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Sustainability in project management: A comprehensive review

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Abstract

This comprehensive review paper delves into the integration of sustainability principles within the realm of project management. The primary objective is to analyze how sustainability is being incorporated into project management practices and to identify the emerging trends and challenges in this integration. The methodology involves a systematic review of existing literature, encompassing academic journals, industry reports, and case studies, to provide a holistic view of the current state of sustainability in project management. Key findings reveal that sustainability in project management is increasingly gaining attention, driven by the growing recognition of environmental, social, and economic impacts. The study identifies three core dimensions of sustainability in project management: environmental responsibility, social equity, and economic viability. It highlights the evolving role of project managers in embedding these dimensions into project life cycles, from initiation to closure. The review also uncovers a range of tools and frameworks being employed to facilitate sustainable project management, such as life cycle assessment, stakeholder engagement strategies, and sustainability balanced scorecards. However, challenges persist, including a lack of standardized guidelines, difficulties in measuring sustainability outcomes, and resistance to change in traditional project management practices. The paper concludes that while strides have been made in integrating sustainability into project management, there is a need for more robust frameworks and educational efforts to enhance the adoption and effectiveness of sustainable practices. Future research directions are suggested, focusing on the development of standardized sustainability metrics and the exploration of the role of technology in enhancing sustainable project management practices.

Keywords: Sustainability; Project Management; Integration; Principles; Sustainability Concepts

1. Introduction

1.1. Importance of Sustainability in Project Management

In the contemporary project management landscape, the integration of sustainability has emerged as a pivotal concern, reflecting a paradigm shift towards more responsible and long-term oriented practices. This shift is driven by the increasing recognition of the environmental, social, and economic impacts of projects, necessitating a holistic approach that balances these dimensions for the benefit of current and future generations (Molaei et al., 2020). The importance of sustainability in project management is underscored by its potential to enhance project outcomes, foster stakeholder engagement, and contribute to the broader goals of sustainable development.

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Sustainability in project management is not merely an ethical imperative but also a strategic one. It involves the incorporation of the triple bottom line—People, Planet, and Prosperity—into project planning and execution (Molaei et al., 2020). This approach ensures that projects not only deliver economic value but also safeguard environmental resources and contribute positively to society. The integration of sustainability into project management practices is increasingly seen as a critical factor for the long-term success and viability of projects, especially in the context of global challenges such as climate change and social inequality.

The relevance of sustainability in project management is further highlighted by the evolving role of project managers. Today's project managers are expected to go beyond traditional project management competencies, incorporating sustainability considerations into every phase of the project lifecycle (Joel, 2016). This requires a comprehensive understanding of sustainability principles and the ability to apply them in diverse project contexts. Moreover, the integration of sustainability into project management aligns with international frameworks and initiatives, such as the United Nations Sustainable Development Goals, emphasizing the role of project management in achieving global sustainability targets (Toljaga-Nikolić et al., 2020).

Despite its growing importance, the integration of sustainability into project management is not without challenges. One of the primary challenges is the lack of standardized guidelines and metrics for measuring sustainability outcomes in projects (Larsson & Larsson, 2019). This creates difficulties in assessing the true sustainability impact of projects and in comparing different projects on sustainability parameters. Additionally, there is often resistance to change in traditional project management practices, which can hinder the adoption of sustainable practices.

The importance of sustainability in project management cannot be overstated. It represents a critical evolution in the field, aligning project objectives with the broader goals of sustainable development. As the world grapples with environmental and social challenges, the role of project management in driving sustainable outcomes becomes increasingly vital. Future research and practice in project management must continue to explore and refine the integration of sustainability principles, ensuring that projects contribute positively to the planet and its inhabitants.

1.2. Overview of the significance and growing relevance of sustainability in the project management field.

The significance and growing relevance of sustainability in project management have become increasingly prominent in the contemporary business and academic landscapes. This evolution reflects a broader societal shift towards sustainable practices, driven by the recognition of the finite nature of our planet's resources and the need for responsible stewardship. In the realm of project management, this shift has led to a reevaluation of traditional practices, emphasizing the integration of environmental, social, and economic considerations into the project lifecycle.

Sustainability in project management transcends the conventional focus on time, cost, and scope, introducing a multi-dimensional approach that considers the long-term impacts and benefits of projects. Gupta (2021) highlights the criticality of incorporating sustainability into project management activities, including conceptualization, budgeting, scheduling, and implementation. This integration is not only a response to environmental and social pressures but also a strategic move to ensure the viability and success of projects in a rapidly changing global context.

The growing emphasis on sustainability in project management is evident in the increasing use of sustainability indicators and frameworks. Stanitsas and Kirytopoulos (2021) emphasize the importance of identifying and employing sustainability indicators in construction project management. These indicators guide practitioners in aligning their projects with sustainable objectives, ensuring that environmental, social, and economic aspects are adequately addressed.

Furthermore, the relationship between project success and sustainable development has become a focal point of research. Moreno-Monsalve et al. (2022) explore this relationship, demonstrating that projects aligned with sustainable development principles tend to create more value. This finding underscores the strategic advantage of integrating sustainability into project management, as it contributes to the overall success and impact of projects.

The historical development and theoretical underpinnings of sustainability in project management have also been subjects of extensive study. Aliyu Sule M. and Nathaniel (2023) provide a critical analysis of the concept of sustainability in project management, tracing its evolution and examining its theoretical foundations. Their work highlights the depth and complexity of integrating sustainability into project management, indicating the need for a nuanced understanding of the concept and its application.

The significance and growing relevance of sustainability in project management are clear and compelling. This paradigm shift is not merely a response to external pressures but a proactive strategy to ensure the long-term success and impact of projects. As the field continues to evolve, it is imperative that project managers and stakeholders deepen their understanding of sustainability principles and integrate them effectively into their practices.

1.3. Evolution of Sustainable Practices in Project Management

The evolution of sustainable practices in project management marks a significant shift in the discipline, reflecting a broader societal and organizational commitment to sustainability. This evolution is characterized by the integration of environmental, social, and economic considerations into project planning, execution, and evaluation, moving beyond the traditional focus on time, cost, and scope. This paper explores the trajectory of this evolution, examining the impact of sustainability on project management methods, processes, practices, and knowledge areas, and how these have been reshaped to align with sustainable development goals.

The integration of sustainability into project management necessitates a reevaluation of traditional practices and strategies. Moehler, Hope, and Algeo (2018) discuss the challenges faced by the discipline in moving towards 'sustainable project management', highlighting the need for a deeper understanding of the levers that shape current practices and the potential for an evolutionary or revolutionary approach. This discussion underscores the complexity of integrating sustainability into project management and the need for a comprehensive rethinking of methods and processes.

The intersection of sustainability and project management is further explored by Banaduc, Mirea, and Draghici, who emphasize the importance of combining project management know-how with sustainability tools for the efficient implementation of sustainable objectives in urban projects (Banaduc, Mirea, & Draghici, n.d.). Their work provides insights into how the two fields can mutually benefit from each other, paving the way for a green and inclusive future.

Liu et al. (2020) conducted an empirical study to understand how project management practices (PMPs) impact the sustainable success of infrastructure projects. Their findings reveal that culture, strategy, implementation, and reflection in PMPs have direct and indirect relationships with infrastructure sustainable success (ISS), offering a new perspective on measuring sustainability success in project management.

Additionally, Malik, Ali, Latan, and Jabbour (2023) investigate the impact of green project management (GPM) practices on sustainable competitive advantage (SCA), highlighting the mediating role of green knowledge acquisition (GKA). Their study provides empirical evidence on the positive relationship between GPM practices and SCA, emphasizing the importance of GPM and GKA for achieving high performance in sustainable projects.

The evolution of sustainable practices in project management is a dynamic and multifaceted process, reflecting the growing recognition of the importance of sustainability in achieving long-term project success and alignment with global sustainability goals. This evolution challenges traditional project management paradigms and calls for a holistic approach that integrates sustainability at every stage of the project lifecycle.

1.4. A brief history of how sustainability has become a key consideration in project management.

The history of sustainability in project management is a narrative of gradual evolution, reflecting the changing priorities and values in business and society. This journey from traditional project management to a sustainability-focused approach has been shaped by the growing awareness of environmental, social, and economic challenges. This paper traces the development of sustainability as a key consideration in project management, examining the shift in practices, methodologies, and mindsets.

The integration of sustainability into project management began as a response to the increasing emphasis on corporate social responsibility and the need for businesses to address their environmental impact. Martens and Carvalho (2017) highlight the importance of viewing sustainability through the triple-bottom line perspective: economic, social, and environmental. Their research underscores the need to understand key aspects of sustainability in the project management context, emphasizing the role of sustainable innovation, stakeholder management, and environmental policies.

Molaei, Hertogh, Bosch-Rekvelde, and Tamak (2020) investigate the integration of sustainability in the early phases of infrastructure projects, developing a framework based on the triple bottom line of sustainability. Their study reveals the critical success factors for integrating sustainability in project management, such as awareness of external factors,

clearly defined scope, and goals. This research marks a significant step in understanding how sustainability can be effectively incorporated into project management practices.

Armenia, Dangelico, Nonino, and Pompei (2019) contribute to the discourse with a conceptualization-oriented review, proposing a new framework for sustainable project management. Their framework links key dimensions such as corporate policies, resource management, life cycle orientation, stakeholders' engagement, and organizational learning. This comprehensive approach reflects the multifaceted nature of sustainability in project management.

Woźniak (2021) explores the sustainable approach in IT project management, focusing on the client's role in choosing the project management methodology. The study demonstrates how internal sustainability perspectives, manifested in the matching of project management methodologies to the client, can significantly affect client satisfaction and project success. This research highlights the importance of considering sustainability in the context of client relationships and project outcome

The history of sustainability in project management is characterized by a growing recognition of the need to balance economic, social, and environmental objectives. This evolution has been driven by both external pressures and internal realizations within the project management community. As the field continues to evolve, it is clear that sustainability will remain a key consideration, shaping the future of project management practices.

1.5. Purpose of the Review

The purpose of this review is to synthesize and critically analyze the existing body of literature on a specific topic, providing a comprehensive overview of the current state of research and identifying gaps that may exist in the knowledge base. This review aims to offer a clear and coherent understanding of the subject matter, drawing on a range of academic sources to ensure a balanced and well-rounded perspective. The review is intended to serve as a valuable resource for scholars, practitioners, and students, offering insights and guidance for future research and practice.

The role of academic reviews in the advancement of knowledge cannot be overstated. As Munasinghe et al. (2022) emphasize, peer reviewers play a pivotal role in the academic writing and publication process, acting as gatekeepers who ensure the quality and integrity of scholarly work. This review seeks to emulate the standards of excellence upheld by peer reviewers, providing a thorough and rigorous examination of the literature.

Academic writing, as Dewasiri, Abeysekera, and Samarasinghe (2019) note, is characterized by clarity, conciseness, and coherence, backed by evidence. This review adheres to these principles, presenting information in a formal style that aids the reader's understanding. The review is structured to provide a clear and logical progression of ideas, ensuring that the content is accessible and informative.

Kostopoulou and O'Dwyer (2021) highlight the importance of peer review writing practices in English for Academic Purposes, underscoring the value of collaborative learning and knowledge transmission. This review draws on these principles, aiming to contribute to the collective understanding of the topic and facilitate further scholarly discussion.

Inouye and McAlpine (2019) discuss the development of academic identity in doctoral students, focusing on the role of writing and feedback. This review, while not focused on doctoral writing per se, seeks to contribute to the academic identity of its readers by providing a comprehensive and critical analysis of the literature, thereby supporting the development of budding researchers.

The purpose of this review is to provide a thorough and critical examination of the literature on a specific topic, offering insights and guidance for future research and practice. By adhering to the highest standards of academic writing and scholarship, this review aims to contribute to the advancement of knowledge in the field.

1.6. Outlining the objectives and scope of the comprehensive review.

The objective of this comprehensive review is to meticulously examine and synthesize the existing body of literature on a specified topic, providing a holistic understanding of the subject matter. The review aims to identify, analyze, and integrate key findings, theories, and discussions from a wide range of scholarly sources. By doing so, it seeks to offer a clear, coherent, and comprehensive overview of the current state of knowledge, highlighting significant trends, gaps, and areas for future research. The scope of this review encompasses a thorough examination of peer-reviewed articles, books, and other relevant academic publications, ensuring a rigorous and balanced analysis.

The importance of such comprehensive reviews in academic research cannot be overstated. As outlined by Mehra et al. (2020), systematic reviews play a crucial role in collating and evaluating existing research, thereby aiding in the formulation of evidence-based conclusions and recommendations. This review follows a similar approach, aiming to provide a structured and critical assessment of the literature.

The review also draws inspiration from the work of Yeung, Carpenter, and Corral (2021), who conducted a comprehensive review in the field of educational technology. Their methodology, focusing on objective learning outcomes in academic contexts, serves as a model for this review, emphasizing the importance of clear objectives and a well-defined scope.

Farooq's study on the market for sustainability assurance services (n.d.) is another exemplar of a comprehensive review that provides a thorough understanding of a new and evolving field. This review aims to mirror such depth and breadth in its analysis, covering a wide range of topics and perspectives within the chosen subject area.

Battisti et al. (2021) provide a comprehensive analysis of international marketing studies within the banking and finance context, offering an integrative framework that maps the existing literature. This review adopts a similar approach, seeking to integrate diverse findings into a coherent framework that can guide future research and practice.

In summary, the purpose of this review is to offer a detailed and critical examination of the literature, providing insights and guidance for future research and practice. By adhering to the highest standards of academic rigor and scholarship, this review aims to contribute significantly to the advancement of knowledge in the field.

1.7. Methodology: Detailed description of the methodology for the literature review, including data sources, search strategy, and selection criteria

The methodology of this comprehensive literature review is meticulously designed to ensure a thorough and systematic examination of the relevant academic literature. The process involves a structured approach to data sourcing, search strategy, and selection criteria, aiming to capture a wide range of perspectives and insights on the topic.

The primary data sources for this review include academic databases such as PubMed, Web of Science, Scopus, and Google Scholar. These databases are chosen for their extensive coverage of peer-reviewed articles across various disciplines. Additionally, grey literature sources, including reports, dissertations, and conference proceedings, are considered to provide a broader understanding of the topic, as highlighted by Koivu et al. (2021).

The search strategy employs a combination of keywords and Boolean operators to filter and retrieve relevant literature. The keywords are carefully selected based on the review's objectives and are used in various combinations to ensure comprehensive coverage. The search is limited to articles published in English within the last ten years to focus on the most current research while maintaining a manageable scope, as suggested by Gul and Guneri (2021).

The selection of articles is based on predefined inclusion and exclusion criteria. Inclusion criteria encompass articles that directly address the review's topic, are published in peer-reviewed journals, and contribute significantly to the understanding of the subject. Exclusion criteria include articles that are not in English, lack peer review, or do not directly relate to the review's objectives. The selection process involves screening titles and abstracts, followed by a full-text review of shortlisted articles, a method similar to that used by Khatri (2021).

To ensure the reliability and validity of the included studies, a quality assessment is conducted using established appraisal tools. This assessment evaluates the methodological rigor, relevance, and contribution of each study to the field, as demonstrated in the work of Upadhyay and Sa-ngiamwibool (2021).

The methodology of this literature review is designed to provide a comprehensive, systematic, and unbiased overview of the existing literature. By adhering to these methodological standards, the review aims to contribute valuable insights and a deeper understanding of the topic.

2. Literature Review

2.1. Concepts and Definitions of Sustainability in Project Management

The concept of sustainability in project management has evolved significantly over the years, becoming a central focus in both academic and professional circles. This section of the literature review delves into the various definitions and interpretations of sustainability within the context of project management, drawing from a range of scholarly sources.

Sule M. Aliyu and Jemimah Nathaniel (2023) provide a critical analysis of the theoretical discussion concerning sustainability in project management. They explore the history and goals of sustainability, emphasizing its importance and relevance to the environment. Their work offers a foundational understanding of how sustainability has been conceptualized in the field of project management.

Gabriela Banaduc, Nicoleta Mirea, and A. Draghici investigate the intersection between sustainability and project management, particularly in the context of urban projects targeting sustainable objectives (Banaduc, Mirea, & Draghici, 2022). Their systematic literature review highlights the exchange of strengths between project management know-how and sustainability tools, demonstrating the synergistic potential of integrating these two fields.

Toljaga-Nikolić, Marija Todorović, M. Dobrota, Tijana Obradović, and V. Obradović (2020) examine the integration of sustainability dimensions in project management. Their research reveals that the application of project management methodologies promotes the introduction of sustainability dimensions, particularly the social aspect. This study underscores the growing interest in sustainable project management and the challenges it poses for project managers.

Ferrarez, Claudia G. B. do Valle, Jeferson C. Alvarenga, F. C. Dias, D. Vasco, A. L. A. Guedes, C. Chinelli, A. Haddad, and C. A. Soares (2023) research key practices for incorporating sustainability in project management from the perspective of Brazilian professionals. Their study identifies five key practices: environmental efficiency, compliance, social responsibility, continuous improvement and lessons learned, and project success. This research contributes to understanding how sustainability actions can be improved in project management processes.

In summary, the literature reveals a diverse range of concepts and definitions of sustainability in project management. The integration of sustainability into project management practices is increasingly recognized as essential for achieving long-term success and aligning with global sustainability goals.

2.2. Exploration of the foundational concepts and varying definitions of sustainability as they apply to project management.

In the realm of project management, the concept of sustainability has evolved from a peripheral consideration to a central focus, reflecting the increasing importance of environmental, social, and economic responsibility in business practices. This literature review explores the foundational concepts and varying definitions of sustainability as they apply to project management, drawing insights from a range of academic sources.

Silvius and R. Schipper (2022) delve into the relationship between sustainability and project success, developing a conceptual model that provides a detailed understanding of how different dimensions of sustainability may affect individual criteria of project success. Their work highlights the positive relationships expected between sustainability and criteria such as stakeholder satisfaction, future readiness, and controlled project execution, while noting the uncertain relationship between sustainability and traditional success metrics like schedule and budget adherence.

This study provide a critical analysis of the theoretical discussion concerning sustainability in project management. They explore the history and goals of sustainability, emphasizing its relevance to the environment and its incorporation into project management. Their research offers a theoretical model that lays the foundation for understanding the integration of sustainability in project management.

Ferrarez, Claudia G. B. do Valle, Jeferson C. Alvarenga, F. C. Dias, D. Vasco, A. L. A. Guedes, C. Chinelli, A. Haddad, and C. A. Soares (2023) investigate key practices for incorporating sustainability in project management from the perspective of Brazilian professionals. Their study identifies five key practices: environmental efficiency, compliance, social responsibility, continuous improvement and lessons learned, and project success. This research contributes to understanding how sustainability actions can be improved in project management processes.

Toljaga-Nikolić, Marija Todorović, M. Dobrota, Tijana Obradović, and V. Obradović (2020) examine the integration of sustainability dimensions in project management. Their findings reveal that the application of project management methodologies promotes the introduction of sustainability dimensions, particularly the social aspect, across various sectors.

In summary, the literature reveals a diverse range of concepts and definitions of sustainability in project management. The integration of sustainability into project management practices is increasingly recognized as essential for achieving long-term success and aligning with global sustainability goals.

2.3. Theoretical Frameworks and Models

The exploration of theoretical frameworks and models in literature reviews is pivotal for understanding complex concepts and phenomena. In the context of project management, various theoretical models have been developed and employed to elucidate the multifaceted nature of sustainability. This section of the literature review examines these frameworks and models, drawing on a range of academic sources to provide a comprehensive understanding.

Milat, Bauman, and Redman (2015) discuss the use of theoretical frameworks in assessing research impact, particularly in public health. Their narrative literature review synthesizes evidence that describes processes and conceptual models for assessing policy and practice impacts of public health research. This approach is relevant to project management in that it offers a structured method for evaluating the impact of sustainability initiatives within projects.

Bergeron et al. (2017) focus on capacity building interventions that include theoretical foundations. Their systematic review identifies underlying theories, models, and frameworks used to support capacity building interventions relevant to public health practice. The findings of this review are applicable to project management, as they provide insights into how theoretical models can be used to enhance capacity and effectiveness in managing sustainable projects.

Marton and Choo (2012) provide an informal assessment of theoretical foundations and research methods used to study internet health information seeking. Their review of theory-driven survey studies offers valuable insights into how theoretical models can be applied to understand complex behaviors, which can be analogous to understanding stakeholder behaviors in sustainable project management.

Green (2014) debates the definition and use of theoretical and conceptual frameworks in qualitative research, highlighting the lack of clarity and understanding among researchers regarding these terms. This discussion is pertinent to project management literature, as it underscores the importance of clearly defining and employing theoretical and conceptual frameworks to enhance the rigor and clarity of research.

In summary, the literature reveals a diverse range of theoretical frameworks and models that have been employed to understand and assess various aspects related to sustainability in project management. These frameworks provide structured approaches for analyzing complex phenomena and contribute to a deeper understanding of sustainability's role in project management.

2.4. Review of various theoretical frameworks and models that integrate sustainability into project management.

The integration of sustainability into project management has been a subject of considerable academic interest, leading to the development of various theoretical frameworks and models. These frameworks aim to guide project managers in embedding sustainability into their practices, ensuring that projects not only achieve their immediate goals but also contribute positively to environmental, social, and economic sustainability. This literature review explores various theoretical frameworks and models that integrate sustainability into project management.

Madureira, Silva, Amorim, Ferreira Dias, Lins, and Mello (2022) contribute to the development of a new Sustainable Project Management (SPM) paradigm, focusing on the role of project managers. Their research under the Erasmus+ program Think Twice led to the creation of the Project Management Triple Sustainability Cube, a conceptual model designed to guide project managers in adopting comprehensive sustainability practices. This model emphasizes the triple bottom line sustainability vectors (environmental, social, and economic) and relates them to people, processes, and innovative solutions throughout the project lifecycle.

Zhou, Alcalá, and Yepes (2021) aim to establish an international framework for sustainable project management in engineering. Their research, which includes a literature review, mathematical programming algorithm, and case study, addresses the lack of research in this field and proposes a scientific theoretical basis for a new project management

system. This comprehensive international project management system model integrates sustainable development with project management, offering new frames and management models to promote sustainable development in the construction industry.

Silvius and Schipper (2022) explore the relationship between sustainability and project success, developing a conceptual model that provides a detailed understanding of how different dimensions of sustainability may affect project success criteria. Their study provides a conceptual mapping of the relationships between dimensions of sustainability and project success criteria, highlighting the positive relationships expected between sustainability and stakeholder satisfaction, future readiness, and controlled project execution.

Moreno-Monsalve, Delgado-Ortiz, Rueda-Varón, and Fajardo-Moreno (2022) investigate the relationship between project success and sustainable development. Their research, which includes a literature review and a survey of Colombian companies, applies a structural equation modeling (SEM) model to determine the relationship between selected variables. The results show that project success under a sustainable development approach has a positive tendency toward value creation, emphasizing the importance of impact, relevance, effectiveness, and efficiency in explaining project success through sustainable development and value creation.

These theoretical frameworks and models provide valuable insights into how sustainability can be effectively integrated into project management. They offer guidance for project managers and organizations seeking to align their projects with broader sustainability goals, ensuring long-term success and positive contributions to society and the environment.

2.5. Case Studies and Practical Applications

The practical application of sustainability in project management is best understood through case studies and real-world examples. These case studies provide valuable insights into how theoretical concepts are implemented in practice, offering lessons and strategies that can be applied in various project management contexts. This section of the literature review examines several case studies and practical applications of sustainability in project management.

Molaei, Hertogh, Bosch-Rekvelde, and Tamak (2020) investigate the factors affecting the integration of sustainability into the project management of infrastructure projects, specifically highway projects, during early phases. Their research is based on a comprehensive literature review and a qualitative cross-case analysis of three sustainability-oriented highway projects in the Netherlands. The study identifies critical success factors for integrating sustainability and conceptualizes a model for integrating key roles involved in the project management of infrastructure projects. This model is based on the triple bottom line of sustainability, bringing together all roles involved in project management.

Shah and Ganji (2019) present preliminary findings on the use of sustainable project management practices within social enterprise projects. Their research addresses the challenges arising from the lack of sustainable infrastructures in social-based projects in both for-profit and non-profit organizations. The study highlights the lack of sustainable behavior adoption within organizations and identifies opportunities for improvement in light of the economic and organizational context. The novelty of this research lies in developing an early understanding of the linkages between sustainable practices and project management programs within social projects.

García Villena, Gracia Villar, Dzul López, Álvarez, Delgado Noya, and Vidal Mazón (2021) plan an approach to a project framework that integrates a model for sustainability and CSR with the process groups of the Project Management Body of Knowledge (PMBOK®) standard. This framework is used to structure a Sustainability Management Plan, which incorporates sustainability criteria throughout the life cycle of a training project. The training proposal in Project Design, Management, and Evaluation was chosen through a multi-criteria selection process, demonstrating the integration of sustainability and CSR in project management standards.

Mrzygłocka-Chojnacka, Stanek, and Kuchta (2021) propose using simulation in the phase of project definition to choose implementation forms for individual project phases or tasks that facilitate the delivery of value expected by stakeholders. Their approach supports the process of agreeing on the value expected from the project among stakeholders. The case study shows that the application of simulation in the predictive project stage can significantly increase the project's probability of success.

These case studies and practical applications demonstrate the diverse ways in which sustainability can be integrated into project management. They provide valuable insights for project managers and organizations seeking to implement

sustainable practices in their projects, ensuring long-term success and positive contributions to society and the environment.

2.6. Examination of case studies that illustrate the application of sustainable practices in real-world projects.

The application of sustainable practices in real-world projects is a critical area of study in project management. Case studies provide valuable insights into how sustainability principles are implemented in various contexts, offering lessons and strategies that can be applied in similar situations. This literature review examines several case studies that illustrate the application of sustainable practices in real-world projects.

Chatty, Harrison, Ba-Sabaa, Faludi, and Murnane (2022) conducted a case study at an engineering consultancy firm to identify considerations that influence the integration of sustainable design practices into real-world product development (PD) practices. Through a human-centered design process, they co-created a reusable, modular framework of practices that aids in the selection of relevant strategies based on environmental hotspots, the stage of the PD process, and the client's sustainability priorities. This case study highlights the importance of co-creation in enhancing receptivity and retention of sustainable practices.

Yunus, Handan, and Riazi (2020) present a case study to test the Guidelines for Sustainable Construction of Industrialized Building System (GSCIBS). The study assesses the implementation of these guidelines in real projects, contributing towards the improvement of the guidelines and ensuring the significance of decision tools in promoting sustainability. The case study analysis involved semi-structured interviews and document reviews, confirming the applicability and suitability of the guidelines in Malaysia.

Fleacă, Fleacă, and Maiduc (2023) focus on education as a system in their study, developing a conceptual design of deployed teaching processes for a real-world project scenario aimed at mainstreaming sustainability into the curriculum in the case of business engineering. The research process included the application of functional decomposition and the SIPOC method, providing new possibilities for teaching sustainability through process-centric views and tested methodologies.

Eckersten, Gunnarsson-Östling, and Balfors (2022) analyze strategic choice of measures (SCM) processes from a systems perspective in the early-stage planning of transport infrastructure projects in Sweden. The case study approach, based on observations and document studies, shows that coordination of transport and land-use planning practice in the SCM process requires handling conflicting views of development and creating shared objectives and visions. The study emphasizes the importance of understanding synergies and the relationships between transport, land-use, and environmental problems.

These case studies demonstrate the diverse ways in which sustainability can be integrated into various types of projects. They provide valuable insights for project managers and organizations seeking to implement sustainable practices, ensuring long-term success and positive contributions to society and the environment.

3. Sustainability Dimensions in Project Management

3.1. Environmental Aspects: Discussion of how environmental considerations are incorporated into project management processes.

The integration of environmental considerations into project management processes is a critical aspect of sustainable project management. This section of the literature review explores how environmental aspects are incorporated into project management, drawing on recent research and case studies.

Toljaga-Nikolić, Todorović, Dobrota, Obradović, and Obradović (2020) examine the integration of sustainability dimensions in project management methodologies across different sectors. Their study reveals that the application of these methodologies promotes the introduction of sustainability dimensions, particularly the environmental aspect. The research underscores the need for project managers to gain knowledge and skills in sustainable project management, highlighting the challenges and opportunities in incorporating environmental considerations.

Nikolic, Vasović, Filipović, Musicki, and Ristic (2016) focus on the environmental management system (EMS) improvement in mining and energy complexes. Their study applies project management processes to enhance EMS, demonstrating the significant impact of large mining and energy complexes on environmental quality. The research

utilizes the Critical Path Method in network planning to represent the logical structure of the environmental protection system, offering a practical approach to integrating environmental aspects into project management.

Gallo Vechi, N.R., Casteli Figueiredo Gallardo, A.L. and Teixeira, C.E., (2016) address the environmental aspects of the construction industry, particularly in the context of small and medium enterprises (SMEs). Their research develops a framework for identifying environmental aspects associated with construction activities, assisting in the adoption of EMS in the Brazilian sector. This study highlights the importance of recognizing environmental impacts and implementing management systems to mitigate them.

Gupta (2021) conducts a literature assessment on diverse topics impacting project management sustainability, including environmental considerations. The study identifies and discusses the use of computational processes to approximate and optimize sustainability challenges in project management. Gupta proposes an integrated framework that includes a feedback function for evaluating each decision and action to ensure the long-term viability of projects.

The incorporation of environmental aspects into project management processes is essential for achieving sustainable outcomes. The reviewed studies provide valuable insights into the challenges and strategies for integrating environmental considerations, emphasizing the need for knowledge, skills, and practical frameworks to guide project managers in this endeavor.

3.2. Social and Ethical Considerations

The integration of social and ethical considerations into project management is a vital component of sustainability. This section of the literature review explores how these aspects are incorporated into project management processes, drawing on recent research and studies.

Trocki, Juchniewicz, and Bukłaha (2020) examine the development of socially responsible project-related activities, highlighting how the idea of social responsibility emerged as a natural consequence of the evolution of an organization with respect to sustainable development. Their study defines the place and role of project management in socially responsible development and discusses different views on the subject from authors in various countries. The research includes findings from surveys focused on the role and relevance of social responsibility in project management in Poland, providing insights into the practical application of these concepts.

Ershadi, Jefferies, Davis, and Mojtahedi (2021) investigate the incorporation of environmental sustainability in project portfolio management by construction contractors. Their study aims to provide an understanding of the benefits of applying project portfolio management in achieving sustainable development. The findings, in terms of potential sustainability actions, offer insights into considering sustainability as an important factor in the selection and execution of projects, particularly regarding contractors' level of capability and ethical impacts.

This study considers the principles and approaches to project management aimed at providing ecosystem services by business structures, taking into account the principles of sustainable development. The article emphasizes the importance of an integrated approach that considers economic, environmental, and social aspects of projects. It also highlights the importance of involving all stakeholders and partners to achieve the most positive results, underlining the significance of innovation, an ethical approach, and a long-term perspective in project planning and implementation.

Kyriakogkonas, Garefalakis, Pappa, and Kagias (2022) provide a theoretical framework for companies and organizations to incorporate sustainability criteria into the project management process. The study focuses on the benefits businesses receive from implementing sustainability methods in their decision-making to act responsibly and have a beneficial impact on the environment and people affected by their operations.

The integration of social and ethical considerations into project management is essential for achieving sustainable outcomes. The reviewed studies provide valuable insights into the challenges and strategies for incorporating these considerations, emphasizing the need for knowledge, skills, and practical frameworks to guide project managers in this endeavor.

3.3. Analysis of the social and ethical dimensions of sustainability in project management.

The social and ethical dimensions of sustainability in project management encompass a broad range of considerations, from stakeholder engagement and community impact to ethical decision-making and social responsibility. This section of the literature review explores how these dimensions are integrated into project management practices, drawing on recent research and studies.

Toljaga-Nikolić, Todorović, Dobrota, Obradović, and Obradović (2020) investigate the integration of sustainability dimensions in project management methodologies across various sectors. Their study reveals that these methodologies support the introduction of sustainability dimensions, with a particular emphasis on the social aspect. The research highlights the challenges project managers face in incorporating sustainability and underscores the need for acquiring relevant knowledge and skills in sustainable project management.

Silva, Rincón-González, and Díez-Silva (n.d.) present empirical research on the perception of project managers in the construction industry in Colombia regarding the implementation of sustainability elements in projects. The study, based on the maturity model of Salem Azahrani, indicates a low average level of maturity in sustainability integration, with a higher orientation toward economic dimensions compared to social and environmental aspects.

Armenia, Dangelico, Nonino, and Pompei (2019) contribute to the research knowledge through a systematic review of literature on the integration of project management and sustainability. Their study aims to clarify the research domains of sustainable project management and understand the current state of development and future research directions. The proposed conceptual framework links key dimensions of sustainable project management, including corporate policies, resource management, life cycle orientation, stakeholder engagement, and organizational learning.

Just (2020) investigates risk and project management in business performance, considering sustainability issues. The study focuses on balancing factors within the social, economic, and ecological dimensions and handling trade-offs in time and space, which are at the core of sustainability thinking. This research emphasizes the changing expectations for sustainability and the demands for efficiency in planning, constructing, and maintaining the environment.

The social and ethical dimensions of sustainability in project management are critical for achieving sustainable outcomes. The reviewed studies provide valuable insights into the challenges and strategies for integrating these considerations, emphasizing the need for knowledge, skills, and practical frameworks to guide project managers in this endeavor.

3.4. Economic Sustainability

Economic sustainability in project management involves ensuring that projects are financially viable and contribute positively to the economic well-being of the stakeholders and the broader community. This section of the literature review examines how economic sustainability is integrated into project management, drawing on recent research and studies.

Kirchhof and Brandtweiner (2011) discuss the potential of incorporating sustainability in project management, emphasizing the need to focus on ecological, social, and economic aspects. Their paper highlights the creation of additional value for companies through the implementation of an integrated management approach that includes sustainability. This approach underscores the importance of considering economic sustainability alongside environmental and social factors in project management.

Toljaga-Nikolić, Todorović, Dobrota, Obradović, and Obradović (2020) explore the integration of sustainability dimensions in project management methodologies across different sectors. Their study reveals that these methodologies promote the introduction of sustainability dimensions, including economic aspects. The research highlights the challenges project managers face in incorporating sustainability and the need for acquiring relevant knowledge and skills in sustainable project management.

Madureira, Silva, Amorim, Ferreira Dias, Lins, and Mello (2022) contribute to the development of a new Sustainable Project Management (SPM) paradigm, focusing on the role of project managers. Their research presents the Project Management Triple Sustainability Cube, a conceptual model designed to guide project managers in adopting comprehensive sustainability practices. This model emphasizes the triple bottom line sustainability vectors (environmental, social, and economic) and relates them to people, processes, and innovative solutions throughout the project lifecycle.

Woźniak (2021) proposes a sustainable approach to IT project management, involving the client in choosing the project management methodology. The study assesses how the internal perspective of sustainability in IT projects affects overall client satisfaction and the project's success. The research highlights the importance of matching IT project management methodology to the client type as a key factor determining the level of client satisfaction and the economic success of the project.

Economic sustainability in project management is essential for ensuring the long-term viability and success of projects. The reviewed studies provide valuable insights into the strategies for integrating economic considerations, emphasizing the need for a balanced approach that includes environmental and social aspects.

3.5. Examination of economic sustainability practices within the project management context.

Economic sustainability in project management focuses on ensuring that projects are financially viable, contribute to economic development, and do not compromise the financial stability of the stakeholders involved. This section of the literature review examines the practices and approaches that facilitate economic sustainability within the context of project management.

Petrelli, Júnior, Ignácio, Rampasso, Anholon, and Bortolotto (2023) analyze the influence of construction practices on sustainability dimensions in the construction industry. Their study, conducted through a survey with 80 project managers, assesses the performance of sustainable management practices in relation to social, economic, and environmental indicators. The findings reveal that not all practices significantly explain all dimensions of sustainability, and some factors have a more substantial impact than others in achieving sustainability goals. Interestingly, the study notes that some practices may negatively influence economic sustainability, particularly in resource management and pollution control.

Martens and Carvalho (2017) identify key aspects of sustainability in the project management context through a systematic literature review and a survey of project managers. Their research highlights four factors: Sustainable Innovation Business Model, Stakeholders Management, Economic and Competitive Advantage, and Environmental Policies and Resources Saving. This study underscores the importance of balancing economic sustainability with environmental and social considerations in project management.

Martens and Carvalho assess the integration of sustainability into project management in the food service sector. Their exploratory study, based on interviews and project document analysis, describes the results of a pilot tool for systematically evaluating sustainability in projects. The study concludes that economic dimensions often overshadow environmental and social aspects, indicating a need for a more balanced approach to sustainability in project management.

Lima, Fernandes, and Tereso (2023) conduct a comprehensive Systematic Literature Review (SLR) to identify practices that ensure innovation and sustainability in project management within Small and Medium-Sized Enterprises (SMEs). The study categorizes 166 innovation practices, 86 sustainability practices, and 61 benefits, providing insights into the interplay between project management, innovation, and sustainability in SMEs. The research highlights the importance of integrating these practices for the overall well-being of SMEs and society, beyond just economic considerations.

Economic sustainability in project management requires a balanced approach that considers financial viability alongside environmental and social impacts. The reviewed studies provide valuable insights into the strategies and practices for integrating economic sustainability, emphasizing the need for comprehensive and innovative approaches to ensure long-term project success and contribution to economic development.

4. Integrating Sustainability into Project Management Practices

4.1. Sustainable Project Lifecycle

The concept of a sustainable project lifecycle involves integrating sustainability principles into every phase of a project, from initiation to closure. This approach ensures that projects are not only successful in terms of their immediate objectives but also contribute positively to environmental, social, and economic sustainability. This section of the literature review examines how the sustainable project lifecycle is integrated into project management practices.

Robichaud and Anantatmula (2011) discuss the growth of environmentally sustainable building construction and the need for modifications in traditional project management processes to deliver green projects within cost constraints. Their paper suggests specific adjustments to conventional building practices to optimize the delivery of cost-efficient green building projects. The research highlights the value of greening project management practices and presents a detailed analysis using a matrix to specify adjustments to traditional project management practices.

Toledo, Farias Filho, Castro, Putnik, and Silva (2021) analyze the incorporation of sustainability issues and Sustainable Development Goals (SDGs) in project management as critical success factors for sustainable project delivery. Their

research proposes a sustainable project management model containing variables related to barriers and motivation factors for integrating sustainability with project management.

The model is validated using a structural equation model, indicating the necessity of disseminating and using sustainable project management methodologies that consider the SDGs.

Larsson and Larsson (2019) address the complexities of implementing sustainability in construction and infrastructure projects. Their paper focuses on collaborative business arrangements, often called partnering, in sustainable project management. The study, based on a case study of an infrastructure maintenance contract, reveals that different collaborative practices affect diverse aspects of sustainable project management and promote sustainable deliveries based on organizational learning and continuous improvements.

Toljaga-Nikolić, Obradović, and Todorović (2022) examine the contribution of sustainable project management to value co-creation through project results. Their research explores how integrating the concept of sustainable development into business strategies contributes to co-creating value by minimizing the harmful impact and maximizing the positive impact of business activities on society and the environment.

Integrating sustainability into the project lifecycle is crucial for achieving sustainable outcomes in project management. The reviewed studies provide valuable insights into the strategies and practices for integrating sustainability principles into every phase of a project, emphasizing the need for comprehensive and innovative approaches to ensure long-term project success and contribution to sustainability.

4.2. Overview of how sustainability can be integrated throughout the project lifecycle.

Integrating sustainability into project management practices is a critical endeavor in today's world, where the importance of sustainable development is increasingly recognized. This paper provides an overview of how sustainability can be integrated throughout the project lifecycle, drawing on recent research in the field.

The concept of sustainability in project management has evolved significantly, particularly in sectors like facilities management (FM) and project management (PM). Zahid, Klungseth, and Andersen (2023) explored the connection between sustainability in PM and FM, highlighting the integration of sustainable development goals (SDGs) in these areas. They conducted a systematic literature review, which led to the development of a simplified facility lifecycle model. This model illustrates the integration of sustainability in FM and PM, emphasizing the importance of sustainable activities in different phases of a facility's lifecycle (Zahid, Klungseth, & Andersen, 2023).

In the rapidly evolving information technology sectors, agile methodologies have been employed to facilitate efficient and swift development of digital products. Făgărășan et al. (2023) addressed the integration of sustainability metrics into project and portfolio performance assessment in agile software development. They proposed a data-driven scoring model designed for software firms, which integrates sustainability metrics into their project and portfolio performance assessment. This model aims to enhance delivery performance while reinforcing the sustainability of the software development lifecycle (Făgărășan, Cristea, Cristea, Popa, & Pîslă, 2023).

Cruzado-Ramos and Brioso (2020) contributed to the sustainable management of Peruvian buildings throughout the project lifecycle by integrating the Lean Construction philosophy and sustainability concepts. They developed a methodology for evaluating sustainability performance in projects, which integrates the Last Planner® System and sustainability management. This methodology was validated through the Delphi method and applied to case studies, demonstrating the synergy between Lean philosophy and sustainability management methodologies (Cruzado-Ramos & Brioso, 2020).

García-García et al. (2023) presented an integral project management model based on organizational maintenance, emphasizing the role of maintenance as a driver for sustainability. They proposed a quality toolbox as the core set of tools to design, manage, and control any project, with a focus on sustainability goals. This approach enables the conversion of the maintenance function into a holistic function, forming the basis for organizational viability and sustainability (García-García, Gallego-García, Ren, & García-García, 2023).

Integrating sustainability into project management practices involves a multifaceted approach that encompasses various sectors and methodologies. From facilities management to software development and building projects, the integration of sustainability principles is essential for achieving sustainable development goals. The research discussed

in this paper underscores the importance of sustainable practices throughout the project lifecycle, offering valuable insights and models for practitioners and researchers in the field.

4.3. Tools and Techniques for Sustainable Project Management: Discussion of various tools and techniques used to implement sustainability in project management.

The integration of sustainability into project management requires specific tools and techniques that facilitate the implementation of sustainable practices. This section of the literature review discusses various tools and techniques used to implement sustainability in project management.

Soares, Fernandes, and Santos (2023) conducted a comprehensive literature review to understand the motivation behind incorporating sustainability in project management practice and to identify key project management practices and frameworks/models for ensuring sustainability in projects. Their findings provide valuable insights for project managers seeking to integrate sustainability practices throughout the entire project management life cycle.

Gogela, Oke, and Aigbavboa (2018) explore available project management tools and techniques that can enhance construction project performance, focusing on achieving value for money and ensuring client satisfaction. The study identifies value management or value engineering, reliable feasibility studies, usage of computerized integrated software, application of life cycle costing, and utilization of emerging technology and development as important tools for effective project delivery.

Rahat, Ferrer, Pradhananga, and ElZomor (2022) investigate the synergies between Front-End Planning (FEP) techniques and sustainability rating systems, such as the Envision™ rating system, in the context of sustainable infrastructure projects. Their research methodology includes surveying infrastructure experts, investigating the use of pre-project planning tools in the industry, and implementing a Problem Based Learning (PBL) activity to enhance students' knowledge of FEP and sustainability. The study highlights the alignment of sustainability practices with FEP and the effectiveness of active learning methods in teaching these concepts.

Holzmann (2021) presents case studies analysis to identify good practices for integrating challenges of sustainable cities and communities into the curriculum of project management courses. The paper emphasizes the responsibility of project management instructors to raise students' awareness of social and environmental challenges and to offer methods to address these challenges.

The tools and techniques for sustainable project management are diverse and multifaceted, ranging from project planning practices and sustainability rating systems to educational approaches and software tools. These tools and techniques are essential for project managers and organizations seeking to implement sustainable practices in their projects, ensuring long-term success and positive contributions to sustainability.

5. Challenges and Opportunities

5.1. Barriers to Implementing Sustainable Practices: Identifying and discussing common challenges and barriers faced in integrating sustainability into project management.

Integrating sustainability into project management practices presents several challenges and barriers. This section of the literature review identifies and discusses common challenges faced in incorporating sustainability into project management.

Siew, Sepasgozar, and Akbarnezhad (2015) highlight key barriers in implementing sustainability within the construction industry sector. They identify unclear definitions of sustainable construction, ineffectiveness of sustainability reporting tools (SRTs), slow adoption of 'green' technology, and negligence of human resource management as the main barriers. The paper challenges current practices that hinder the successful implementation of sustainability in construction and provides recommendations to address these barriers.

Ohiomah, Aigbavboa, and Thwala (2019) assess the drivers and obstacles of sustainable project management in South Africa, focusing on the construction industry. The study reveals that major barriers include the perception that green buildings are expensive, lack of expertise, and lack of training. The research also identifies financial benefits as a key driver for organizations to invest in sustainable project management, suggesting the need for increased training and client awareness.

Conedera, Zahid, Andersen, and Klungseth (2023) explore barriers to sustainability in facilities management through a project management framework for project governance. Their literature review categorizes types of barriers related to sustainability implementation and groups their components. The study showcases the main factors hampering organizations in incorporating sustainability principles and how these can be overcome to move toward sustainable development.

Kineber, Kissi, and Hamed (2022) identify and assess sustainability implementation barriers for residential building projects in Ghana. The study categorizes barriers under management, standards, society, and knowledge, using exploratory factor analysis (EFA) and partial least squares structural equation modelling (PLS-SEM). The results indicate that management-related barriers are the most significant, affecting sustainability implementation.

The barriers to implementing sustainable practices in project management are diverse and multifaceted. The reviewed studies provide valuable insights into the challenges faced by project managers and organizations, emphasizing the need for clear definitions, effective tools, increased training, and awareness to successfully integrate sustainability into project management practices.

5.2. Opportunities for Innovation and Improvement: Exploring opportunities for innovation and improvement in sustainable project management practices.

While there are challenges in integrating sustainability into project management, these challenges also present opportunities for innovation and improvement. This section of the literature review explores various opportunities for enhancing sustainable project management practices.

Scafuto, Araújo, Moreiras, and Knies (2021) examine the relationship between project management and green innovation processes in sustainable fabric companies. Their study finds that firms developing green innovation derived textiles do not use formal project management to execute their green innovation projects, indicating an opportunity for introducing project management to enhance green innovation. The study suggests adapting practices or using less formal and bureaucratic techniques to integrate project management into enterprises focused on green innovation.

Doost Mohammadian, H. and Rezaie, F, (2019) propose an innovative sustainable project management approach as a tool to design modern livable and sustainable areas. They suggest that innovation can accelerate the achievement of sustainable project management. The study emphasizes the need for urban planning and good governance with effective regulatory frameworks to create sustainable cities, thereby improving livability and quality of life.

Moreno-Monsalve, Delgado-Ortiz, Rueda-Varón, and Fajardo-Moreno (2022) identify the degree of relationship between the success of projects and the sustainable development approach. Their research shows that project success under a sustainable development approach tends to create value, emphasizing the importance of impact, relevance, effectiveness, and efficiency in explaining project success through sustainable development and value creation.

Skyttermoen and Wedum (2023) explore the significance of project maturity in complex innovation processes for developing sustainable business models. Their longitudinal case study tracks a market-leading company's journey from ideation to implementation, focusing on creating a sustainable business emphasizing waste reduction, customer satisfaction, and profitability. The study highlights the pivotal role of project maturity in innovation projects centered around sustainable value propositions and suggests that tailoring project maturity to each project's specific needs can forge necessary capabilities for crafting sustainable business models.

The opportunities for innovation and improvement in sustainable project management are vast and varied. The reviewed studies provide valuable insights into how project management can be leveraged to enhance green innovation, create sustainable urban settings, and develop sustainable business models, emphasizing the need for innovative approaches and effective governance.

6. Future Trends and Developments

6.1. Emerging Trends in Sustainable Project Management: Speculating on future trends and the evolution of sustainability practices in project management.

The field of sustainable project management is continuously evolving, with new trends and developments shaping its future. This section of the literature review speculates on future trends and the evolution of sustainability practices in project management.

Toledo, Farias Filho, Castro, Putnik, and Silva (2021) analyze the incorporation of sustainability issues and Sustainable Development Goals (SDGs) in project management as critical success factors for sustainable project delivery. They propose a sustainable project management model that includes variables related to barriers and motivation factors for integrating sustainability with project management. The study indicates that for sustainability to become an integral part of project management, the dissemination and use of sustainable project management methodologies that consider the SDGs are necessary.

Armenia, Dangelico, Nonino, and Pompei (2019) contribute to the research knowledge through a systematic review of literature on the integration of project management and sustainability. They propose a new conceptual framework linking key dimensions of sustainable project management, indicating that academic literature about this topic is still in its infancy but is growing, opening new research directions. This framework suggests future trends in sustainable project management, focusing on corporate policies and practices, resource management, life cycle orientation, stakeholder engagement, and organizational learning.

Apenko and Klimenko's research on sustainable project management in Russian enterprises (2023) presents some experience of sustainable project management and introduces a new methodology for assessing the maturity level of sustainable project management. The study focuses on institutional, economic, environmental, and social indicators of green project management, providing insights into the future of sustainable project management in enterprises.

The future of sustainable project management is likely to see an increased focus on integrating SDGs, developing new frameworks and methodologies, filling knowledge gaps, and enhancing the maturity level of sustainable practices. These trends indicate a growing emphasis on comprehensive and holistic approaches to sustainability in project management.

6.2. The Role of Technology and Digitalization: Discussing the impact of technology and digitalization on sustainable project management.

The impact of technology and digitalization on sustainable project management is a critical area of exploration, as these advancements offer new opportunities and challenges. This section of the literature review discusses the influence of technology and digitalization on sustainable project management practices.

Cabeças (2022) examines the evolution of project management in the digital economy, focusing on the Fourth Industrial Revolution's impact on project management. The study identifies the need for project managers to adapt to new digital technologies to increase project success and contribute added value to the economy, environment, and society. It emphasizes the importance of using new digital technologies in project management and suggests adopting less formal and bureaucratic techniques to integrate project management into enterprises focused on green innovation.

Sajjad, Hu, Waqar, Falqi, Alsulamy, Bageis, and Alshehri (2023) investigate the potential of Industry 4.0 digitization practices to improve sustainability and enhance overall project performance in the construction industry. The research utilizes a mixed-methods methodology, including exploratory factor analysis (EFA) and structural equation modeling (SEM), to examine survey data from the construction sector in China. The study highlights the significance of sustainability as a factor in shaping sustainable construction practices and the effectiveness of Industry 4.0 digitalization techniques in achieving sustainability goals.

Salama and Janjusevic (2018) discuss the challenges and opportunities in the era of digital transformation, particularly in the context of sustainable project management. The study compares traditional project management approaches with modern, technology-driven methods, emphasizing the need for project managers to acquire relevant knowledge and master new skills and techniques to deal with state-of-the-art technology.

Gusakova and Pavlov (2020) present an analysis of current domestic and foreign experiences in project management, particularly in large-scale construction. The study focuses on the organizational and technological features of large-scale projects and the necessity of applying specific management principles. It considers various IT methods and management models, highlighting those most promising for use in large-scale construction management in the context of digitalization.

Technology and digitalization significantly impact sustainable project management, offering new tools, methods, and approaches to enhance project success and sustainability. The reviewed studies provide valuable insights into how digital technologies can be leveraged to improve sustainability in project management, emphasizing the need for project managers to adapt to these technological advancements.

7. Conclusion

The comprehensive review of sustainable project management has illuminated several key insights that are pivotal for the future of project management. Firstly, the integration of sustainability into project management is not just an ethical imperative but a strategic necessity. The environmental, social, and economic dimensions of sustainability are intertwined with the core objectives of project management, emphasizing the need for a holistic approach. Environmental considerations, such as resource efficiency and pollution reduction, are crucial for the long-term viability of projects. Social and ethical aspects, including stakeholder engagement and community impact, are essential for maintaining the social license to operate. Economic sustainability ensures that projects are financially viable and contribute positively to economic development.

The role of technology and digitalization in sustainable project management has emerged as a significant theme. The Fourth Industrial Revolution and the digital economy are reshaping the landscape of project management. Digital technologies, such as Industry 4.0 practices, are not only enhancing project efficiency but also enabling more sustainable outcomes. These technologies facilitate better resource management, improved stakeholder communication, and more effective project monitoring and control.

However, the integration of sustainability into project management practices is not without challenges. Barriers such as unclear definitions of sustainability, slow adoption of green technologies, and lack of expertise and training are significant hurdles. Overcoming these barriers requires a concerted effort from all stakeholders, including project managers, organizations, and policymakers.

Despite these challenges, there are numerous opportunities for innovation and improvement. The evolving landscape of project management offers a fertile ground for developing new tools, methodologies, and approaches that embed sustainability into every aspect of project management. The growing focus on sustainability is driving the development of new project management models that consider the Sustainable Development Goals (SDGs) and other global sustainability frameworks.

The field of sustainable project management is at a critical juncture. The increasing recognition of the importance of sustainability in project management is a positive development, signaling a shift towards more responsible and sustainable practices. However, this shift is not without its challenges. The barriers to integrating sustainability into project management practices are significant but not insurmountable. Overcoming these barriers will require innovative thinking, continuous learning, and a willingness to adapt to new technologies and methodologies.

The role of technology and digitalization in this transition cannot be overstated. As project management continues to evolve in the digital age, leveraging technology will be key to achieving sustainable outcomes. Digital tools and platforms offer new ways to manage projects more efficiently and sustainably, enabling project managers to make more informed decisions that balance economic, environmental, and social considerations.

Looking forward, the future of sustainable project management is promising. As awareness of the importance of sustainability grows, so too will the tools and techniques to implement it effectively. The challenge for project managers, organizations, and the broader community is to embrace this change, continuously innovate, and strive for improvement. By doing so, project management can not only achieve its traditional goals of delivering projects on time, within budget, and to the required quality but also contribute positively to the sustainable development of our planet and society.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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