

Review

Integrating sustainability into project management for eco-friendly outcomes

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CITATION

Kehinde S. Integrating sustainability into project management for eco-friendly outcomes. *Sustainable Social Development*. 2025; 3(2): 2894. <https://doi.org/10.54517/ssd2894>

ARTICLE INFO

Received: 19 August 2024

Accepted: 17 February 2025

Available online: 20 April 2025

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Abstract: The pursuit of sustainable project management practices is becoming increasingly important in contemporary project management discourse. This review explores the integration of sustainability principles and environmental considerations within project management frameworks, aiming to identify specific strategies that lead to eco-friendly project outcomes and foster long-term sustainability. By examining a broad range of scholarly works, empirical studies, and industry reports, this review highlights key methodologies for embedding environmental consciousness into project planning, execution, and evaluation. The findings reveal that incorporating sustainability principles into project management not only enhances project outcomes but also significantly reduces adverse environmental impacts. Specifically, the review identifies effective approaches such as life cycle assessment (LCA) and stakeholder engagement, which are shown to be instrumental in promoting sustainable practices across different project stages. Moreover, the study sheds light on common challenges, such as resistance to change and the lack of standardized sustainability metrics, and offers actionable recommendations for overcoming these barriers. In addition, the review discusses opportunities for advancing sustainable project management through the application of emerging technologies and cross-disciplinary collaboration. Insights from behavioral studies, environmental sciences, and management theories provide a comprehensive understanding of the factors driving the successful adoption of sustainability practices among project stakeholders. Ultimately, this review consolidates theoretical perspectives and empirical evidence to present a clear and detailed understanding of how sustainable project management practices can be effectively implemented to achieve environmentally responsible and enduring project outcomes.

Keywords: sustainable project management; environmental considerations; eco-friendly outcomes; long-term sustainability

1. Introduction

In recent years, the global discourse on project management has undergone a profound shift, placing an unprecedented emphasis on sustainability and environmental consciousness. The escalating concerns surrounding climate change, resource depletion, and environmental degradation have propelled the integration of sustainability principles into various domains, and notably, into the core of project management practices [1]. This paradigm shift necessitates a reevaluation of traditional project management frameworks, prompting an exploration into the seamless integration of sustainability principles and environmental considerations within project methodologies.

In an ideal world, project management practices seamlessly integrate sustainability principles and environmental considerations at their core, ensuring that every project undertaken prioritizes eco-friendly outcomes and long-term

environmental sustainability. In this ideal scenario, project managers are equipped with comprehensive frameworks that effortlessly incorporate sustainability metrics, ethical sourcing, waste reduction strategies, and carbon footprint mitigation into every phase of project planning, execution, and evaluation. The seamless integration of sustainability within project management is reflected not merely as an option but as a fundamental criterion driving project success, fostering a paradigm where environmental consciousness is inherently entwined with project goals. However, the prevailing reality presents a stark contrast to this ideal scenario [2]. Globally, project management frameworks often overlook sustainability considerations, focusing predominantly on immediate project deliverables and economic objectives while sidelining ecological impacts. The problem extends to a lack of standardized guidelines and implementation frameworks that specifically address the integration of sustainability principles into project management practices. Locally, within specific industries or regions, the gap widens as limited awareness, insufficient resources, and a dearth of established protocols exacerbate the challenge of incorporating sustainability within project management. This disparity not only hampers the ability to address pressing environmental issues but also perpetuates an unsustainable approach to project execution. The consequences of failing to rectify this discrepancy between the ideal and the existing state are dire [3]. Without proactive measures to integrate sustainability into project management practices, the world faces heightened environmental degradation, escalating resource depletion, and increased carbon emissions attributable to project undertakings. The absence of standardized sustainability frameworks within project management not only undermines ecological preservation but also jeopardizes long-term socio-economic stability. Failure to address this gap could lead to perpetuating unsustainable practices, hindering global efforts toward achieving environmental sustainability goals, and exacerbating the adverse impacts of projects on the environment. Ultimately, the perpetuation of this disparity risks further degradation of natural ecosystems, impeding progress towards a more sustainable and resilient future for generations to come.

2. Literature review

In the realm of contemporary project management, a fundamental transformation is underway, marked by an increasing recognition of the imperative to embed sustainability principles into project frameworks. Several Studies underscore the significance of integrating sustainability metrics, ethical sourcing, waste reduction strategies, and carbon footprint mitigation into project planning, execution, and evaluation phases. The contemporary global landscape is witnessing a transformative shift in project management ideologies, where sustainability has emerged as a pivotal concern [4]. This shift signifies an evolution in societal values, reflecting an increasing awareness of environmental issues and the recognition of the imperative to address them within project management practices. The integration of sustainability principles into project frameworks signifies a departure from traditional project goals focused solely on economic viability towards a more holistic approach that incorporates environmental and social impacts. This paradigm shift aims to align project objectives with broader sustainability goals, emphasizing eco-friendly outcomes and long-term

environmental preservation. Amid this paradigm shift lies the crucial need to assess the efficacy of integrating sustainability principles and environmental considerations into existing project management frameworks.

2.1. Historical evolution of sustainable project management

The historical evolution of sustainable project management traces a compelling journey that intertwines societal shifts, environmental awareness, and evolving project paradigms. Historically, project management focused primarily on efficiency, cost-effectiveness, and meeting deliverables within set timelines. Sustainability was not a focal point as projects were evaluated based on immediate gains without considering long-term environmental implications. The 20th century witnessed the awakening of environmental concerns globally. Events such as the publication of Rachel Carson's "Silent Spring" and the establishment of Earth Day in 1970 marked pivotal moments in raising awareness about environmental degradation [5]. This burgeoning consciousness catalyzed a shift in societal values, prompting a reevaluation of industrial practices, including project management. The late 20th and early 21st centuries marked a pivotal era for sustainable project management. Organizations began recognizing the significance of integrating sustainability principles into project frameworks. This involved considering ecological footprints, social responsibility, and economic viability in project planning, execution, and evaluation. International frameworks like the Global Reporting Initiative (GRI), Leadership in Energy and Environmental Design (LEED), and the Project Management Institute's (PMI) incorporation of sustainability into project management standards solidified the integration of sustainable practices. Certifications such as LEED accreditation and PMI's Project Management Professional (PMP) with an emphasis on sustainability further validated this shift [6]. International initiatives like the United Nations Sustainable Development Goals (SDGs) played a pivotal role in shaping project management practices. They provided a comprehensive roadmap, urging organizations to align projects with broader global sustainability objectives, influencing decision-making and project planning worldwide. Presently, sustainable project management stands as an indispensable aspect of modern project planning. It encompasses life cycle assessments, stakeholder engagement, risk mitigation for environmental impact, and the utilization of green technologies [7]. Looking ahead, the future of sustainable project management seems poised for further evolution, with an increasing focus on circular economy principles, carbon neutrality, and innovative technologies to enhance eco-friendly project outcomes.

Incorporating sustainability principles into project management frameworks leads to enhanced project outcomes, both in terms of performance and environmental impact. Using life cycle assessments (LCA) and engaging stakeholders early and often results in projects that not only meet their objectives but also contribute positively to the environment. For instance, LCA provides a holistic view of the environmental impact of a project from inception to completion, enabling project managers to make informed decisions that reduce resource consumption and waste. One of the significant gaps identified in current times is the lack of standardized sustainability metrics. Without a common framework for measuring sustainability, it is challenging to

evaluate the effectiveness of sustainable practices across different projects and industries. The development of standardized metrics is crucial for ensuring that sustainability goals are met consistently [8]. These metrics should cover various aspects of sustainability, including energy efficiency, waste reduction, and social impact. Successful sustainable project management hinges on effective stakeholder engagement. Early and ongoing communication with stakeholders, including clients, suppliers, and the community, is crucial for aligning project goals with sustainability objectives. Engaging stakeholders in the decision-making process fosters a sense of ownership and encourages the adoption of eco-friendly practices. For instance, involving suppliers in discussions about sustainable sourcing can lead to more environmentally conscious procurement decisions. By integrating these practices and standardized metrics, projects can achieve their goals, better assess performance and make data-driven decisions while minimizing their ecological footprint, leading to a win-win scenario for both the business and the planet [9]. The chart below shows that 70% of companies have adopted sustainable project management practices, while 30% have not. This indicates a strong trend towards integrating sustainability in project management to achieve eco-friendly outcomes and long-term sustainability. **Figure 1** presents the Adoption of sustainable project management practices

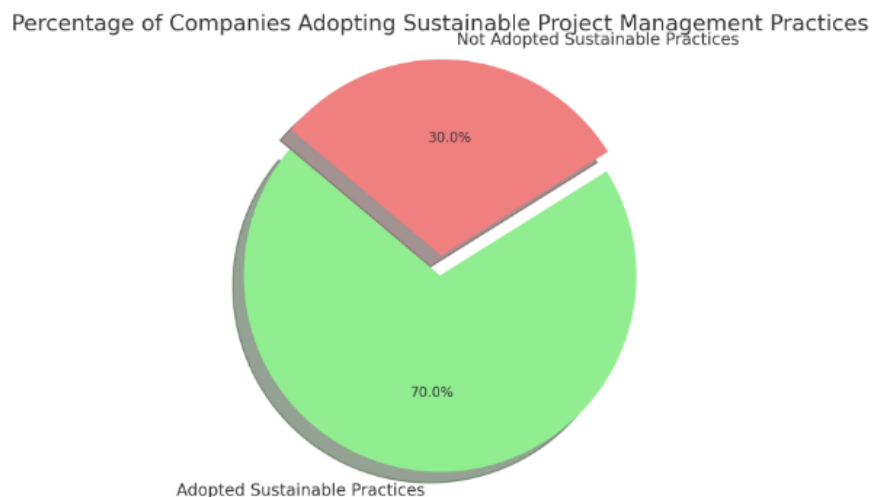


Figure 1. Adoption of sustainable project management practices.

Figure 2 presents Key sustainable project management practices implemented. This bar chart above highlights key sustainable project management practices implemented by companies. The practices include green procurement (80%), energy-efficient technologies (75%), waste reduction strategies (60%), and stakeholder engagement (50%). These practices are crucial for minimizing environmental impact and promoting sustainability.



Figure 2. Key sustainable project management practices implemented.

2.2. Theoretical frameworks in sustainable project management

Theoretical frameworks in sustainable project management provide the conceptual structure and guiding principles that underpin the integration of sustainability into project practices. These frameworks offer a systematic approach to incorporating environmental, social, and economic considerations within project management methodologies. Here are some key theoretical frameworks shaping sustainable project management:

- 1) **Triple Bottom Line (TBL) Approach:** The TBL framework, popularized by John Elkington, advocates for evaluating project success based on three interconnected pillars: social, environmental, and economic performance. It emphasizes the importance of not only financial outcomes (profit) but also societal impact (people) and environmental stewardship (planet) in project decision-making [10].
- 2) **Life Cycle Assessment (LCA):** LCA is a comprehensive methodology used to assess the environmental impacts of a product, process, or service throughout its entire life cycle. In sustainable project management, LCA helps in identifying and mitigating environmental hotspots, guiding decisions towards eco-friendly materials, efficient resource use, and waste reduction across all project stages.
- 3) **Systems Thinking:** Systems thinking involves viewing a project as an interconnected system of components where changes in one area can affect the entire system. In sustainable project management, this framework aids in understanding the complex relationships between project elements, stakeholders, and the environment, fostering holistic decision-making to achieve sustainable outcomes.
- 4) **Corporate Social Responsibility (CSR):** CSR frameworks emphasize an organization's responsibility to operate ethically and contribute positively to society. When applied to project management, CSR principles guide projects to consider social impacts, engage stakeholders, promote fair labor practices, and contribute to community development alongside meeting project objectives.
- 5) **Green Project Management (GPM):** GPM focuses on integrating environmentally friendly practices into project management processes. It involves strategies such

as selecting sustainable materials, minimizing waste, optimizing energy efficiency, and adhering to environmental regulations throughout project lifecycles.

- 6) Sustainable Development Goals (SDGs): The United Nations' 17 SDGs provide a global framework for sustainable development, influencing project management practices. Aligning projects with SDGs allows for a broader perspective, enabling projects to contribute directly to global sustainability objectives.
- 7) Stakeholder Theory: Stakeholder theory emphasizes the importance of considering the interests of all stakeholders affected by a project. In sustainable project management, this framework emphasizes engaging diverse stakeholders, including communities, governments, NGOs, and future generations, ensuring their perspectives and concerns are addressed.

2.3. Challenges in integrating sustainability

Integrating sustainability into project management practices presents a series of complex challenges that organizations must navigate to achieve successful implementation. These challenges stem from various sources and demand proactive strategies to overcome. One primary challenge lies in the intricate interconnectedness of sustainability considerations across environmental, social, and economic domains. Projects often interact with diverse stakeholders, regulations, and ecosystems, making it challenging to account for all variables and their interdependencies. A significant hurdle is the limited awareness or understanding of sustainability principles among project stakeholders, including team members, clients, and investors. This lack of comprehension can impede the integration of sustainable practices. Education and awareness initiatives are essential to foster a shared understanding of sustainability goals and their relevance to project success. Moreover, the integration of sustainable practices might initially incur higher costs or resource demands, posing a challenge in balancing sustainability objectives with budget limitations and resource availability. Resistance to change within organizational cultures or entrenched traditional project management methodologies can hinder the adoption of sustainable practices [11]. Overcoming this resistance requires strong leadership, effective communication, and demonstrating the tangible benefits of sustainability in projects. Measuring and evaluating the impact of sustainability initiatives on project outcomes is another significant challenge due to the lack of standardized metrics and methods. Quantifying environmental, social, and economic impacts accurately remains a hurdle in demonstrating the effectiveness of sustainable practices. Additionally, navigating complex and evolving regulatory frameworks related to sustainability while maintaining project objectives demands thorough knowledge and continuous adaptation. Sustainability initiatives often extend beyond organizational boundaries, requiring collaboration across supply chains and stakeholders [12]. However, coordinating diverse partners and suppliers to align their practices with sustainability goals can be challenging due to differing priorities and capabilities. Balancing competing priorities where sustainability objectives might conflict with other project

goals or stakeholder interests is a persistent challenge in integrating sustainability into project management.

2.4. Key reasons for barriers to large-scale implementation of eco-management principles

The large-scale implementation of eco-management principles in project management faces several barriers. A primary challenge is the perceived high cost associated with sustainable practices. Many companies, particularly in developing economies, prioritize short-term financial gains over long-term sustainability, which often requires upfront investment in green technologies, sustainable materials, and training. According to the World Bank, the upfront cost barrier is especially pronounced in small and medium-sized enterprises (SMEs), which may lack the capital to invest in sustainable practices despite long-term benefits. Another significant barrier is the lack of awareness and understanding of sustainability principles among key stakeholders. This is compounded by the absence of standardized guidelines and metrics for measuring sustainability in projects, leading to inconsistent application across industries. A survey by McKinsey & Company found that 44% of companies cited the complexity of integrating sustainability into existing frameworks as a major obstacle to large-scale adoption. Finally, regulatory and policy environments often do not incentivize sustainable practices. In many regions, environmental regulations are either weak or poorly enforced, allowing companies to ignore sustainability with minimal repercussions. In contrast, countries with stringent regulations, such as those in the European Union, have seen better integration of eco-management principles due to the combination of legal requirements and government incentives. Addressing these barriers requires a multi-faceted approach. Governments must play a crucial role by creating and enforcing regulations that promote sustainability and protect workers' rights. This could include introducing carbon pricing, providing subsidies for green technologies, and enforcing fair labor practices [13]. At the corporate level, companies should move beyond mere compliance and integrate sustainability into their core business strategies. This involves setting clear sustainability goals, measuring progress through standardized metrics, and ensuring transparency in reporting. Collaboration between governments, businesses, and civil society is essential to creating an environment where sustainable practices are the norm rather than the exception.

2.5. Best practices and innovative approaches

Exploring successful case studies, methodologies, and innovative strategies in integrating sustainability principles into project management reveals a diverse array of best practices that have yielded remarkable outcomes. Several case studies highlight exemplary instances where sustainability was seamlessly integrated into project management. For instance, the construction industry has seen projects achieve LEED (Leadership in Energy and Environmental Design) certification by employing eco-friendly materials, energy-efficient designs, and waste reduction strategies. These projects not only met environmental standards but also demonstrated cost-effectiveness and enhanced marketability. Certain methodologies have proven effective in embedding sustainability within project management frameworks.

Adopting Life Cycle Assessment (LCA) methodologies allowed organizations to comprehensively assess and mitigate environmental impacts across a project's lifecycle. Similarly, Triple Bottom Line (TBL) approaches ensured a balanced consideration of social, environmental, and economic aspects, guiding decisions toward sustainable outcomes. Innovation has played a pivotal role in fostering sustainability within project management. The use of advanced technologies like Building Information Modeling (BIM) facilitated efficient resource management, reduced material wastage, and enhanced collaboration among project stakeholders [14]. Additionally, agile project management methodologies have been adapted to incorporate sustainability iterations, enabling continuous improvement and adaptation to evolving sustainability goals. The successful integration of sustainability principles often hinges on effective stakeholder engagement. Projects that actively involved diverse stakeholders, including communities, governmental bodies, NGOs, and local residents, demonstrated a higher degree of acceptance, collaboration, and commitment to sustainable project outcomes. Adopting holistic approaches that consider the interconnectedness of sustainability elements throughout the project lifecycle has also proven highly effective. Incorporating circular economy principles, where materials are reused or repurposed, minimizes waste and contributes to a sustainable project ethos beyond project completion. Organizations that invested in educating and building the capacity of their workforce on sustainability principles witnessed smoother integration. Training programs, workshops, and certifications focused on sustainability empowered project teams to implement best practices effectively. Additionally, successful projects often tailored sustainability approaches to fit local contexts while aligning with global sustainability goals, such as the United Nations' Sustainable Development Goals (SDGs) [15]. Projects that embraced these goals not only contributed to global initiatives but also gained recognition for their commitment to broader sustainability objectives.

2.6. Considerations in project lifecycle

Understanding the influence of sustainability considerations across the project lifecycle, from initiation to closure, illuminates the pivotal role these factors play in shaping environmentally responsible outcomes.

Initiation Phase: During the project initiation phase, laying the groundwork for sustainability sets the tone for the entire project. Here, key decisions are made regarding project objectives, scope, and feasibility. Incorporating sustainability principles at this stage involves conducting environmental impact assessments, identifying potential risks to ecosystems or communities, and setting clear sustainability goals aligned with project objectives.

Planning and Design Phase: In the planning and design phase, the integration of sustainability principles takes center stage. This phase involves choosing materials, technologies, and methodologies that minimize environmental impact while maximizing efficiency. Concepts like Life Cycle Assessment (LCA) come into play, guiding decisions on resource usage, energy efficiency, waste reduction, and selecting eco-friendly materials [16]. Design considerations aim to optimize environmental performance without compromising project goals.

Execution Phase: As the project moves into the execution phase, translating sustainability plans into action becomes crucial. Implementing environmental management systems, adhering to environmental regulations, and monitoring key performance indicators related to sustainability help ensure that the project aligns with its environmental objectives. Collaboration with stakeholders, including suppliers and contractors, plays a critical role in ensuring that sustainability practices are effectively executed on the ground.

Monitoring and Control Phase: The monitoring and control phase involves ongoing assessment and adjustment of sustainability initiatives. Continuous monitoring of environmental impacts, tracking resource usage, and assessing compliance with sustainability benchmarks allow for timely intervention and corrective actions. Regular audits and performance reviews help in identifying areas for improvement and maintaining alignment with sustainability goals.

Closure and Post-Project Phase: As the project reaches closure, focusing on environmentally responsible closure practices is essential. Proper disposal of materials, site restoration, and transitioning to sustainable post-project operations are integral. This phase also involves evaluating the project's overall environmental performance, documenting lessons learned, and disseminating best practices for future projects.

2.7. Stakeholder engagement and impact assessment

The role of stakeholder engagement in sustainability integration within projects and the methods employed to assess its impact on stakeholders and project outcomes is crucial for ensuring alignment, transparency, and positive impacts. Stakeholder engagement is a cornerstone in the successful integration of sustainability into projects [17]. It involves identifying and involving diverse stakeholders, including communities, local authorities, NGOs, investors, and employees, throughout the project lifecycle. Their insights, concerns, and perspectives are essential in shaping sustainability strategies and decisions. Assessing the impact of sustainability integration on stakeholders requires robust methodologies. Surveys, interviews, focus groups, and workshops facilitate gathering stakeholders' perceptions, expectations, and concerns regarding sustainability initiatives. These methods aid in understanding stakeholders' attitudes towards sustainability, identifying their needs, and evaluating the effectiveness of engagement efforts. Analyzing the influence of stakeholder engagement on project outcomes involves assessing how their involvement affects decision-making, project design, and implementation. Key performance indicators (KPIs) related to stakeholder satisfaction, participation rates, changes in behavior or policies, and overall project success serve as benchmarks to measure stakeholder impact on project outcomes [18].

Tools such as Social Return on Investment (SROI), stakeholder mapping, and materiality assessments aid in comprehensively evaluating the impact of sustainability integration on stakeholders. SROI measures social, environmental, and economic outcomes to quantify the value created by stakeholder engagement. Stakeholder mapping identifies the significance and influence of different stakeholders on project decisions. Materiality assessments prioritize sustainability issues based on their significance to stakeholders and the project's objectives. Effective stakeholder engagement not only ensures that diverse perspectives are considered but also

contributes to better decision-making, risk mitigation, and enhanced project credibility. It fosters trust, transparency, and accountability, ultimately leading to more sustainable and socially responsible project outcomes. Challenges in assessing stakeholder impact include the complexity of stakeholder dynamics, diverse interests, and the subjective nature of qualitative data. Balancing conflicting stakeholder interests and expectations while aligning them with project goals can also pose challenges.

The application of sustainable practices at the level of an individual enterprise is not only possible but also increasingly common across various sectors. For instance, in the agriculture sector, companies like Patagonia Provisions have implemented regenerative farming practices to restore soil health and reduce carbon emissions. Similarly, in the construction industry, firms are adopting green building standards like LEED to minimize environmental impact. While some argue that sustainability can only be achieved on a global scale, these examples demonstrate that individual enterprises can make significant contributions. However, the success of these initiatives often depends on the availability of resources, expertise, and supportive policy frameworks. To promote broader adoption, it is crucial to showcase successful case studies, provide incentives for sustainable practices, and offer guidance on integrating sustainability into business models.

2.8. Technology and tools for sustainable project management

Technological advancements and specialized tools play a pivotal role in enabling and enhancing sustainable project management practices, offering innovative solutions to address environmental, social, and economic considerations.

- 1) **Data Analytics and Decision Support Systems:** Advanced data analytics and decision support systems empower project managers to make informed decisions by analyzing vast amounts of data [19]. These tools assist in predicting environmental impacts, optimizing resource usage, and identifying opportunities for sustainability improvements throughout the project lifecycle.
- 2) **Building Information Modeling (BIM):** BIM is a technology that enables comprehensive digital representations of construction projects. It facilitates collaboration among stakeholders, improves design accuracy, and allows for efficient resource management. BIM's visualization capabilities aid in assessing environmental impacts, optimizing energy efficiency, and reducing waste during the construction phase.
- 3) **Internet of Things (IoT) and Sensor Technology:** IoT devices and sensor technology offer real-time monitoring and data collection capabilities. They enable the tracking of environmental metrics like energy consumption, emissions, and resource utilization, allowing for immediate intervention to optimize sustainability performance.
- 4) **Project Management Software with Sustainability Modules:** Project management software equipped with specialized sustainability modules integrates sustainability considerations into project planning, execution, and reporting. These modules often include features for tracking carbon footprint, managing green certifications, and ensuring compliance with sustainability standards.

- 5) Life Cycle Assessment (LCA) Software: LCA software facilitates a comprehensive assessment of a project's environmental impacts across its entire life cycle. It helps in identifying hotspots, evaluating alternative materials or processes, and making informed decisions to minimize environmental footprints.
- 6) Remote Monitoring and Collaboration Tools: Remote monitoring tools and collaboration platforms enable geographically dispersed teams to work together seamlessly. These tools reduce the need for travel, thus lowering carbon emissions, while still fostering effective communication and collaboration among project stakeholders.
- 7) Blockchain for Transparency and Traceability: Blockchain technology ensures transparency and traceability in supply chains, allowing for the verification of sustainable sourcing practices, ethical labor, and adherence to environmental standards. It enhances trust among stakeholders by providing immutable records of sustainability-related transactions.
- 8) Virtual Reality (VR) and Augmented Reality (AR): VR and AR technologies aid in simulating and visualizing sustainable designs, enabling stakeholders to experience and assess the environmental impacts of different project scenarios. They facilitate better understanding and decision-making, especially in complex construction and infrastructure projects.

2.9. Regulatory frameworks and standards

The integration of sustainability principles into project management is significantly influenced by a myriad of global, regional, and industry-specific regulations, standards, and certifications. These frameworks serve as guiding principles and benchmarks for organizations aiming to align their projects with sustainability objectives.

Global Regulations and Initiatives: Global initiatives, such as the United Nations' Sustainable Development Goals (SDGs), provide a comprehensive framework for sustainable development. The 17 SDGs encompass diverse sustainability aspects, influencing project management practices worldwide by encouraging alignment with broader global sustainability objectives.

Regional Regulations and Policies: Various regions have their specific regulations and policies that influence project management. For instance, the European Union (EU) has directives focusing on environmental protection, energy efficiency, and waste management, impacting projects within member countries [20]. Regional bodies often set standards regarding emissions, resource usage, and sustainability reporting, affecting project planning and execution.

Industry-Specific Standards and Certifications: Industry-specific standards and certifications play a crucial role in shaping sustainability practices within sectors. For example, within the construction industry, Leadership in Energy and Environmental Design (LEED) and Building Research Establishment Environmental Assessment Method (BREEAM) certifications set benchmarks for environmentally responsible building practices. Similarly, industries like manufacturing, energy, and agriculture have their set of standards guiding sustainable practices in their respective domains.

ISO Standards for Sustainability: The International Organization for Standardization (ISO) offers a range of standards relevant to sustainability in project management. ISO 14001 focuses on environmental management systems, ISO 26000 addresses social responsibility, and ISO 9001 outlines quality management systems—all of which intersect with project management and sustainability, influencing processes and practices.

Carbon Offsetting and Emissions Trading Schemes: Carbon offsetting mechanisms and emissions trading schemes, while not specific to project management, influence sustainability strategies. These frameworks incentivize or require organizations to offset their carbon emissions, influencing project decisions regarding energy usage, carbon reduction strategies, and investments in renewable energy projects.

Government Policies and Incentives: National governments often introduce policies and incentives to promote sustainable practices. Tax incentives, grants, and subsidies aimed at encouraging sustainable projects can significantly impact project planning and investment decisions.

Supply Chain and Procurement Standards: Standards and certifications related to supply chain and procurement practices, such as Fair Trade, Responsible Sourcing, or Forest Stewardship Council (FSC) certification, influence project material sourcing and supplier selection, ensuring adherence to sustainability criteria [21].

2.10. Social and ethical dimensions in sustainable projects

In sustainable project management, the social and ethical dimensions hold significant importance, encompassing various aspects that extend beyond environmental considerations. These dimensions involve fostering community engagement, addressing ethical considerations, and conducting social impact assessments to ensure holistic and responsible project outcomes.

Community Engagement: Engaging with local communities affected by projects is fundamental in sustainable project management. Meaningful engagement involves active participation, collaboration, and dialogue with stakeholders to understand their needs, concerns, and aspirations [22]. It enables projects to align with community interests, mitigate potential social disruptions, and foster a sense of ownership and support.

Ethical Considerations: Ethical considerations encompass a range of aspects, including fair labor practices, human rights, transparency, and integrity in project execution. Upholding ethical standards ensures that projects respect the dignity, rights, and well-being of individuals involved, including workers, stakeholders, and affected communities.

Social Impact Assessments: Conducting social impact assessments evaluates the potential positive and negative social effects of projects [23]. It involves identifying, predicting, and mitigating social risks or adverse impacts on communities, cultures, employment, and social infrastructure. These assessments inform decision-making processes and guide strategies to maximize positive social outcomes.

Inclusivity and Diversity: Promoting inclusivity and diversity within project teams and stakeholder engagement efforts is crucial. Embracing diverse perspectives,

cultures, and backgrounds not only enriches project outcomes but also ensures equitable participation and representation of all stakeholders [24].

Respect for Cultural Heritage and Traditions: Projects must respect cultural heritage, traditions, and local knowledge systems. Respecting and preserving cultural values, historic sites, and indigenous knowledge contribute to maintaining social harmony and honoring the identity of affected communities.

Labor and Human Rights Compliance: Ensuring adherence to labor standards and human rights principles within project activities is paramount. This includes fair wages, safe working conditions, and respecting workers' rights, contributing to social well-being and sustainability.

Sustainable Livelihoods and Community Development: Sustainable projects aim to enhance local economies and promote community development. Creating opportunities for skill development, employment, and capacity building fosters sustainable livelihoods, empowering communities for long-term prosperity.

Social Responsibility and Accountability: Promoting social responsibility and accountability involves transparent communication, reporting on social impacts, and taking responsibility for any adverse effects caused by the project. It demonstrates commitment to addressing social concerns and learning from project experiences.

2.11. Economic implications of sustainability integration

Integrating sustainability principles into projects bears significant economic implications that extend beyond upfront costs. While initial investments may seem higher, the long-term economic benefits often outweigh these expenses.

Cost-Effectiveness in the Long Run: Sustainability integration emphasizes resource efficiency, reducing waste, and optimizing energy consumption [25]. While these measures may involve higher initial costs, they lead to long-term savings through reduced operational expenses, lower energy bills, and minimized waste disposal costs.

Return on Investment (ROI): Investments in sustainability often yield favorable returns. Implementing energy-efficient technologies, adopting sustainable practices in supply chains, and enhancing product lifecycle management contribute to improved efficiency and competitiveness, resulting in a positive ROI over time.

Long-Term Financial Benefits: Sustainability initiatives can lead to enhanced brand reputation, increased market share, and improved customer loyalty [26]. Companies demonstrating commitment to sustainability often attract environmentally conscious consumers, investors, and partners, translating into long-term financial gains.

2.12. Cross-industry insights

Drawing insights from various industries reveals common trends and successful strategies in implementing sustainable project management practices.

Construction and Real Estate: In the construction sector, adopting green building practices not only reduces environmental impact but also attracts tenants willing to pay premiums for sustainable spaces. Long-term savings on operational costs due to energy-efficient designs and reduced maintenance contribute significantly to economic gains.

Manufacturing and Supply Chain Management: Implementing sustainability measures in manufacturing processes results in reduced waste, optimized use of raw materials, and enhanced efficiency [27]. Companies investing in renewable energy sources and sustainable supply chain practices experience cost savings and resilience against resource price fluctuations.

Technology and Innovation: The technology sector leverages sustainability through innovations in energy-efficient products, responsible e-waste management, and data center optimization. Embracing circular economy principles by designing products for durability and recycling contributes to economic benefits while reducing environmental impact.

Hospitality and Tourism: In hospitality, eco-friendly initiatives like water and energy conservation not only reduce operating costs but also attract eco-conscious travelers, enhancing market competitiveness and profitability. Sustainable tourism practices preserve natural resources, supporting local economies in the long term.

Finance and Investment: Financial institutions increasingly consider Environmental, Social, and Governance (ESG) criteria in investment decisions. Companies adhering to strong ESG principles often attract investors seeking long-term sustainable returns, driving capital towards sustainable projects [28].

Retail and Consumer Goods: Sustainable packaging, ethical sourcing, and responsible production practices resonate with environmentally conscious consumers, driving sales and brand loyalty. Companies investing in sustainability initiatives witness increased market share and customer trust.

2.13. Educational and training initiatives

Educational programs, training initiatives, and capacity-building efforts are pivotal in preparing project managers with the skills and knowledge required for effective sustainable project management. These initiatives encompass various aspects aimed at fostering expertise in integrating sustainability principles into project planning, execution, and evaluation.

Academic Programs and Courses: Many universities offer specialized academic programs, courses, and degrees focused on sustainable project management. These programs cover topics such as environmental sustainability, social responsibility, green technologies, and ethical considerations in project management [29]. They equip students with theoretical knowledge and practical skills essential for implementing sustainability in projects.

Certifications and Professional Development Programs: Certifications, such as LEED accreditation, Project Management Professional (PMP) with a focus on sustainability, and ISO standards training, provide specialized knowledge and recognition of proficiency in sustainable project management practices. Professional development programs offer ongoing training, workshops, and seminars to keep project managers updated with the latest trends and best practices in sustainability.

In-House Training and Workshops: Organizations often conduct in-house training sessions and workshops tailored to their specific industry or project needs. These sessions focus on integrating sustainability into the company's project

management methodologies, emphasizing practical applications and case studies relevant to their projects.

Online Learning Platforms and Resources: Online platforms offer a plethora of resources, including webinars, e-learning courses, articles, and videos dedicated to sustainable project management. These resources provide flexibility for self-paced learning, allowing project managers to access valuable insights and knowledge at their convenience.

Collaborative Learning and Knowledge Sharing: Encouraging collaboration and knowledge sharing among project managers through forums, networking events, and community platforms fosters an environment for exchanging best practices, lessons learned, and innovative approaches in sustainable project management.

Experiential Learning and Practical Applications: Hands-on experiences, internships, and real-life project simulations offer invaluable learning opportunities. Engaging in practical applications enables project managers to implement sustainability concepts, navigate challenges, and apply learned skills in real-world scenarios [30].

Soft Skills Development: In addition to technical expertise, developing soft skills such as communication, stakeholder engagement, leadership, and change management is essential. These skills are critical for effectively navigating the human aspects of sustainable project management, including stakeholder buy-in, collaboration, and effective communication of sustainability goals.

2.14. Risk management and resilience in sustainable projects

Risk management strategies in sustainable projects encompass identifying, assessing, and mitigating environmental risks and uncertainties. This involves conducting thorough environmental impact assessments, scenario planning for climate-related risks, and developing contingency plans to mitigate potential environmental disruptions [31]. Resilience-building focuses on enhancing a project's ability to adapt and recover from environmental challenges. Strategies include diversifying resource inputs, incorporating flexibility in project designs, adopting sustainable practices that reduce vulnerability to environmental risks, and integrating adaptive management approaches. Implementing adaptive management practices involves continuously monitoring environmental factors, adjusting project strategies in response to changing conditions, and fostering learning and innovation. It allows projects to adapt to unforeseen environmental changes, ensuring ongoing sustainability amidst uncertainties. Engaging stakeholders in risk identification and management processes fosters collective understanding and proactive measures to address environmental risks. Involving diverse perspectives enables the identification of risks that might not be immediately apparent, ensuring comprehensive risk mitigation strategies.

2.15. Measurement and metrics for sustainability integration

Life Cycle Assessments (LCA): LCA methodologies quantify environmental impacts across a project's life cycle, including resource use, emissions, and waste

generation. These metrics help evaluate the environmental performance of projects and identify areas for improvement in sustainability practices [32].

Carbon Footprint and Emissions Reductions: Measuring carbon footprint and tracking emissions reductions serve as key indicators of environmental impact reduction. Metrics related to greenhouse gas emissions, energy efficiency improvements, and adoption of renewable energy sources quantify a project's contribution to mitigating climate change.

Social Impact Assessments: Social impact assessments gauge the project's effects on communities, stakeholders, and social well-being. Metrics encompass indicators like employment generation, community development, social equity, and stakeholder satisfaction, providing insights into the project's societal contributions.

Financial Performance and ROI: Evaluating financial performance through metrics like return on investment (ROI), cost savings from sustainable practices, and market competitiveness due to sustainability initiatives measures the economic impact of sustainability integration.

Compliance with Standards and Certifications: Adherence to industry standards, certifications (such as LEED, BREEAM), and regulatory compliance metrics demonstrates the project's commitment to meeting established sustainability benchmarks.

Stakeholder Perception and Engagement Metrics: Surveys, feedback mechanisms, and qualitative assessments capture stakeholder perceptions and engagement levels regarding sustainability initiatives. Metrics include measures of stakeholder satisfaction, trust, and involvement in project decision-making processes related to sustainability.

2.16. Cultural and behavioral aspects

The successful implementation of sustainable project management practices is deeply influenced by cultural dynamics, behavioral factors, and leadership styles within organizations. Understanding and leveraging these aspects are crucial for fostering a sustainable project management ethos.

Organizational Culture: The prevailing organizational culture significantly shapes the adoption of sustainable practices. Cultures that prioritize innovation, collaboration, transparency, and social responsibility tend to embrace sustainability more readily. An organizational culture that values long-term thinking and environmental stewardship fosters a conducive environment for sustainable project management.

Behavioral Factors: Individual behaviors and attitudes play a pivotal role in the adoption of sustainable practices. Employee engagement, commitment, and willingness to embrace change impact the success of sustainability initiatives [33]. Encouraging behaviors such as environmental consciousness, resourcefulness, and open communication facilitates the integration of sustainability into project management.

Leadership Influence: Leadership styles greatly influence the organizational approach toward sustainability. Transformational leaders who articulate a clear vision, champion sustainability, and lead by example inspire teams to embrace sustainable

practices. Their commitment to sustainability fosters a culture where sustainability is seen as a core organizational value.

Employee Engagement and Empowerment: Empowering employees by involving them in decision-making processes related to sustainability initiatives fosters ownership and commitment. Engaged employees contribute innovative ideas, drive change, and advocate for sustainable practices within their teams, enhancing the overall success of sustainability integration.

Change Management Strategies: Effective change management strategies are essential for embedding sustainability into organizational norms. Addressing resistance to change, communicating the benefits of sustainability, providing training and support, and celebrating successes are critical components of successful change management [34].

Cross-Functional Collaboration: Promoting collaboration among diverse departments and stakeholders facilitates the integration of sustainability into project management. Breaking down silos and encouraging cross-functional teamwork enables the alignment of diverse perspectives and expertise towards sustainable project goals.

Long-Term Vision and Strategic Alignment: A long-term vision aligned with sustainability goals ensures that projects are not solely focused on short-term gains but also consider their broader impact. Strategic alignment of sustainability initiatives with organizational objectives creates a framework where sustainability becomes an inherent part of project planning and execution.

Incentives and Recognition: Rewarding and recognizing individuals or teams for contributions to sustainability fosters a culture that values and encourages sustainable practices. Incentives, such as performance bonuses tied to sustainability goals, motivate employees to actively participate in sustainable project management.

3. Theoretical framework

One potent theory that strongly supports the integration of sustainability into project management is the “Triple Bottom Line” (TBL) theory. The Triple Bottom Line theory, introduced by John Elkington in the 1990s, suggests that organizations should evaluate their performance not only based on economic gains (the traditional bottom line) but also on social and environmental factors. Elkington, a British author and entrepreneur, first coined the term in his book “Cannibals with Forks: The Triple Bottom Line of 21st Century Business [35]. It encompasses three dimensions: profit, people, and planet. The TBL theory proposes that sustainable business practices consider the economic, social, and environmental impacts of business decisions. The Triple Bottom Line theory aligns seamlessly with the essence of sustainable project management by broadening the scope of project success criteria beyond financial gains. It emphasizes the integration of sustainability principles and environmental considerations within project management frameworks. By incorporating the “people” and “planet” dimensions alongside the economic aspect, the theory advocates for project outcomes that prioritize not just profitability but also social well-being and environmental stewardship.

4. Future trends and recommendations

4.1. Future trends in sustainable project management

- 1) **Technology Integration:** Continued advancements in technology, including AI, IoT, and blockchain, will further revolutionize sustainable project management by enabling more accurate data collection, predictive analytics, and enhanced monitoring of sustainability metrics.
- 2) **Circular Economy Adoption:** Increasing focus on circular economy principles will reshape project designs, emphasizing resource efficiency, product lifecycle management, and waste reduction, thus minimizing environmental impact.
- 3) **Climate Resilience:** Projects will prioritize climate resilience strategies, incorporating adaptation measures to mitigate risks arising from climate change, such as extreme weather events and rising sea levels.
- 4) **ESG Integration:** Environmental, Social, and Governance (ESG) considerations will become integral in project financing and investment decisions, influencing project planning to align with ESG goals.
- 5) **Multi-Stakeholder Collaboration:** Enhanced collaboration among governments, industries, NGOs, and local communities will drive more inclusive and comprehensive approaches to sustainable project management.

4.2. Adherence to sustainable development by transnational companies in the context of globalization

Transnational companies (TNCs) operate across multiple countries, often with varying environmental and labor standards. In the context of globalization, these companies face pressure to adhere to the principles of sustainable development and respect for the environment and their personnel. However, the extent of their adherence varies significantly. Research shows that while many TNCs publicly commit to sustainability goals, their actual practices can be inconsistent. A report by the United Nations Conference on Trade and Development (UNCTAD) found that only 20% of the world's largest TNCs fully integrate sustainability into their core business strategies. The remaining 80% often engage in "greenwashing," where they promote environmentally friendly initiatives without substantial changes to their overall operations. Despite this, there are examples of TNCs that have successfully integrated sustainability into their global operations. For instance, Unilever has been recognized for its Sustainable Living Plan, which aims to decouple growth from environmental impact while increasing its positive social impact [36]. This includes adhering to strict environmental standards across all its global operations and promoting fair labor practices. The implementation of principles such as respect for workers' rights and fair wages by TNCs varies widely depending on the region and industry. In countries with strong labor laws, TNCs are often compelled to comply with these principles. However, in regions with weaker regulations, there is a significant gap between corporate commitments and actual practices. For instance, the apparel industry has faced scrutiny for labor practices in developing countries. According to the International Labour Organization (ILO), despite commitments to fair wages and safe working conditions, many factories supplying TNCs still operate

under poor conditions. This highlights the need for stronger international frameworks and more rigorous enforcement of labor standards to ensure that TNCs respect workers' rights globally. The graph shown in **Figure 3**, shows a significant increase in the integration of sustainability principles in project management frameworks from 2010 to 2020, rising from 40% to 85%. This trend reflects a growing recognition of the importance of sustainability in achieving long-term project success. **Figure 3** presents the Trend of sustainability integration in project management (2010–2020).



Figure 3. Trend of sustainability integration in project management (2010–2020).

Figure 4 presents the Environmental benefits of sustainable project management practices. This chart above displays the environmental benefits achieved through sustainable project management practices. These benefits include a 30% reduction in carbon emissions, a 25% decrease in water usage, a 20% reduction in waste generation, and a 15% improvement in biodiversity. These outcomes highlight the positive impact of integrating sustainability into project management.

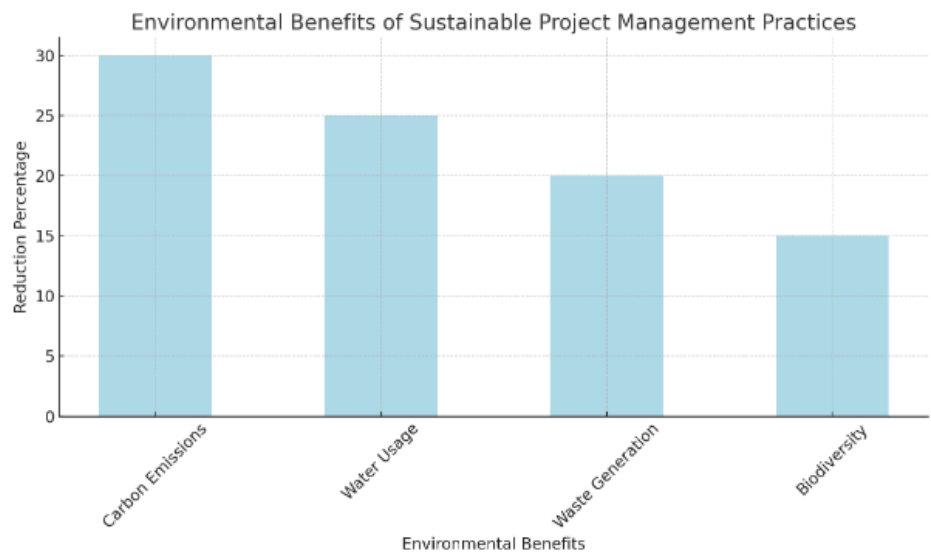


Figure 4. Environmental benefits of sustainable project management practices.

4.3. Recommendations for refining sustainable project management

- 1) Continuous Education and Training: Invest in ongoing education and training programs to equip project managers with evolving sustainability skills and best practices.
- 2) Metrics Enhancement: Develop standardized and universally accepted metrics for measuring sustainability impact, enabling better benchmarking and comparison across projects and industries.
- 3) Holistic Integration: Encourage a holistic approach to sustainability integration by considering social, environmental, and economic aspects throughout the project lifecycle.
- 4) Regulatory Alignment: Advocate for regulatory frameworks that incentivize and support sustainable practices, fostering a conducive environment for sustainable project management.
- 5) Innovation and Collaboration: Foster a culture of innovation and collaboration within organizations to encourage experimentation with new sustainable technologies and methodologies.
- 6) Transparency and Reporting: Emphasize transparent reporting of sustainability efforts, ensuring accountability and enabling stakeholders to make informed decisions.
- 7) Stakeholder Engagement: Strengthen stakeholder engagement by involving diverse voices, ensuring their concerns and perspectives are integrated into project planning and execution.
- 8) Resilience Planning: Integrate resilience planning into project strategies, accounting for uncertainties posed by climate change and other disruptive factors.

4.4. Practical applicability

In the context of sustainable project management, the TBL theory guides project managers to assess project success based on a broader set of criteria. It prompts project teams to evaluate projects not only in terms of financial viability but also in terms of their social impacts on stakeholders and their environmental footprints [37]. This theory advocates for measuring and reporting social and environmental outcomes alongside economic performance. The TBL theory offers a structured approach for decision-making in project management. It encourages project managers to consider the potential impacts of projects on people (stakeholders, community) and the planet (environment) while pursuing profitability. By using this approach, project managers can identify opportunities to integrate sustainability principles, ethical considerations, and environmentally friendly practices into project frameworks, ultimately promoting eco-friendly project outcomes and ensuring long-term sustainability.

Moreover, the TBL theory promotes stakeholder engagement and accountability. It encourages project managers to involve diverse stakeholders, considering their social and environmental concerns. This inclusive approach fosters collaboration, transparency, and shared responsibility among stakeholders in driving projects toward more sustainable and eco-friendly outcomes. In summary, the Triple Bottom Line theory provides a robust foundation for integrating sustainability principles and environmental considerations into project management. It offers a framework that

goes beyond financial metrics, emphasizing the importance of social and environmental impacts in project decision-making. By adopting this theory, project managers can effectively steer projects towards eco-friendly outcomes and long-term sustainability by balancing economic gains with social well-being and environmental preservation.

5. Conclusion

The exploration of sustainable project management practices signifies a transformative shift towards integrating sustainability principles and environmental considerations within project frameworks. This pursuit aims to transcend traditional project goals, prioritizing eco-friendly outcomes and long-term sustainability. The evaluation of these practices involves assessing the efficacy of embedding sustainability metrics, ethical sourcing, waste reduction strategies, and carbon footprint mitigation throughout project phases. Challenges emerge, including the lack of standardized guidelines and limited awareness, hindering seamless sustainability integration. Failure to bridge this gap threatens environmental stability and perpetuates unsustainable practices, emphasizing the urgency of cohesive sustainability integration in project management. This paradigm shift redefines project success, emphasizing a holistic approach that amalgamates economic viability with environmental preservation. The transformative potential of sustainable project management practices not only mitigates adverse environmental impacts but also fosters resilience within ecosystems. However, to attain enduring sustainability, concerted efforts are imperative to recalibrate project management methodologies towards eco-friendly outcomes.

The future of sustainable project management lies in leveraging emerging technologies and fostering cross-disciplinary collaboration. Digital tools, such as Building Information Modeling (BIM) and the Internet of Things (IoT), help in enhancing the efficiency and sustainability of projects. These technologies enable real-time monitoring and data-driven decision-making, which can significantly reduce waste and improve resource allocation. Moreover, collaboration between environmental scientists, behavioral experts, and project managers is essential for developing innovative strategies that drive sustainable practices. By breaking down silos and encouraging knowledge exchange, projects can be managed in a way that aligns with broader environmental goals while still delivering on time and within budget. The integration of sustainability principles within project management frameworks isn't a mere choice; it's an ethical imperative and a responsible commitment towards a sustainable future—a future where project success thrives in harmony with environmental preservation, leaving no room for debate.

Suggestions for further study

Suggestions for further study within the realm of sustainable project management practices open avenues for continuous exploration and advancement:

- 1) **Impact Assessment Frameworks:** Further research could focus on developing comprehensive impact assessment frameworks specific to sustainable project management. These frameworks would facilitate the quantification and

evaluation of environmental, social, and economic impacts arising from sustainable project practices, aiding in decision-making and reporting.

- 2) **Technology Integration:** Investigating the role of emerging technologies (e.g., AI, IoT, blockchain) in enhancing sustainability within project management offers promising research prospects. This exploration could focus on how these technologies facilitate eco-friendly practices, streamline processes, and optimize resource utilization.
- 3) **Cross-Cultural Sustainability:** Considering the global nature of projects, studying the implications of cultural diversity on sustainable project management is crucial. Research could assess how cultural differences influence sustainability perceptions, practices, and stakeholder engagement strategies across various regions.
- 4) **Policy and Regulatory Impact:** Exploring the influence of policies and regulations on sustainable project management practices is essential. Research could analyze how governmental policies, standards, and certifications shape the integration of sustainability principles into project frameworks.
- 5) **Resilience and Adaptability:** Given the dynamic nature of environmental challenges, researching resilience and adaptability within sustainable project management becomes imperative. This could involve studying strategies that enhance project resilience in the face of changing environmental conditions and unforeseen disruptions.

Conflict of interest: The author declares no conflict of interest.

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