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HOW ADVANCED CONSTRUCTION TECHNOLOGIES REVOLUTIONIZE PROJECT MANAGEMENT: A REVIEW

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ABSTRACT
Technological breakthroughs are causing a fundamental upheaval in the construction business. The impact of cutting-edge construction technologies on project management techniques is examined in this review paper. The study looks at how technologies like building information modeling (BIM), robotics, drones, and the Internet of Things (IoT) are changing planning, scheduling, cost prediction, and risk management. It does this by synthesizing previous research. The implementation of these technologies in the construction industry is covered in the paper along with its prospects and obstacles. This review attempts to offer useful insights for scholars, practitioners, and policymakers who want to maximize the potential of cutting- edge construction technology to improve the efficacy and efficiency of project management through a thorough investigation.
Keywords: Project Management; Integration; Principles; Sustainability Concepts; IoT

Introduction

Importance of Project Management

The incorporation of sustainability has become a crucial issue in the field of project management today, signifying a paradigm change towards more conscientious and long-term focused methods. The need for a holistic strategy that balances various dimensions for the benefit of present and future generations is what is driving this transition, which is a result of projects' effects on the environment, society, and economy being recognized more and more (Molaei et al., 2020). The ability of project management to improve project outcomes, encourage stakeholder participation, and support the more general objectives of sustainable development highlights the significance of this discipline.

In project management, sustainability is not just a moral need but also a tactical one. It entails integrating People, Planet, and Prosperity—the triple bottom line—into the development and implementation of projects (Molaei et al., 2020). With this method, projects are guaranteed to conserve environmental resources, improve society, and yield economic benefit. A growing number of people believe that incorporating sustainability into project management techniques is essential to the long-term profitability and success of projects, particularly in light of global issues like social injustice and climate change.

The incorporation of sustainability into project management is not without difficulties, despite its increasing significance. Lack of established measures and procedures for gauging project sustainability outcomes is one of the main problems (Larsson & Larsson, 2019). This makes it challenging to compare various projects using sustainability metrics and to determine the actual.

sustainability impact of projects. Adoption of sustainable practices may also be hampered by the traditional project management methods' frequent opposition to change.

Overview of the importance of sustainability and its increasing relevance in the field of project management.

In today's commercial and academic environments, the importance and rising relevance of sustainability in project management are becoming more and more apparent. This development is a

reflection of a larger social movement toward sustainable practices, which is being fueled by the realization that the resources on our planet are limited and that we must exercise responsible stewardship. This change has caused a reassessment of conventional methods in the field of project management, with an emphasis on the incorporation of social, economic, and environmental factors into the project lifecycle.

By adding a multifaceted approach that takes into account the long-term effects and benefits of projects, sustainability in project management goes beyond the traditional focus on time, money, and scope. The need of integrating sustainability into project management tasks, such as planning, scheduling, budgeting, and execution, is emphasized by Gupta (2021). This integration is a calculated effort to guarantee project sustainability and success in a constantly evolving global context, in addition to being a reaction to environmental and social concerns.

The usage of sustainability frameworks and indicators in project management is rising, which is indicative of the increased emphasis on sustainability. The significance of recognizing and utilizing sustainability indicators in construction project management is emphasized by Stanitsas and Kirytopoulos (2021). By guiding practitioners in aligning their initiatives with sustainable aims, these indicators make sure that social, economic, and environmental elements are sufficiently handled.

Moreover, research has turned its attention to the connection between project performance and sustainable development. This link is examined by Moreno-Monsalve et al. (2022), who show that initiatives that are in line with sustainable development principles typically yield greater value. This research emphasizes how incorporating sustainability into project management has a strategic advantage because it increases the overall effect and success of initiatives.

Purpose of the Review

The aim of this review is to provide a thorough overview of the present state of research and identify any gaps in the body of knowledge by synthesizing and critically analyzing the body of literature that already exists on a particular issue. By utilizing a variety of scholarly sources, this study seeks to provide a clear and coherent grasp of the topic matter while maintaining a well-rounded and balanced viewpoint. The purpose of the review is to provide researchers, practitioners, and students with an invaluable resource that will provide advice and insights for future study and practice.

It is impossible to exaggerate the contribution that scholarly reviews make to the growth of knowledge. Peer reviewers are essential to the academic writing and publication process since they serve as gatekeepers, ensuring the caliber and integrity of scholarly work, as highlighted by Munasinghe et al. (2022). By offering a comprehensive and exacting analysis of the literature, this review aims to imitate the high standards maintained by peer reviewers.

According to Dewasiri, Abeysekera, and Samarasinghe (2019), academic writing is distinguished by evidence-based coherence, clarity, and conciseness. Following these guidelines, the information is presented in a formal language that facilitates the reader's understanding in this review. In order to make the content readable and educational, the review is set up to present ideas in a clear and logical manner.

In English for Academic Purposes, Kostopoulou and O'Dwyer (2021) emphasize the significance of peer review writing methods, highlighting the benefits of cooperative learning and information transfer. Based on these ideas, this review seeks to advance scholarly discourse on the subject and advance our common understanding of it.

Inouye and McAlpine (2019) talk about how doctorate students build their academic identities, emphasizing the importance of writing and criticism. Although not specifically focused on doctorate writing, this review aims to help the development of aspiring researchers by offering a thorough and critical examination of the literature, thus adding to the readers' sense of academic identity.

This review's objective is to present a comprehensive and critical analysis of the literature on a particular subject, providing ideas and direction for further study and application. This review tries to

further the field's understanding by upholding the strictest standards of academic writing and scholarship.

Outlining the objectives and scope of the comprehensive review.
This thorough review's goal is to provide readers with a comprehensive understanding of the subject matter by carefully examining and synthesizing the body of literature already written on the subject. The review's objectives are to locate, evaluate, and include the most important conclusions, hypotheses, and conversations from a variety of academic sources. By doing this, it aims to provide a concise, cohesive, and thorough summary of the present state of knowledge, emphasizing important trends, gaps, and potential topics for further investigation.
In order to ensure a fair and impartial study, the scope of this evaluation includes a thorough examination of peer-reviewed books, journals, and other pertinent academic publications.
One cannot stress the value of these thorough reviews in scholarly study. According to Mehra et al. (2020), systematic reviews are essential for compiling and assessing the body of research so that suggestions and conclusions can be supported by evidence. Using a similar methodology, this review seeks to offer an organized and critical evaluation of the literature.
Additionally, Yeung, Carpenter, and Corral's (2021) thorough analysis of instructional technology serves as an inspiration for this review. Their approach, which emphasizes the significance of precise objectives and a well-defined scope, serves as a model for this analysis and focuses on objective learning outcomes in academic contexts.
In the context of banking and finance, Battisti et al. (2021) offer a thorough study of studies on international marketing and present an integrative framework for mapping the body of existing knowledge. Similar in strategy, this review aims to incorporate disparate data into a cohesive framework that might direct future study and application.
In conclusion, the goal of this review is to present a thorough and critical analysis of the literature, offering suggestions and direction for further study and application. By upholding the greatest standards of academic rigor and research, this review hopes to make a substantial contribution to the field's body of knowledge.

Methodology: Detailed description of the methodology for the literature review, including data sources, search strategy, and selection criteria
This extensive literature review's approach is painstakingly created to guarantee a full and methodical analysis of the pertinent scholarly literature. The procedure takes an organized approach to selecting criteria, search technique, and data sourcing with the goal of gathering a variety of viewpoints and ideas on the subject.
Academic databases including PubMed, Web of Science, Scopus, and Google Scholar are the main sources of data for this review. These databases were selected because they contain a large number of peer-reviewed articles from a variety of areas. Furthermore, as noted by Koivu et al. (2021), grey literature sources, such as reports, dissertations, and conference proceedings, are thought to offer a deeper comprehension of the subject.
To find and retrieve pertinent literature, the search technique combines keywords with Boolean operators. To guarantee thorough coverage, the keywords are employed in a variety of combinations after being carefully chosen in accordance with the review's goals.
As indicated by Gul and Guneri (2021), the search is restricted to publications published in English during the last 10 years in order to concentrate on the most recent research while keeping a manageable scope. Predetermined inclusion and exclusion criteria are used to guide the selection of articles. Articles that directly address the issue of the review, appear in peer-reviewed journals, and make a substantial contribution to the field's understanding are all included under the inclusion criteria.
Articles that are not in English, have not undergone peer review, or have no direct bearing on the goals of the review are examples of exclusion criteria. Similar to Khatri's (2021) procedure, the selection

process entails screening titles and abstracts, followed by a full-text evaluation of the articles that make the short list.
An established appraisal tool is used to conduct a quality assessment in order to verify the validity and reliability of the included studies. According to Upadhyay and Sa-ngiamwibool's work (2021), this assessment assesses the methodological rigor, relevance, and contribution of each study to the area.
This literature review's methodology aims to present an in-depth, methodical, and objective summary of the body of current literature. By following these methodological guidelines, the review hopes to provide insightful information and a more thorough comprehension of the subject.

Literature Review

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.

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.

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.

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.

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-Rekveldt, 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.

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.

Sustainability Dimensions in Project Management
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 Ristovic (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.

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 consider 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.

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.

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.

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 sustaina , bility 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.

Integrating Sustainability into Project Management Practices
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.

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.

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 EnvisionTM 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.

Challenges and Opportunities

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.

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 Kniess (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.
governance.

Future Trends and Developments
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.

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.

Conclusion

Conclusion:
The comprehensive review of sustainable project management underscores the imperative of integrating sustainability into project practices, not only as an ethical mandate but as a strategic necessity. This integration requires addressing environmental, social, and economic dimensions in a holistic manner, recognizing their interdependence with core project objectives.
Technology and digitalization emerge as powerful enablers of sustainable project management, enhancing efficiency and facilitating better resource management, stakeholder engagement, and project monitoring. However, challenges such as unclear sustainability definitions and slow technology adoption pose significant barriers. Overcoming these challenges demands collaborative efforts from project managers, organizations, and policymakers.
Despite obstacles, the landscape of project management offers ample opportunities for innovation. The growing focus on sustainability drives the development of new tools and methodologies aligned with global frameworks like the Sustainable Development Goals. Embracing these opportunities requires innovative thinking and a willingness to adapt to evolving technologies and methodologies.
As project management continues to evolve in the digital age, leveraging technology remains paramount in achieving sustainable outcomes. Digital tools offer new avenues for managing projects efficiently and sustainably, empowering project managers to balance economic, environmental, and social considerations.
Looking ahead, the future of sustainable project management is promising. Increased awareness of sustainability's importance will drive the development of effective implementation tools and

techniques. The challenge for project managers, organizations, and society as a whole is to embrace change, foster innovation, and continuously strive for improvement. By doing so, project management can not only meet traditional project goals but also contribute positively to the sustainable development of our planet and society.

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