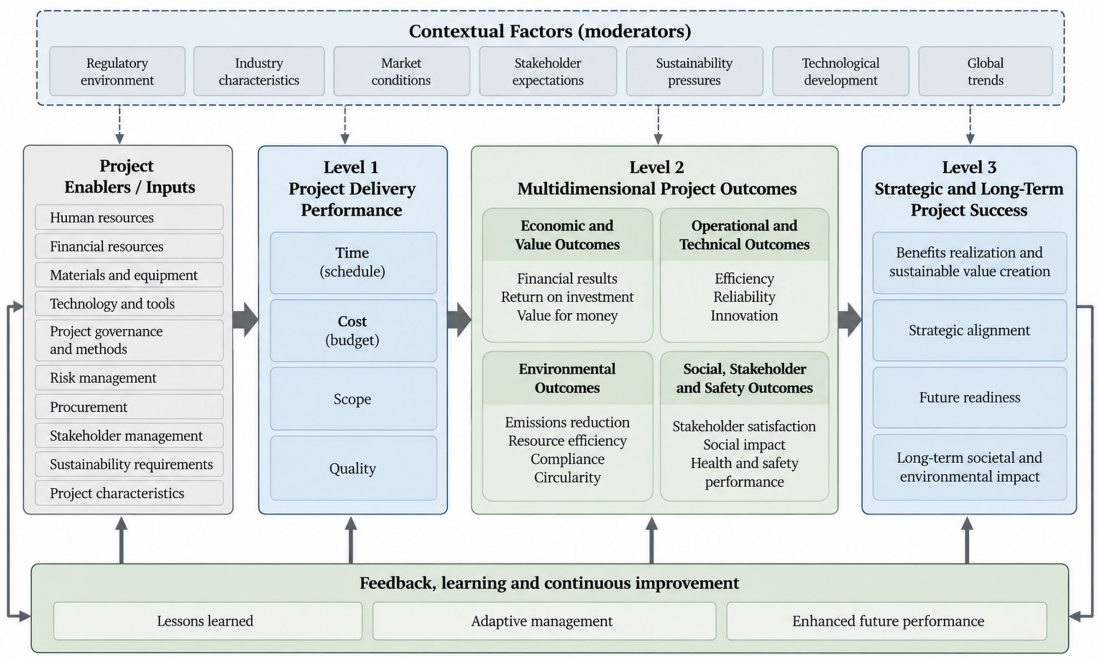


Fig. *2. Proposed multidimensional framework for project performance measurement in sustainable industrial projects*

The project enablers and contextual factors in Figure 2 are not additional outcome dimensions; they position the literature-derived framework within project-management practice. Human resources, financial resources, materials and equipment, technology and tools, project governance and methods, risk management, procurement, stakeholder management, sustainability requirements, and project characteristics enable delivery. Regulatory environment, industry characteristics, market conditions, stakeholder expectations, sustainability pressures, technological development, and global trends act as contextual moderators of outcomes. The feedback loop captures lessons learned, adaptive management, and enhanced future performance. Figure 2 should therefore be read from left to right: enablers support delivery performance; delivery contributes to multidimensional outcomes; and longer-horizon outcomes determine strategic and long-term project success.

As an example, consider a hypothetical industrial energy-efficiency retrofit. At Level 1, schedule/cost variance, scope acceptance, and commissioning defects could be used to assess project delivery. Level 2 could combine NPV/LCC, energy intensity, verified energy savings, GHG reduction, safety rates, and stakeholder acceptance. Level 3 could assess benefits realization after 6–12 months, alignment with decarbonization goals, readiness for scaling, and lifecycle value. Relevant data could be drawn from project-control systems, ERP/SCADA platforms, meters, HSE records, surveys, and post-implementation reviews.

CONCLUSION

This paper shows that time, cost, scope, and quality remain necessary measures of delivery performance but are insufficient for assessing sustainable industrial project success. The literature supports six interrelated dimensions spanning delivery, economic/value, operational/technical, environmental, social/stakeholder/safety, and strategic/long-term success.

The proposed three-level framework links project delivery performance to multidimensional outcomes and, ultimately, to broader project success. Its contribution is integrative rather than prescriptive: conventional project-control KPIs are retained while sustainability and long-term value are incorporated without imposing unsupported universal weights.

The framework is therefore a flexible classification structure whose final KPI set should be adapted to project type, lifecycle stage, stakeholder requirements, and available data.

LIMITATIONS AND FUTURE RESEARCH

Limitations include reliance on two sources rather than Scopus/Web of Science; relevance-ranked Google Scholar results; no formal citation-chasing or grey-literature stream; combined rather than prospectively separated title/abstract screening counts; and a pragmatic quality/relevance appraisal rather than a design-specific risk-of-bias tool. Table 2 and Figure 2 remain literature-based and require empirical validation.
Future research should extend searching to Scopus/Web of Science and citation chasing and validate the framework across diverse industrial sectors. A multi-case design could record Level 1 KPIs at handover and Level 2–3 outcomes at about 6–12 and 24 months, combining expert review with cross-case and longitudinal analysis. Context-specific indicator importance and integration with BIM, ERP, SCADA, and Industry 4.0 data streams could then be tested.

REFERENCES

Akomea-Frimpong, I., Jin, X., & Osei-Kyei, R. (2022). Mapping studies on sustainability in the performance measurement of public-private partnership projects: A systematic review. *Sustainability*, *14*(12), 7174. https://doi.org/10.3390/su14127174

Atkinson, R. (1999). Project management: Cost, time and quality, two best guesses and a phenomenon, its time to accept other success criteria. *International Journal of Project Management, 17*(6), 337–342. https://doi.org/10.1016/S0263-7863(98)00069-6

Bochtler, S., Misopoulos, F., Chacha, I., Suja, S., & Mutungi, D. (2024). Extending corporate sustainability reporting indicators to projects' sustainability. *Procedia Computer Science*, *239*, 346–355. https://doi.org/10.1016/j.procs.2024.06.181

Contini, G., & Peruzzini, M. (2022). Sustainability and Industry 4.0: Definition of a set of key performance indicators for manufacturing companies. *Sustainability*, *14*(17), 11004. https://doi.org/10.3390/su141711004

Cruz Villazón, C., Sastoque Pinilla, L., Otegi Olaso, J. R., Toledo Gandarias, N., & López de Lacalle, N. (2020). Identification of key performance indicators in project-based organisations through the lean approach. *Sustainability*, *12*(15), 5977. https://doi.org/10.3390/su12155977

de Wit, A. (1988). Measurement of project success. *International Journal of Project Management, 6*(3), 164–170. https://doi.org/10.1016/0263-7863(88)90043-9

Díaz Caselles, L. M., & Guevara, J. (2024). Sustainability performance in on-site construction processes: A systematic literature review. *Sustainability*, *16*(3), 1047. https://doi.org/10.3390/su16031047

Fallah, M., & Moini, A. (2026). Examining the role of sustainability metrics in advancing sustainable construction project management. *Clean Technologies and Environmental Policy*, *28*(1), 23. https://doi.org/10.1007/s10098-025-03380-w

Ferrarez, R. P. F., Valle, C. G. B. d., Alvarenga, J. C., Dias, F. d. C., Vasco, D. A., Guedes, A. L. A., Chinelli, C. K., Haddad, A. N., & Soares, C. A. P. (2023). Key practices for incorporating sustainability in project management from the perspective of Brazilian professionals. *Sustainability*, *15*(11), 8477. https://doi.org/10.3390/su15118477

He, Q., Tian, Z., & Wang, T. (2022). Performance measurement methods in megaprojects: An analytical review. *International Journal of Project Management*, *40*(6), 634–645. https://doi.org/10.1016/j.ijproman.2022.05.009

Hussain, A., Khalid, Q. S., Hussain, I., Omair, M., & Habib, M. S. (2026). A framework for project sustainability assessment and schedule optimization in multi-mode construction projects. *International Journal of Management Science and Engineering Management*. Advance online publication. https://doi.org/10.1080/17509653.2026.2706585

Iannaccone, T., Landucci, G., Tugnoli, A., Salzano, E., & Cozzani, V. (2020). Sustainability of cruise ship fuel systems: Comparison among LNG and diesel technologies. *Journal of Cleaner Production*, *260*, 121069. https://doi.org/10.1016/j.jclepro.2020.121069

Ibrahim, A., Zayed, T., & Lafhaj, Z. (2024). Enhancing construction performance: A critical review of performance measurement practices at the project level. *Buildings*, *14*(7), 1988. https://doi.org/10.3390/buildings14071988

Iga Istri, M. P., Zaika, Y., Puspa Negara, K., Solimun, & Mochamad, A. W. (2025). The effect of implementing green construction on project performance: A comprehensive study using structural equation models (SEM). *Civil and Environmental Engineering*, *21*(1), 167–181. https://doi.org/10.2478/cee-2025-0014

Ika, L. A., & Pinto, J. K. (2022). The "re-meaning" of project success: Updating and recalibrating for a modern project management. *International Journal of Project Management*, *40*(7), 835–848. https://doi.org/10.1016/j.ijproman.2022.08.001

Ikudayisi, A. E., Chan, A. P. C., Darko, A., & Adegun, O. B. (2022). Integrated design process of green building projects: A review towards assessment metrics and conceptual framework. *Journal of Building Engineering*, *50*, 104180. https://doi.org/10.1016/j.jobe.2022.104180

Kaewunruen, S., Sresakoolchai, J., & Zhou, Z. (2020). Sustainability-based lifecycle management for bridge infrastructure using 6D BIM. *Sustainability*, *12*(6), 2436. https://doi.org/10.3390/su12062436

Korhonen, T., Jääskeläinen, A., Laine, T., & Saukkonen, N. (2023). How performance measurement can support achieving success in project-based operations. *International Journal of Project Management*, *41*(1), 102429. https://doi.org/10.1016/j.ijproman.2022.11.002

Ma, J., Harstvedt, J. D., Jaradat, R., & Smith, B. (2020). Sustainability driven multi-criteria project portfolio selection under uncertain decision-making environment. *Computers & Industrial Engineering*, *140*, 106236. https://doi.org/10.1016/j.cie.2019.106236

Mansell, P., Philbin, S. P., & Broyd, T. (2020). Development of a new business model to measure organizational and project-level SDG impact—Case study of a water utility company. *Sustainability*, *12*(16), 6413. https://doi.org/10.3390/su12166413

Mansell, P., Philbin, S. P., & Konstantinou, E. (2020). Redefining the use of sustainable development goals at the organisation and project levels—A survey of engineers. *Administrative Sciences*, *10*(3), 55. https://doi.org/10.3390/admsci10030055

Mengistu, A. T., & Panizzolo, R. (2023). Analysis of indicators used for measuring industrial sustainability: A systematic review. *Environment, Development and Sustainability*, *25*(3), 1979–2005. https://doi.org/10.1007/s10668-021-02053-0

Moreno-Monsalve, N., Delgado-Ortiz, M., Rueda-Varón, M., & Fajardo-Moreno, W. S. (2023). Sustainable development and value creation, an approach from the perspective of project management. *Sustainability*, *15*(1), 472. https://doi.org/10.3390/su15010472

Müller, R., & Jugdev, K. (2012). Critical success factors in projects: Pinto, Slevin, and Prescott – the elucidation of project success. *International Journal of Managing Projects in Business, 5*(4), 757–775. https://doi.org/10.1108/17538371211269040

Sanad, H., Elbeltagi, E., Etman, E., Gaber, M., & Elkorany, T. (2026). Optimizing sustainability in infrastructure projects: A framework integrating time, economic, social and environmental perspectives. *Construction Innovation*, *26*(7), 2040–2076. https://doi.org/10.1108/CI-12-2024-0398

Saxena, P., Stavropoulos, P., Kechagias, J., & Salonitis, K. (2020). Sustainability assessment for manufacturing operations. *Energies*, *13*(11), 2730. https://doi.org/10.3390/en13112730

Shenhar, A. J., Dvir, D., Levy, O., & Maltz, A. C. (2001). Project success: A multidimensional strategic concept. *Long Range Planning, 34*(6), 699–725. https://doi.org/10.1016/S0024-6301(01)00097-8

Sherif, Z., Sarfraz, S., Jolly, M., & Salonitis, K. (2022). Identification of the right environmental KPIs for manufacturing operations: Towards a continuous sustainability framework. *Materials*, *15*(21), 7690. https://doi.org/10.3390/ma15217690

Shokouhi, M., & Bachari, M. S. (2025). An overview of the aspects of sustainability in project management. *Progress in Engineering Science*, *2*(1), 100048. https://doi.org/10.1016/j.pes.2024.100048

Son, C. H., Oh, D., & Ban, Y. U. (2023). Eco-industrial development strategies and characteristics according to the performance evaluation of eco-industrial park projects in Korea. *Journal of Cleaner Production*, *416*, 137971. https://doi.org/10.1016/j.jclepro.2023.137971

Tareemi, A. A. (2025). An integrated financial–sustainability framework for predicting green infrastructure project success. *Sustainability*, *17*(21), 9529. https://doi.org/10.3390/su17219529

Wu, S.-W., Yan, Y., Pan, J., & Wu, K.-S. (2023). Linking sustainable project management with construction project success: Moderating influence of stakeholder engagement. *Buildings*, *13*(10), 2634. https://doi.org/10.3390/buildings13102634

Zheng, Z., Zhang, N., Zhang, S., & Gao, L. (2026). Developing an indicator system for ESG performance evaluation in international construction projects. *Journal of Construction Engineering and Management*, *152*(11), 04026197. https://doi.org/10.1061/JCEMD4.COENG-17619