Environment, Development and Sustainability
https://doi.org/10.1007/s10668-024-04946-2

REVIEW

Enhancing sustainability considerations in construction industry projects

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Received: 18 August 2022 / Accepted: 17 April 2024

Abstract
In today's society, the construction sector significantly influences all three aspects of sustainability: economic, environmental, and social. Industry and academia have recognized sustainability in construction projects as a key concern. The New Zealand government also focuses on providing a sustainable construction sector centred on high performance, high productivity, enhanced innovation, and improving community well-being through a better-built environment. Project management and sustainability are two distinct areas of research. Previous empirical research on the effectiveness of construction project implementation lacked sustainability success components. This research aims to provide criteria for project sustainability success for future performance on construction projects. Based on the existing literature, many economic, environmental, and social sustainability indicators were compiled for consideration at various pipeline project life cycle phases. The information gathered from the Scopus database was analyzed using ATLAS.ti 9 software to create project sustainability success criteria. Pipeline construction projects and sustainability must focus on environmental challenges while managing economic and social advantages. The research investigated sustainable construction adoption, revealing weak awareness among organizations due to limited understanding among key actors like clients, regulatory bodies, and construction organizations. Lack of effective application of sustainability guidelines, inadequate legislation, and building codes were significant hurdles in implementing sustainable practices in the construction sector. The study highlights essential issues to promote sustainable practices in the industry. The study findings suggest that organizations and individual factors are strong predictors for achieving sustainable construction and are vital antecedents leading to greater sustainability adoption. Finally, the study points to construction project managers' knowledge of how to set up criteria connected to sustainability and how it could affect the outcome of their projects.

Keywords Adoption · Barriers · Construction projects · Sustainable practices · Sustainability

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Published online: 29 April 2024

1 Introduction

In the second part of the 20th century, there has been a significant increase in the calls for sustainable development (Hendiani & Bagherpour, 2019). Lima et al. (2021) and Davies et al. (2018) suggest that it has brought to the forefront global governmental policies concerning the long-term viability of society, the economy, and the environment. The focus on sustainable development resulted from the understanding that construction practices adversely affected society and the environment. Achieving sustainable development demands a delicate balance between meeting human needs for energy, food, housing, waste management, and preserving environmental quality and resources (Zuo et al., 2012). However, despite the growing capacity to supply resources to meet human needs, the rising global population has elevated demands for housing (Herrera, 2019).

Currently, our global population requires more than the Earth's capacity, with studies suggesting that we have surpassed the planet's resources, threatening future sustainability (Arora et al., 2018; Gratzer & Keeton, 2017; Halonen, 2021). Over 80% of the world's population lives in ecological deficits, utilizing resources beyond their ecosystems' capacity, which takes one year and eight months to replenish (Salah et al., 2021). The United Nations has recognized the significance of sustainability in global conferences and Earth Summits (Grubb et al., 2019). In the same light, the construction industry and other sectors have increased their focus on environmental, social, and economic challenges. Jabbour et al. (2020) suggest that the new focus has led to strategic changes, with businesses being pressured to reduce their environmental impact (Wang et al., 2019).

Therefore, experts in the construction industry are often the first to support environmental and social assessments of a project, as they clearly understand the significance of sustainability and its effects on the techniques and purposes of construction (Bamgbade et al., 2019). For instance, Abidin & Pasquire (2005a) recommended that sustainability be considered a vision component across the construction process. According to Abidin and Pasquire (2005a), a commitment to sustainability needs to be made at the beginning of a project to guarantee that the procedures will go smoothly and that participants will accept them. The entire development process would need to be monitored and managed to ensure the project's overall success (Zavadskas et al., 2018). Sustainability protects oncoming generations by preserving the natural and built environment and recognizing the benefits of sustainability to humans and natural resources (Hendiani & Bagherpour, 2019). Sustainability is thus a dynamic framework that focuses on the sustainability of people's well-being by prioritizing collaboration and social security and effectively investing in economic development dependent on these ecological tools (Santos et al., 2019). It is becoming increasingly necessary for project managers to oversee sustainability-related activities. The decisions might influence the project's owner, users, and overall stakeholder community (Zuo et al., 2012). Thus, it is critical for all concerned to understand and discuss the ramifications of ongoing projects (Banihashemi et al., 2017; Martens & Carvalho, 2017). Project managers need empirical and theoretical information to determine a project's success in light of expanding sustainability concerns. Greater awareness among project managers of the challenges posed by sustainability would be beneficial to society. Therefore, a comprehensive understanding of the environmental implications of construction projects empowers project managers to develop tailored tools and protocols that align with sustainability standards for construction activities and infrastructure enhancements. However, within the context of New Zealand,

there is a noticeable gap in research that integrates sustainability into construction projects by considering their holistic impact on the economy, environment, society, and strategic stakeholder levels.

Understanding the limits of implementation can significantly enhance a project's chances of success and minimize negative impacts on society (Umar, 2017). One of the main barriers to building a sustainable society is project managers' lack of sustainability skills (Wang et al., 2018). In the 21st century, a project must first pass a screening for its possible sustainability consequences on economic, environmental, and social risks before being developed (Umar, 2021). Understanding the sustainability of construction projects is necessary for maintaining a sustainable construction sector. Therefore, this research aims to establish the criteria for the successful adoption of sustainability on future construction projects, shedding light on potential avenues for future research opportunities in this domain.

2 Methodology

2.1 Search string

This section highlights the stages and techniques employed in the comprehensive review of the construction sector's project management and sustainability. Articles relevant to the study were identified and obtained using the Scopus database. The Scopus database was chosen as the primary source due to its coverage and reputation for academic and high-quality research publications. Some of the keywords frequently used included "Construction industry", AND "Construction projects ", AND "sustainability". These keywords were chosen to pinpoint the intersection between construction activities, specific projects, and sustainability elements. Thus, studies focused on sustainability within the construction sector could be retrieved, including topics such as eco-friendly building practices, environmental impact, and energy efficiency. Other keywords have been excluded to maintain the study's precise and relevant search scope. The first quest was restricted to document titles and keywords, resulting in 409 articles from the mixture of the three keywords (see Table 1; Fig. 1).

Table 1 shows the keywords used during the search. The aggregate investigations that were carried out to compile relevant information in the literature were validated by employing this degree of granularity in the database (Bastas & Liyanage, 2018). Only peer-reviewed journal articles, books, and conference proceedings were included in the study to ensure that the most trustworthy sources and publications had examined the academic issues with exceptional management impact (Rajeev et al., 2017). These were the only publications that were taken into account. The study did not include articles written in languages other than English. The period from 2005 to 2023 was chosen as the study's target date. It focused on

Table 1 Search engines, scholarly databases, phrases used, and keywords

Search Engines and Database	Key Words
Academic Research Databases	TITLE-ABS-KEY
Scopus Database	"Construction industry " AND "Construction projects" AND "sustainability") AND (LIMIT-TO (PUB-YEAR, 2005 to 2023).

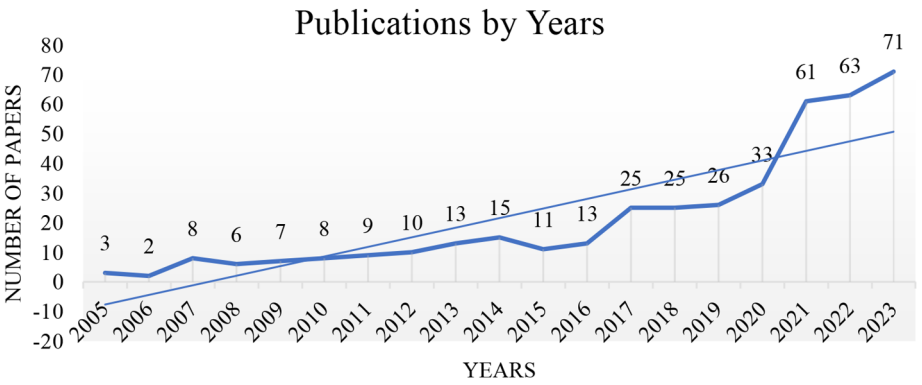

Fig. 1 Publications on sustainability in project management by year

significant achievements in efficiency and global sustainability, construction projects, and various state-of-the-art publications.

The evaluation phase is structured with distinct sections focusing on Processes, Findings, and Discussion, outlining a systematic organization for the assessment. This allows readers to gain a deeper understanding of how the data are evaluated and to follow both the implications of the evaluation and the data produced as a result (Moshood et al., 2020). Following the technique for conducting a systematic literature review presented in Fig. 1, the articles found were subjected to screening, filtering, and validation to determine whether or not they should be included in the study. In order to facilitate the analysis and screening of the collected studies, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) procedures are employed (Moher et al., 2009). Using the PRISMA approach in this systematic review amplifies the calibre and dependability of the findings by introducing a uniform methodology for conducting, disclosing, and evaluating the chosen studies. By employing this rigorous approach, we aim to inform and influence sustainable construction practices within the industry and provide a solid foundation for evidence-based decision-making. The PRISMA process flow, consisting of four sequential steps, is illustrated in Fig. 2.

The assessment phase is structured into several sections, namely processes, findings, and discussion, which facilitate a comprehensive understanding of the data evaluation process. This framework enables the reader to comprehend the evaluation procedures, interpret the consequences of the process, and analyze the resultant data. A total of 409 papers were initially identified through database searching. After removing duplicates, the screening process was conducted, resulting in 324 remaining papers. After reviewing abstracts, 212 papers were deemed eligible for further analysis. Finally, a full-text review was conducted, resulting in the inclusion of 114 papers in the study. As part of the methodology employed in this study, duplicate entries were excluded.

Additionally, the eligibility of papers has been ascertained by the inspection of abstracts. Furthermore, a comprehensive evaluation of the entire content of exceptional articles has been conducted, considering the specific issues addressed in the study. These steps have culminated in the final determination of the sustainable construction areas under investigation. In accordance with the established systematic literature review technique employed in

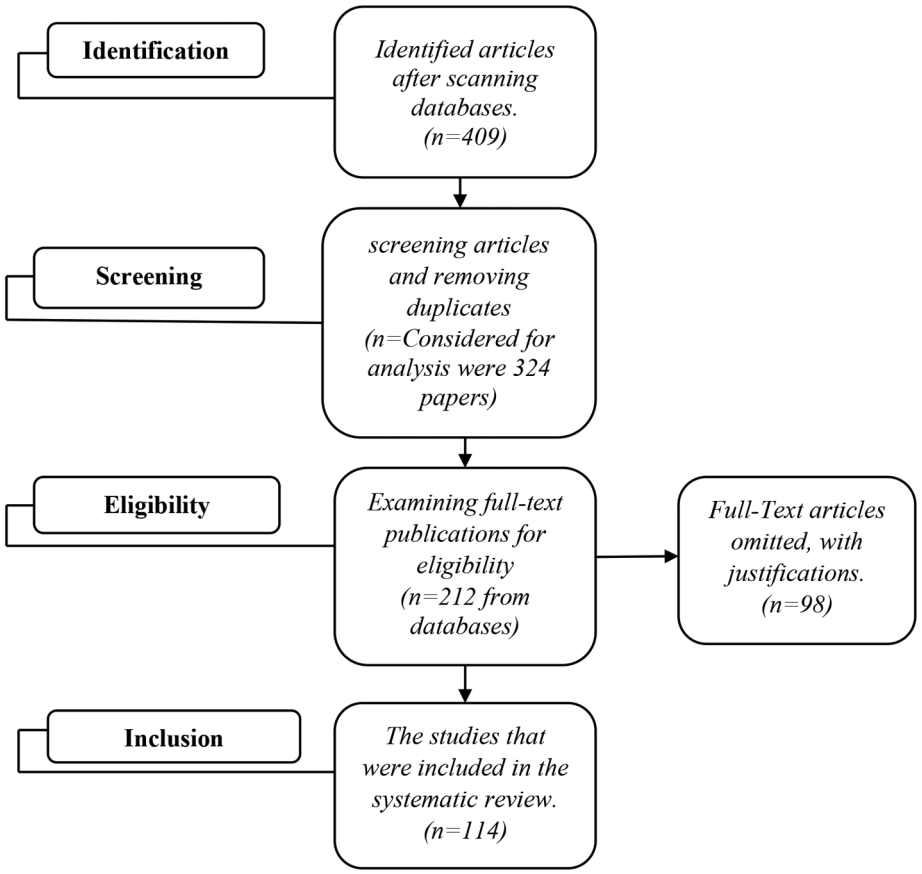

Fig. 2 Overview of the process for identifying, selecting, and including papers

this study, a total of 114 papers were meticulously evaluated and subsequently confirmed to be legitimate.

2.2 Analysis process

The method described illustrates one of the many conceivable ways qualitative types of research might be applied to text results. Following the Preferred Reporting Items for Systematic Reviews (PRISMA) approach for systematic literature review (Rousseau et al., 2008; Tseng et al., 2019), the articles found were screened, filtered, and verified using an iterative selection method to determine whether or not they should be included in the analysis. To conclude the sustainability and construction project assessment, duplicates were eliminated, eligibility was validated based on abstracts, and the entire text of an exceptional article was assessed in the context of the research topics. The process for this study's systematic literature evaluation followed, and each of the 114 publications was analyzed and checked to ensure that they were relevant. All 114 publications were then analyzed using the ATLAS.ti 9 software package. The software is an intelligent data analysis tool for extracting

valuable insights from qualitative data. It is widely considered a potent software for qualitative analysis, particularly in situations involving substantial amounts of textual and graphical data (Moshood et al., 2021a, b). The results from the ATLAS.ti software is presented in the following sections, including some visualizations for easy understanding.

3 Results and analysis

3.1 Publications by year

The emergence of papers on sustainability in project management commenced in 2005 and has experienced steady growth until 2023. Figure 1 depicts an exponential surge since 2017, persisting to the present. Moreover, the trend line indicates a consistent upward trajectory, suggesting an ongoing expansion of the literature on sustainability in project management. In 2021, 61 articles were published, marking a significant upturn compared to previous years. Consequently, there is a heightened focus and interest in sustainability in project management, aligning with contemporary challenges like environmental stability, industrial and business considerations, and the government's growing emphasis on social responsibility.

3.2 Sustainability in project management

The global challenge of sustainability is a critical issue, posing the question of how to foster prosperity while enriching the lives of current and future generations. Organizations have been integrating sustainability into various facets of their operations, including marketing, internal communications, and day-to-day activities (Silvius & Schipper, 2014). The adoption of more sustainable practices by companies relies significantly on projects, and the association of project management with sustainability has emerged as a recent development (Hassan et al., 2019; Wang et al., 2018). A growing body of research indicates that considering sustainability significantly impacts project management methodologies and procedures. However, the existing project management standards do not comprehensively encompass the sustainability agenda.

Rathi (2017) views sustainability as more of a mentality than a specific set of practices or procedures. According to Li-Yin Shen et al. (2007), assistance is needed for project participants in applying sustainable building practises, but there is a lack of consistency and comprehensive methodologies across the various stages of the project cycle. Unlike a project, a one-time endeavour to develop a one-of-a-kind product, service, or outcome, sustainability considers the societal impact over a longer period (Hetemi et al., 2020). Each project action throughout the implementation stage has the potential to either have a short-term or long-term influence on society regarding sustainability. As a result, the project's near-term execution and long-term profitability are not at odds. They cannot be separated from one another. Hetemi et al. (2020) explain that the actions that take place throughout the implementation stage of a project have a substantial influence on human sustainability. There has been a recent surge in the number of research projects investigating different ways the concept of sustainability might be incorporated into project management; however, these studies have traditionally approached the issue from a philosophical, logical, or ethical position (Silvius,

2013). When addressing sustainability for constructing infrastructure projects, one must consider both quality and performance objectives relevant to the environment.

Consequently, adopting sustainable construction principles, aimed at fostering a conscientiously built environment, contributes significantly to creating high-performance green buildings, commonly known as green buildings (Kibert, 2016). The sustainability domain in the construction industry has spawned various themes and areas of exploration. A thorough literature review spanning two decades up to 2018 focused on incorporating sustainability into project management and delivery processes (Kiani Mavi et al., 2021). This review categorized research into overarching themes such as motivations, stakeholder orientation, organizational context, temporal orientation, benefits, barriers, and risks (Goel et al., 2019). The findings from this research underscored that many organizations willingly adopt sustainable practices in their construction projects without external coercion. Nevertheless, the study emphasized the crucial roles of government as a sustainability facilitator and society as influential stakeholders in construction projects. The research suggests avenues for future exploration, including motivations across a broader spectrum of stakeholders (both internal and external), the integration of sustainability at the strategic levels of organizations, and the examination of behavioural impediments to sustainability integration, extending beyond economic and technical considerations (Goel et al., 2019).

Regarding the relationship between lean construction and environmental sustainability, existing literature recommends incorporating lean construction philosophies into the operational phase of a project's life cycle (Francis & Thomas, 2020). Another literature review, encompassing studies on the interplay between building information modelling (BIM), lean construction, and sustainability in the architectural, engineering, and construction industry, emphasizes project-centred perspectives (Saieg et al., 2018). The research indicates that BIM functionalities, combined with lean principles, have the potential to influence not only design-related activities but also the construction processes of projects.

At each stage of a project's life cycle, the decision-making process must explicitly and systematically consider the constraints imposed by sustainability (Construction in New Zealand H1, 2021), especially throughout the planning, conceptual design, and early finance phases. It is an extra performance indicator across the project life cycle (Maldonado-Fortunet, 2002). The suggestion of Brundtland (1987) that a healthy economy, a just society, and a sound environment are necessary for sustainable development can serve as a yardstick for determining whether or not a project is successful from a sustainability standpoint (Lessing et al., 2017). Important factors contributing to a project's environmental sustainability include assessing air quality, CO_2 emissions contributing to climate change, waste management, and treating hazardous materials (Hendiani & Bagherpour, 2019). On the subject of measuring the success of a project in terms of its social sustainability, one must measure both the positive contribution that the project makes and the negative detrimental impacts that it causes. These effects might include how the project affects people's lives and the community's viewpoint, how it uses local labour and resources, and how the community's health and safety are improved (Wang et al., 2018). When determining a project's success, it is essential to consider its financial viability, resource consumption and efficiency, the use of suitable technology, and the avoidance of harm to renewable resources.

According to some estimates by Piasentin and Roberts (2018), one of the primary drivers of New Zealand's development is the construction sector, but this sector has a downside. This has damaged the ecosystem, including soil erosion, flooding, sedimentation, natural

resource loss, vegetation disruption, use of hazardous materials during construction work, and dust contamination (Chen et al., 2019). The construction sector desires to carry out the building process in a way that does not negatively affect people or the environment regarding social or ecological factors, in addition to meeting the demands of fast urbanization and adequate housing. New Zealand should not overlook the importance of using and adequately managing its resources. Industrial designers must ensure that the environment is not sacrificed for economic growth. In New Zealand, green buildings are also in their embryonic period, and more initiatives are needed, followed by recognizing the industry's green plan to develop more sustainable buildings. Du Plessis (2007) indicated that various approaches are involved in transitioning to sustainable building practices; these include creating a professional and sustainable construction sector which responds to the sustainable development of its actions for the division (Colangelo et al., 2018).

There is a need to disseminate information and appreciation of the concept of sustainable buildings since this will improve its visibility and criteria in project implementation. Du Plessis (2007) claimed that only when there is a personal dedication to it can there be a change of behaviours. Therefore, their values must align with the proposal to encourage practitioners or organizations to adopt sustainable building. Through sustainable building implementation, people will benefit from such knowledge and continue to create change. Figure 3 presents this direction for creating a sustainable construction industry. The figure depicts all the construction industry's players, including manufacturers, contractors, architects or engineers, suppliers, consultants, clients, and government developers. Building consultants must recognize the value of sustainable construction and ensure that human activities and decisions impacting society do not affect the environment and produce as little environmental pressure as possible (Parkin, 2000).

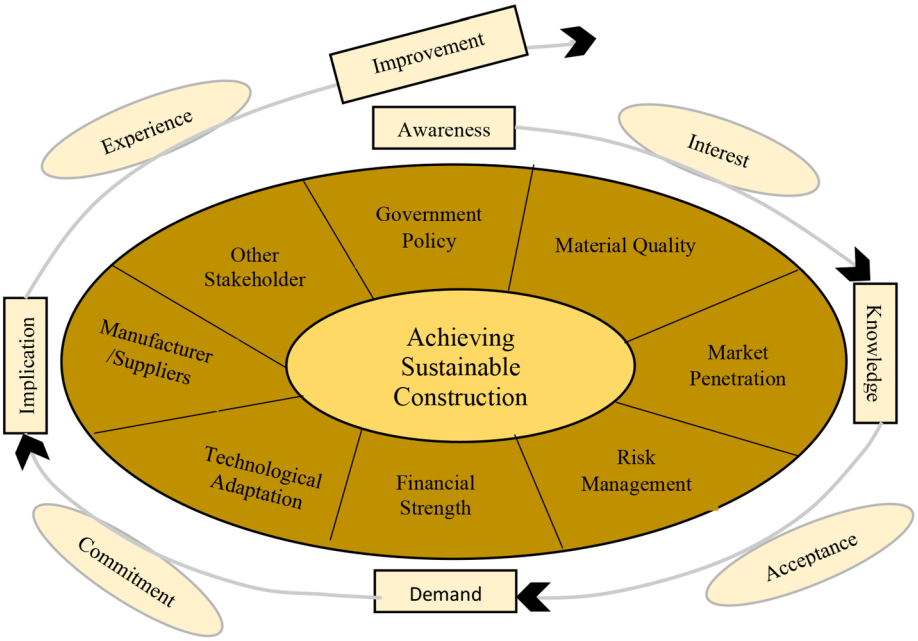

Fig. 3 Organisational and individual factors in the sustainable construction life cycle

This research identifies the significant driving factors for sustainability success from the construction industry's viewpoint. From the construction industry's perspective, individual and organizational factors were identified as the most important predictors of sustainability. The success rates and positions of sustainable construction are determined by their sustainability credentials and customers, as well as legislation, technology, and resources (Moshood et al., 2021a, b). As a result, an organization with a dynamic structure considers how various unexpected behaviours can challenge sustainability. The environment of an organization involves individuals within (internal) and outside (external) the organization, which is influenced by the process in some way. An organization's factors include government support and legislative instruments, financial strength, material quality, market penetration, technological adaptation, communication and awareness and risk management. At the same time, the individual factors include awareness, interest in sustainability, knowledge of sustainability, acceptance of sustainability, demand for environmentally friendly building, commitment to environmentally friendly construction, the implication of sustainability, Knowledge and experience pertaining to the maintenance and enhancement of the society.

Although there are efforts to increase public interest and awareness of sustainable projects In New Zealand, project delivery is poorly implemented, especially in the construction industry (Parkin, 2000). According to Ashley et al. (2003), the general policy for sustainable building does not strongly emphasize sustainable construction in all developed projects. While several building firms have embraced sustainable design, many firms have not yet realized the implications of their current wasteful practices, and even fewer have implemented sustainable design (Erdogan et al., 2019).

3.3 The triple bottom line

Sustainable construction is based on three main tenets: environmental preservation, social progress, and economic prosperity (Brownhill & Rao, 2002). Impact on environment studies is divided into two categories: the built environment and the natural environment. The designed ecosystem applies to the building project's activities and can result in environmental harm if appropriate responsibilities are not assumed (Goh et al., 2020; Moshood et al., 2022a, b). The focus of environmental protection is on the elimination of natural resources. Social well-being explores people's habits, including education, safety, luxury, and happiness, as well as the individual input that encompasses awareness, expertise and health. Finally, economic sustainability relates to the economic advantages of innovations for the profit of contractors, builders, consumers, the public and the community (Bals & Tate, 2017). Globally, design consultants are beginning to embrace sustainability and understand the benefits of sustainable construction. The key aims are to reach equilibrium regarding individuals, location, and time, representing the equitable allocation of global wealth among all nations and future generations (Taofeeq et al., 2019; Yılmaz & Bakış, 2015).

Sustainability involves a stable change by changing our consumption traditions without impacting our existing life advantages. Global unity and an autonomous and fair allocation are also concerned with creating a sustainable development practice (Moshood, 2022a, b; Tang et al., 2020). A sustainable development concept is a comprehensive approach that emphasizes social obligations, environmental responsibility, and economic explanations by abusing the consumer society's status as a consumer society. The three active sustainability

pillars are environmental protection, economic development, and social well-being (Yin et al., 2018).

Social, environmental, and economic sustainability aspects are carefully and continuously coordinated throughout the planned development. Social sustainability is seen as a pre-requisite for economic sustainability since environmental and social sustainability cannot be attractive to developers without economic sustainability. All three variables may be tallied as a single unit since they are completely integrated with one another (Carvajal-Arango et al., 2019).

International events have made several attempts following Bruntland's implementation of the idea of a sustainable building in 1987 to increase awareness of the importance of the environment and sustainable initiatives (Abidin, 2010). Several governments, organizations, firms, and individuals have welcomed the need for more significant environmental concerns in sustainable development (Ofori, 2000). The corporations' aim is now to emerge as a minor part of the act with environmental issues to put construction practices being undertaken into the broader perspective of the industrial ecosystem (Gandhi et al., 2006).

The principles of sustainable building have been clarified and considered: 1). they provide consumers with an eco-friendly, balanced, safe, and usefully constructed ecosystem. 2). protecting the world for the next generation while simultaneously addressing today's needs. 3). assessing the well-being of the project and its economic effect on culture and the environment. 4). decreasing the damage to the ecosystem. 5). improving the consistency of services and utilities and exercising collective harmony. 6). increasing the project's feasibility and effectiveness with the assistance of technologies and professional expertise. 7). setting up policies and understanding (Abidin & Pasquire, 2005b). Figure 4 provides the diagram of sustainability in construction projects.

3.3.1 Economic sustainability aspect

An economic effect evaluation is not the same as carrying out a standard accounting technique, according to Gregersen and Contreras (1992). Examining the pre- and post-project effects of a project or activity on society and certain social groups is an endeavour (Mustafa & Shapawi, 2015). A long-term goal of this type of review is to arm individuals with the knowledge they need to use society's finite resources more wisely. Abidin and Pasquire (2005a) looked at all phases of the product's life cycle, as well as its cost-effectiveness and risk assessment, to estimate the financial ramifications of a building project. In order to establish if a project was economically feasible, Gregersen and Contreras (1992) prioritized financial efficiency (total cash flow), the distribution of costs and rewards among parties involved (i.e., who pays what and who benefits from it), as well as economic efficiency. The viewpoint of all interested parties (organization, government, and individual) must be used to analyze a financial statement. The costs and advantages to society as a whole, independent of who pays and who gets what, are analyzed in terms of economic efficiency. The main driver of both endeavours is financial gain.

On the other hand, economic efficiency considers profitability from the perspective of society. The money remains after society has used its limited resources (Ribas & Cachim, 2019). Silvius (2013) focused on the financial rewards of commercial endeavours. The economic successes of an industry are the result of government policies and several other activities. A project's commissioning organization may demonstrate the business case's

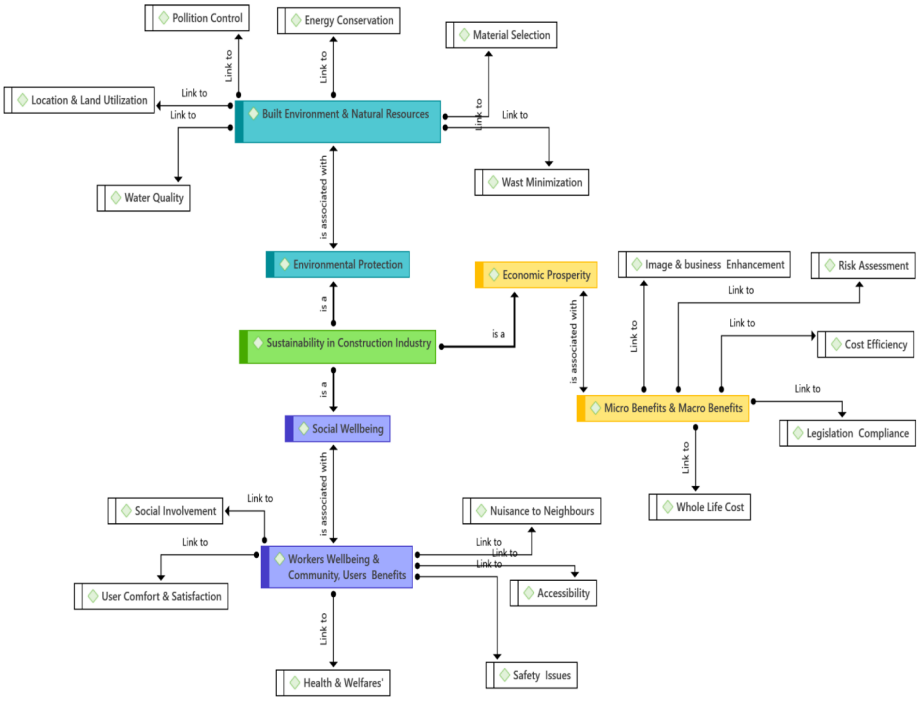

Fig. 4 Diagram of sustainability in construction

immediate financial benefits by pointing to cost reductions, decreased resource consumption, or enhanced business procedures (Navaratnam et al., 2022). How many of these benefits are acknowledged will depend on the commissioning organization's project sustainability maturity level. Projects are chosen and evaluated using a mix of short- and long-term strategic values and a short-term return on investment (Nadazdi et al., 2022).

3.3.2 Environmental sustainability aspect

According to Gregersen and Contreras (1992), inter-generational equity and intra-generational development are reliable indicators of a project's viability for all parties involved in its development. While fairness among generations is required for long-term advancement, equity across generations is crucial for long-term sustainability (Opoku et al., 2019a). Sustainable development aims to "equitably address the developmental and environmental demands of present and future generations" (Silvius, 2013). The use of renewable energy and resources should be encouraged, and the use of non-renewable resources should be discouraged (Zavadskas et al., 2018). When non-renewable fossil fuels and minerals are extracted and used for production, greenhouse gases (such as carbon dioxide) and other harmful deposits are frequently produced. According to Silvius (2013), to achieve sustainability, the way a project's materials are manufactured should be based on the amount of energy used, the amount of pollution created, and the logistical processes required.

Energy, water, materials, and land are natural resources utilized in construction projects that should be reduced, according to Hill and Bowen (1997). In addition, reducing the quan-

tity of pollution released into the air, land, and water while simultaneously increasing the amount of resource recycling is recommended (Vasilca et al., 2021). According to Silvius (2013), to build a deliverable project, it is necessary to minimize the amount of energy consumption, water use, and pollution. This involves purifying and recycling water. A project's desired outcome is to generate the least amount of waste possible while incorporating a high level of recycling into the delivery process (Stanitsas & Kirytopoulos, 2021).

3.3.3 Social sustainability aspect

As was said before, equal treatment between different generations is a crucial component of sustainable development (Tseng et al., 2022). Inter-generational equality encompasses economic and environmental factors and the social sphere (Kiani Mavi et al., 2021). Social sustainability is based on the idea that future generations should have just as much access to social amenities as the current generation. Social resources include fundamental human and fundamental freedoms, and a few of the social concerns that should be considered while developing a project are the use of child labour, female empowerment, safety and health, preservation of natural resources, and the inclusion of social investment for future generations (Chang et al., 2018). The pursuit of inter-generational justice in project development to ensure future generations' economic, environmental, and social sustainability significantly contributes to sustainable development. The processes of analyzing, monitoring, and controlling the intended and unintentional social repercussions, both negative and positive, of strategic planning (policies, programmes, plans, projects), as well as any social change processes triggered by such interventions, are included in the assessment of social effects for sustainability.

In addition, assessing the social effects on sustainability also considers any social change processes triggered by such interventions (Afshari et al., 2022). Ultimately, this kind of assessment should help shape a world that benefits all living things and is more just and sustainable (Valdes-Vasquez & Besiktepe, 2022). The evaluation considers the aesthetic effects on the landscape, archaeology and cultural heritage (tangible and intangible), community and culture, gender, physical and mental health, indigenous rights, leisure and entertainment, and the infrastructure and institutional effects (Kordi et al., 2021). Due to the complexity involved, a thorough review almost always necessitates the participation of many people working together (Vanclay, 2003). Evaluating social sustainability requires a conceptualization of social implications stemming from people's lifestyles, cultures, communities, political systems, the environment, health and welfare, personal and property rights, fears and goals (Maqsoom et al., 2021).

Maintaining and improving human health within a sanitary setting and risk-low for labour are essential aspects of a project. It is necessary to emphasize the quality of human life in health, safety, and environment (HSE) to stakeholder groups in order to minimize the social hazards associated with a project's development. In their study of social sustainability, Silvius and Schipper (2014) stated it is crucial to plan project deliverables and outcomes in a manner that ensures adherence to fair labour standards, conditions for healthy and safe employment, and avoidance of corruption and anti-competitive behaviour (Stanitsas & Kirytopoulos, 2021). In addition, projects have an impact on the development of communities (through activities such as training, education, and the overall growth of stakeholders), diversity and equal opportunity (through

activities such as gender, ethnicity, and religion), and human rights (e.g., freedom of organization, no child labour, and other such principles,).

The idea of sustainability is based on the assumption that society will be open to accepting an achievable state that will be accepted by future generations (Ioannidou et al., 2020). Therefore, to accomplish this goal, the growth that will be effectively maintained requires the adoption of stringent efforts concerning many sectors of society and the actions of individuals, and existing principles of social fairness and fundamental civil freedoms must remain untouched by development. Development should also ensure the survival of the current generation and those who will follow it to avert social and environmental catastrophes. The sections of the building life cycle phases that can be addressed are depicted in Fig. 5, along with the stages of the construction life cycle where sustainability may be improved.

The agreement's scope should extend beyond the specific materials at issue; it should include the whole building's lifespan and the continuance of sustainability via its design, production, government policy, and final disposal (see Fig. 5). Global industrial standards must have functional definitions, environmental criteria for each lifecycle process, Extended Producer Responsibility (EPR) programmes, labelling systems identifying recycled content, correct disposal, and hazard potential, among other requirements (Karen Raubenheimer & McIlgorm, 2018). Despite several suggestions, the problem remains in figuring out how to modify these standards for specific regional circumstances.

Sustainable design may be promoted by deploying a cutting-edge global certification system (Raubenheimer et al., 2018). Best practices for containing pellets, flakes, and powders may be found in "Operation Clean Sweep," a worldwide programme. Unfortunately, it is a volunteer-only service (Tessnow-von Wysocki & Le Billon, 2019). There is potential for more effective control of substandard materials and smaller-scale production of construction

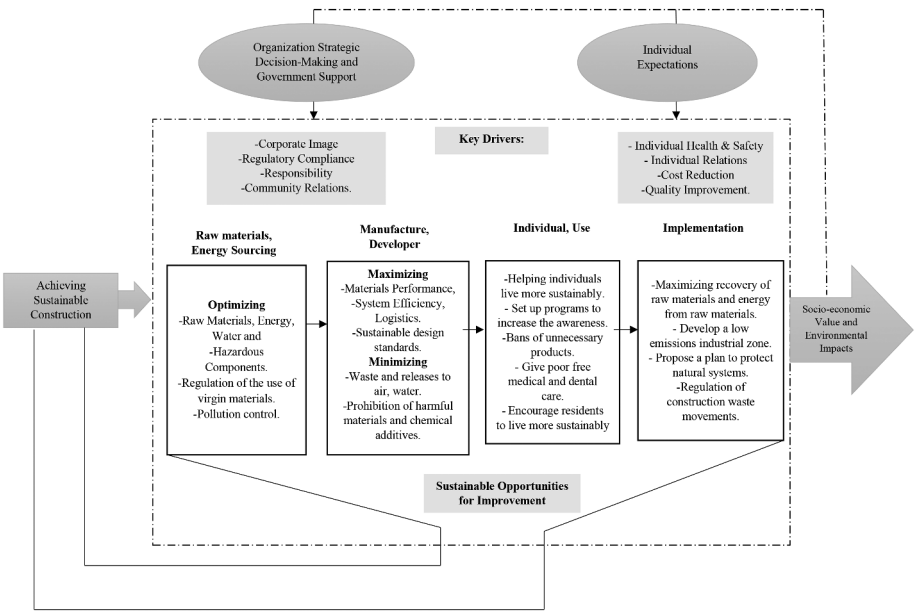

Fig. 5 Framework for sustainability adoption on construction projects

materials that exceed international quality standards. As a result, there is a pressing need for more in-depth instruction in sustainable construction and green products to be added to university curricula and training programmes for professionals like scientists, university lecturers, policy makers, and industry personnel. This is true particularly in developed and developing countries.

Moreover, community pressure and the threat of legal liability may encourage firms to improve their environmental and social performance (Tessnow-von Wysocki & Le Billon, 2019). Businesses are more likely to improve their environmental performance when public pressure results in strict environmental regulation. Firms might lobby for guidelines that benefit their interests if they have developed eco-friendly building methods and believe that widespread use of their technology will give them an economic advantage. Environmental regulation has been debated for its long-term costs and benefits by scholars of strategy and public policy (Raubenheimer & McIlgorm, 2018; Simon & Schulte, 2017; Tessnow-von Wysocki & Le Billon, 2019). The trade-offs that need to be made between environmental preservation and social-economic competitiveness were at the centre of many of the earliest discussions about sustainable products.

As a result, this organization's guiding principles for sustainable construction projects and product systems include minimizing the use of natural resources, manufactured inventory, and packaging; minimizing the use of single-use items that cannot be recycled or composted; switching from the use of materials derived from fossil fuels to materials and products derived from renewable feedstocks; and taking sustainability into account at every stage of a material's life cycle. When talking about sustainability, it's all about environmental protection, social impact, and economic fairness.

Construction site hazards must be eliminated, the soil must be preserved and enhanced, nutrient cycles must be preserved, air and water must be protected, biological diversity must be fostered, overall energy consumption must be reduced, and transportation impacts must be mitigated. A certified sustainable plan must be crafted, workers' health and safety must be guaranteed, and fair compensation must be provided. Another important rule is to avoid engineered nanomaterials and chemicals whose environmental and public health effects have not been thoroughly examined throughout their life cycles. Decentralizing production and shopping locally are other essential practices that reduce the environmental impact of production, logistics, and consumption (Álvarez-chávez et al., 2012).

3.4 Project success

The study of project management as an academic field and as a professional practice has emerged in direct reaction to the requirements of modern society. It emphasizes making optimal use of available resources and carrying out business plans promptly. Pinto (1986) researched the success of project implementation and defined its success using four criteria: time, budget, effectiveness, and client satisfaction. In contrast, sustainability is a long-term life considering individual generations' development and wealth distribution over generations (Brundtland, 1987).

Using a responsible strategy for construction has significant economic advantages, such as a better understanding of client demands, identifying innovation potential, increased shareholder value, decreased costs and risks, improved public relations and community interaction, and higher staff motivation. It can provide strategies that benefit society and the

environment while being effective and profitable (Alshawabkeh et al., 2020). The building and construction sector knows that considering a project's possible environmental impacts is crucial in guaranteeing its success. There is a need for projects in the public sector that the government sponsors are sustainable, according to exploratory pilot research carried out by Opoku and Fortune (2010). This strategy is consistent with economic, environmental, and social sustainability. It includes developments in various fields, including energy, waste management, and building procedures. However, as shown by Li-yin Shen et al. (2010), the industry has profited more from barriers to adopting environmental management than from economic, environmental, and social sustainability benefits. This is in contrast to the building sector in China, where economic criteria are given greater weight than social and environmental aspects when determining the feasibility of a project (Li-yin Shen et al., 2010).

The participation of various actors in the construction industry significantly helps achieve sustainable community development. Consultants include the government, planners, engineers, constructors, electrical and mechanical engineers, and quantity surveyors. Contractors have the primary contractor, sub-contractors, and suppliers. Site agents, site supervisors, and foremen were all categorized by Yip and Poon (2018). In order for project management to advance, it must shift its emphasis from merely "doing things well" to "doing the right things properly." This move means that project managers are legally compelled to take ownership of the project's final results, including the sustainability-related aspects of those results (Zaman et al., 2019). Also, Brundtland (1987) holistic view of sustainable social development must be widely disseminated. This view holds that economic, environmental, and social factors must all be given equal weight in any effort to create a truly sustainable society (Edum-Fotwe & Price, 2009; Li-yin Shen et al., 2010). However, little research has been conducted on the criteria that lead to successful project completion in the New Zealand construction industry.

3.5 Relating sustainability dimensions to project success

Abidin & Pasquire (2005) suggested that issues regarding the preservation of the environment should be incorporated into the overall project vision in the building sector. The traditional approach to project assessment focused on efficacy may lead to unacceptable results from the perspective of inter-generational justice (Labuschagne & Brent, 2004). While evaluating the project, there must also be a careful examination of how the project will impact the community and the natural world. Doing this will ensure that all possible environmental liabilities and costs in the future, as well as the social effects of the project's execution, are considered throughout the planning phase (Labuschagne et al., 2005). One needs a thorough grasp of project life cycles and the linkages between life cycles and the outside environment and society to align project management frameworks with the concepts of sustainable development. Only then can one possibly expect to match management frameworks with concepts of sustainable development (Labuschagne et al., 2005). The extensive connection between the effects of sustainability and project management has been debated in several books written by different authors. Gregersen and Contreras (1992) established a methodology for evaluating the predicted economic repercussions of the project. Lopes and Flavell (1998) provided a framework that can be used to analyze environmental and social hazards and other risks. According to Chan and Chan (2004), the economic, social, political, and physical environments of a country, as well as its labour relations and degree of technologi-

cal innovation, are all examples of the environment and external elements that impact the success of construction projects. Figure 6 provides a visual representation of this link. On the other hand, they are not developed to establish a connection between sustainability and the effective execution of projects.

According to Maldonado-Fortunet (2002), various challenges are associated with the process of driving project sustainability. One of these challenges is the absence of clear sustainability criteria and a realistic approach to designing particular building projects. Maldonado-Fortunet (2002) created a set of unique sustainability criteria for his research on a highway project. Resources, ecology, people, materials, environmental effects, energy, greater efficiency, project execution, and facility interior quality were the main factors considered.

3.6 Barriers and challenges of sustainability in project management

The construction sector has responded positively to calls for sustainability (Fathalizadeh et al., 2021). However, before a sustainable building plan can be fully endorsed and championed, the obstacles that stand in the way must be acknowledged. The phrase, sustainable building plan, is highly imprecise politicized and has diverse connotations for different individuals, as noted by a large body of sustainability literature (Aleixo et al., 2018). There is no "one size fits all" description of sustainability, possibly due to its fuzziness (Fathalizadeh et al., 2021). While Warren-Myers (2013) cites valuation as the barrier to investment in sustainability due to some valuers' lack of reporting of sustainability in property listings, Arif et al. (2009) cite limited sustainability knowledge, the adversarial impact of cultural evaluation, poverty, technological deficiencies, a lack of research, and the emergence of greener issues as some of the issues affecting sustainability in construction. It has been noted that the construction industry's lack of ability to incorporate sustainable practices is a significant impediment to green building (Häkkinen & Belloni, 2011). Other obstacles to eco-friendly buildings can be pinpointed on a national or even subregional scale, according to the widespread nature of the construction sector (see Figure 7).

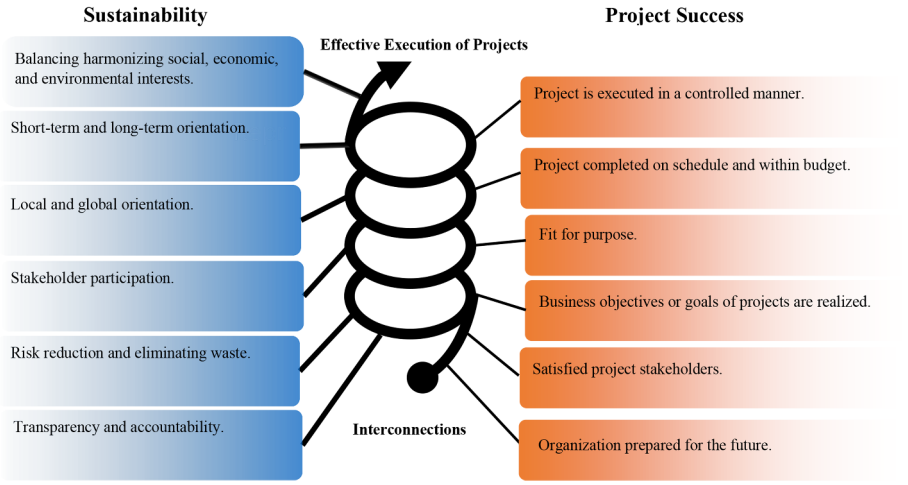

Fig. 6 Relating sustainability dimensions to project success

Alkhaddar et al. (2012) found that UK construction professionals working in offices seemed to have a deeper understanding of sustainability than those working on construction sites. Additionally, their analysis showed that on-site personnel working in offices appeared only to absorb surface information about sustainability. This would imply that UK industry experts in the building sector still regard sustainability as a fad that might soon become irrelevant and may not consider it much in terms of overall applicability.

However, in view of the flood of rapid urbanization and the acceleration of construction activities in most developing countries, Du Plessis (2007) urged for intentional measures to avoid the needless negative repercussions of building activities by implementing a sustainability strategy. Despite this lobbying, there has been little advancement in developing nations in this area, according to the research. Nigeria is a perfect example of a developing country where the construction sector is crucial and a significant driver of economic progress (Zuofa et al., 2015). The workforce of Nigerian construction professionals still lacks some understanding and awareness of sustainability issues, according to Dania et al. (2007). Similarly, research by Ojo et al. (2014) on implementing green supply change management highlighted several barriers, including a lack of sustainable practises, insufficient top management commitment, a lack of government legal enforcement, and a lack of public awareness. Furthermore, Dania et al. (2013) demonstrated that the Nigerian government's efforts to promote sustainable building practices had not succeeded.

Still, their investigations showed that a limited number of overseas companies are beginning to promote interest in sustainability even though there is often minimal awareness of and demand for sustainable construction. According to Dania, Dania et al. (2014) and Dania et al. (2013), multinational corporations have a stronger foundation in sustainability expertise than medium-sized indigenous corporations. When taken as a whole, these obstacles and difficulties raise questions about the sustainability of the building sector. As shown by the examined literature, despite the greater degree of development in industrial-

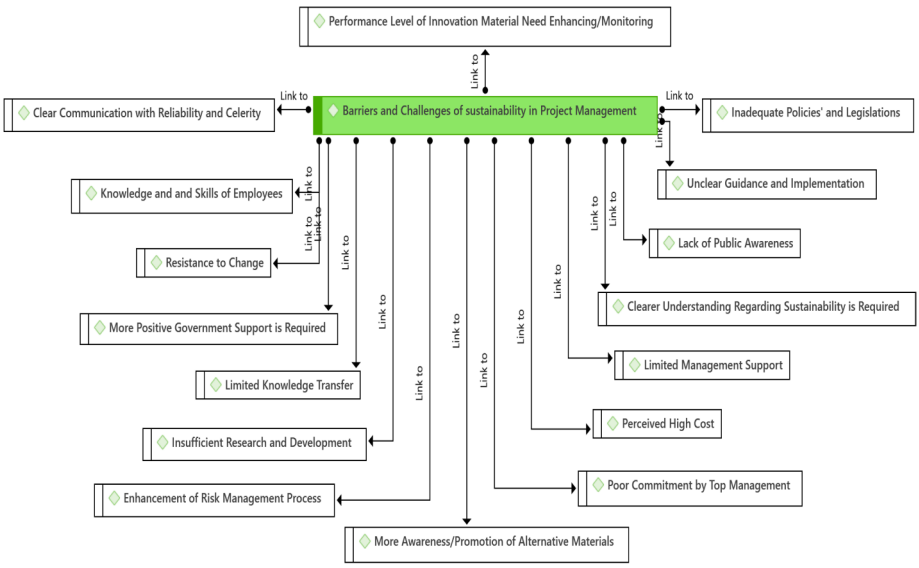

Fig. 7 Overview of critical barriers and challenges to sustainability adoption in construction project

ized nations, there are still several obstacles to sustainability in building. The situation in emerging nations may even be worse. Despite all the justifications for incorporating sustainable practices in construction, it is still necessary to investigate and perhaps even question stakeholders' ideas of sustainability in the building project.

4 Discussion

This study conducted a literature review on the symbolic importance and assessment of sustainability in construction and project sustainability success criteria. The results of this review provided a detailed account of the primary explanations of sustainable construction and how the concept was functional when applied in practice. This body of research uncovered several distinct conceptualizations of sustainability in the building industry and identified essential components of environmentally responsible building practices. In addition, it provided a literature review on sustainable building methods from across the world, intending to gain a deeper comprehension of the factors currently being taken into account in the construction sector. In addition, the literature covered a wide range of facets related to sustainability in various contexts, including those of developed and developing countries. This was done to understand the most effective way to implement changes to the current construction practices used in pipeline construction projects in New Zealand. It also demonstrated the various views and perceptions held about environmentally friendly actions. Considering that the purpose of this research study was to design a strategy for implementing sustainable building in New Zealand, it was vital to throw light on the most famous and well-known sustainable construction applications that have been implemented worldwide. As a result of this purpose, the literature on construction practises was provided to obtain insights into the ongoing discussions on sustainable practices and systems in the building sector. It also presented a large number of studies for sustainable change in a variety of situations to understand better how to most effectively bring transformation into the construction practices that are currently in place.

In addition, the findings of this study revealed 19 obstacles that need to be overcome before sustainable construction techniques can be used in pipeline construction projects in New Zealand. The following were identified as the primary challenges: the cost of environmentally friendly materials and products; limited knowledge transfer; inadequate public policies; poor leadership decision-making processes; legislation; adoption of new technologies; limited availability of information and specifications regarding environmentally friendly materials; unfamiliarity on the part of stakeholders regarding sustainability; high initial capital and investment costs and a lack of technical ability and information technology skills.

Furthermore, this study creates project sustainability success criteria to improve construction pipeline projects in New Zealand. The assessment concentrated on works that connect sustainable development or project management approaches to sustainability. Based on identifying pertinent sustainability factors evident from the publications, areas were determined were sustainability impacts project management. Gilbert Silvius et al. (2013) highlighted the escalating interest among academics and industry experts in the fusion of sustainable project management with traditional project management approaches. Research exploring the application of sustainability principles to project management often delves

into various perspectives, including logical, ethical, and philosophical dimensions. Given that sustainability in project management is still in its nascent stages of exploration, these techniques align logically. The theoretical frameworks presented by Gu et al. (2023); Ogunmakinde et al. (2023); Opoku et al., 2019a, b); Karji et al. (2020), and other researchers emphasizing the amalgamation of project management with sustainability gain empirical reinforcement from this study.

Gu et al. (2023) underscore how the construction industry is primarily driven by financial incentives, with initial green construction incurring additional costs, posing a significant barrier. Ogunmakinde et al. (2023) further identify a range of barriers, including insufficient training and education among construction professionals, ethical shortcomings in sustainability execution, negative public attitudes toward sustainability, lack of awareness, imprecise data, and misaligned sustainability priorities. Opoku et al. (2019a) reveal additional impediments like perceived initial costs, inadequate comprehension of Environmental Sustainability (ES), technological hurdles, external pressures on ES practices, and environmental conditions in developing nations. Karji et al. (2020) pinpoint key challenges as pre-construction, managerial, legislative, and financial constraints. These studies collectively suggest the potential advantages of integrating sustainability into project management. In particular, the New Zealand construction industry lacks overall maturity in project sustainability within project management frameworks.

Furthermore, this study furnishes valuable insights for researchers probing success factors linked to sustainability, which is essential for effective project implementation. These findings have substantial implications for construction managers, particularly those aligned with companies' conscious of their projects' environmental impact, and for the academic community. Earlier theories gave practitioners the necessary knowledge to meet economic, environmental, and social sustainability (Atkinson, 1999). The New Zealand construction industry has conducted few empirical studies on specific sustainability-related success criteria for efficiently executing building projects. The findings of this study ought to persuade construction project managers in New Zealand to focus on five distinct aspects of their work. To begin, people responsible for managing projects need to have a thorough grasp of the long-term viability of the organizational strategy that underlies the successful completion of projects. It is essential to have a solid understanding of the current state of the local construction sector in terms of the level of maturity of projects concerning sustainability to establish a sustainable society. This understanding must be obtained before any progress can be made towards establishing a sustainable society.

Second, managers of construction projects may now benchmark what it takes for a project to be implemented successfully. When a construction project is carried out efficiently, project managers will have a strong chance of having the project executed successfully thanks to the four key success factors (Fig. 4). Thirdly, this research helps project managers comprehend how the elements that make up each of the three sustainability pillars may influence the successful execution of a project. It is beneficial for project managers to consider improving their routine responsibilities related to resource conservation, supply chain management, and collaboration with other organizations. These pre-requisites for achievement are significant in managing a project's sustainability.

The different effects of sustainability on the individual success criteria are the fourth additional implication for the project manager. They may focus on improving the associated sustainable impact if the manager decides that a specific success criterion is essential. Proj-

ect managers could focus their efforts on lowering water consumption and pollution and the number of resources squandered; for example, they could decide it is vital to improve managerial performance. The most significant implication for project managers is the fifth. This study finds numerous crucial components within the three sustainability pillars that support successful project implementation (see Figs. 4 and 5). Project managers must concentrate on three areas to increase their chances of successfully managing a project's sustainability. The goal of this research study is to attempt a better understanding of project execution's efficacy in connection to a sustainability-related influence.

The following objectives should be considered while planning a project in New Zealand, according to the newly available information: (1) customer usage; (2) enhancement of performance management; (3) positive influence on the client; (4) constructive awareness; and (5) project within the expenditure. To positively impact sustainability, it is crucial to incorporate criteria for resource conservation, the supply chain, and collaborations while executing a project. These success elements have to include the following: There are three types of sustainability: economic, environmental, and social. Economic sustainability focuses on efficiency gains, resource conservation, efficient system design, and technology use. Environmental sustainability focuses on pollution and waste minimization, hazardous material control, and proper system and material selection. Social sustainability focuses on proper system and material selection. The aforementioned makes it possible for construction project managers in New Zealand to improve their effectiveness in regulating the projects' environmental impact.

5 Conclusion

This study investigates the sustainability considerations in construction industry projects and thoroughly reviews existing research in this field. The primary aim is to establish successful project sustainability implementation criteria in future construction projects. Drawing insights from various reputable sources, the study compiles diverse economic, environmental, and social sustainability indicators tailored to different phases of a project's life cycle. The data is carefully extracted from credible databases to ensure robust findings. The study contributes to the existing research on sustainable construction and project management, emphasizing the influence of organizational values and individual responsibility in sustainability practices. It underscores the importance of government regulations encompassing sustainable practices for all projects, advocating for proper monitoring to ensure compliance. Incentive programs, as observed in certain nations, can effectively promote environmentally responsible building practices among contractors.

The research reveals management implications, highlighting the impact of stakeholder involvement on the proactive adoption of sustainable practices in the construction sector. It emphasizes the need for long-term strategies aligning businesses with stakeholders, such as clients, environmental NGOs, and regulators, to enhance corporate reputations and profitability. The study suggests developing procedures to address specific stakeholder issues and actively engaging them in defining and implementing sustainability objectives. To reap sustainable performance benefits, construction project managers must enforce sustainability through audits, tracking, reporting, measurement, and program evaluations. Establishing systems for auditing, monitoring, and assessing sustainability performance is crucial for

continuous improvement. While providing valuable insights, the study acknowledges certain limitations. Replicating the research using alternative methodologies and diverse marketplaces is recommended to enhance generalizability. Cross-country comparisons could offer insights into congruence and disparity across different contexts. The study identifies opportunities to explore specific strategies for sustainable building practices, urging further qualitative and quantitative investigations to enhance the social, economic, and environmental practices of construction stakeholders in the New Zealand construction sector.

6 Recommendations

This study presents a series of strategic recommendations designed to elevate sustainable construction practices within New Zealand. Drawing insights from a thorough assessment of existing literature and the research findings, these recommendations carry the potential to catalyze far-reaching advancements across the construction sector. Elevating awareness and understanding of sustainable construction elements emerges as a pivotal suggestion, especially when targeted at organizations and individuals involved in the construction industry. A concerted effort in this direction is expected to bolster the adoption of sustainable practices significantly.

Recommendations further promote a more robust regulatory framework from New Zealand's governmental authorities, encompassing stringent legislation, codes, and standards tailored to sustainable construction practices. These measures should uniformly apply to both the public and private sectors, ensuring comprehensive compliance and efficient implementation across all stakeholders. Expanding the consciousness about sustainable applications in higher educational institutions nationwide is vital. Equipping future professionals with robust knowledge and tools derived from industry research can profoundly influence the widespread integration of sustainable construction principles. In order to fortify awareness and knowledge levels among stakeholders, initiatives like seminars, talks, training sessions, and workshops should be augmented, particularly targeting developers and stakeholders in small and medium-sized enterprises. These educational platforms can effectively disseminate practical insights derived from industry research, enhancing their applicability and efficacy. Fostering competitive practices among producers becomes imperative to mitigate the cost-associated challenges related to sustainability. Broadening the spectrum of activities and strategies is equally crucial to fostering the pervasive adoption of sustainable practices throughout the construction domain. Simultaneously, emphasis must be placed on educating individuals about government incentives to incentivize sustainable construction. This knowledge promotion can serve as a potent motivator, encouraging wider acceptance and engagement with sustainable construction concepts among various stakeholders.

Author contributions Conceptualization: Taofeeq D. Moshood and James O.B. Rotimi; Writing - original draft preparation: Taofeeq D. Moshood and James O.B. Rotimi; Writing - review and editing: Wajiha Shahzad, James O.B. Rotimi and Wajiha Shahzad; Methodology: Taofeeq D. Moshood and James O.B. Rotimi. All authors have read and agreed to the published version of the manuscript.

Funding The authors gratefully acknowledge the generous financial support the CanConstructNZ research program provides through the Ministry of Business, Innovation, and Employment (MBIE) Endeavour Fund, administered within the School of Built Environment at Massey University.
Open Access funding enabled and organized by CAUL and its Member Institutions

Data availability Data sharing does not apply to this article as no datasets were generated or analyzed during the current study.

Declarations

Conflict of interest The authors declare no conflict of interest.

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