International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 11 Issue: 03 | Mar 2024 www.irjet.net p-ISSN: 2395-0072

Sustainable Approaches in Infrastructure Development and Construction Projects: A Systematic Literature Review on Planning and Implementation in India

Amit Krishan[1], Ravi Kumar Pathak[2], Ankita Srivastava[*3]

[1]Altinok Consulting Engineering Pvt. Ltd., New Delhi, Delhi, India
[2]LEA Associates South Asia Pvt. Ltd., New Delhi, Delhi, India
*[*3]Aarush Welfare Society, Lucknow, Uttar Pradesh, India*

Abstract - *The swift expansion of infrastructure in India aligns with Vision (2030), envisioning a robust, reliable, sustainable, and resilient infrastructure supported by sound technology. The conventional approach to construction projects poses environmental, social, and economic challenges. Embracing sustainable planning emerges as a prominent solution to address these issues. This paper seeks to delineate the primary research concepts explored in the literature on sustainability in construction projects. It underscores the importance of integrating sustainability from the early stages of design and feasibility studies, advocating for continuous monitoring throughout the project's lifespan. Efficient infrastructure development plays a pivotal role in driving the socioeconomic advancement of nations and regions. The planning of infrastructure projects is crucial as it ensures their timely delivery within allocated budgets and predefined scopes. Both academics and professionals have championed various methodological and technological advancements aimed at enhancing the planning processes, as evidenced by numerous scholarly works dedicated to the subject. Despite these advancements, there remains a dearth of studies that systematically analyze the knowledge structure, technological advancements, and methodological trends in sustainable infrastructure development planning. By employing an integrated approach to pinpointing research gaps in this field, this paper offers valuable insights for researchers seeking to explore sustainability in construction projects.*

Key Words: Construction project, Sustainability, Sustainable development, Project management, Infrastructure, Environment.

1. INTRODUCTION

The construction industry ecosystem is recognized as a significant contributor, constituting approximately 13% of the global gross domestic product [1]. However, this sector is concurrently responsible for substantial environmental impact, with construction activities accounting for 36% of worldwide energy consumption and 39% of energy-related carbon dioxide emissions [2]. Consequently, sustainability has become a focal point for governments, practitioners, and the academic community. Achieving sustainable construction goes beyond addressing ecological concerns and encompasses economic factors (such as competition, costs, and construction time), social aspects (including health, safety and local community needs), and technical sustainability [3].

The aspect of technical sustainability is a critical pillar, encompassing considerations related to the performance, quality, and service life of buildings or structures [3]. It also necessitates the establishment of mechanisms for assessing the success or shortcomings of sustainability in construction projects [4]. Therefore, the holistic view of sustainability in construction revolves around the three interconnected domains of the environment, society, and economy. The construction industry, defined as a collective of firms and organizations engaged in interrelated activities for infrastructure, building, and real estate development, plays a pivotal role in shaping sustainable practices [5].

Looking through the lens of technical sustainability, the adoption of sustainable construction practices is gaining momentum within the construction industry as a means to mitigate the adverse effects on the natural environment, including issues such as global warming, environmental degradation, and depletion of natural resources [6]. Consequently, the integration of sustainable construction concepts and methodologies is fostering the creation of responsibly built environments, leading to the emergence of high-performance green buildings, commonly known as green buildings [7].

Research endeavors in the realm of sustainability within the construction industry have given rise to various areas and themes. While some studies concentrate on specific facets of sustainability [8], others strive to comprehensively address all three domains of environmental, social, and economic sustainability [9]. Implicit in discussions on sustainability in the construction sector is the acknowledgment that project or program delivery serves as the conduit for achieving desired outcomes. Research in this domain spans topics such as value management for sustainability in construction, evaluating the sustainability performance of construction projects [10], and considerations of social sustainability during the planning and design phases, including the impacts of policies on infrastructure projects [11].

Assessment tools like social network analysis and sustainability and equity theories are employed to gauge social sustainability in construction [12]. The roles of government as a sustainability facilitator and society as stakeholders significantly influence construction projects. Literature exploring the interplay between lean construction and environmental sustainability suggests the integration of lean construction principles during the operational phase of a project's life cycle [13].

Collectively, the existing literature indicates that investigations into sustainability in construction projects are dispersed across various research areas and themes. Therefore, the objective of this research is to pinpoint the gaps in the current understanding of the sustainability of construction projects, offering insights into potential avenues for future research in this domain. This study undertakes a systematic review of the available literature with the aim of allowing researchers to discern the primary research clusters pertaining to sustainability in construction projects. The outcomes of this study are intended to guide researchers in identifying key areas for future exploration within the broader field of sustainability in construction projects.

2. LITERATURE REVIEW

2.1 Construction Projects

The mission underlying a construction project is defined as the creation of desired infrastructure facilities, encompassing buildings, roads, canals, tunnels, dams, and industrial structures, with predetermined performance objectives specified in terms of quality, completion time, budgeted costs, and other defined constraints. Distinguishing from routine activities like regular maintenance, construction projects are typically high-value endeavors. Their execution necessitates the management of both spatial elements, including plans, designs, layouts, and blueprints, and non-spatial components such as schedules, material quantities, quality specifications, etc., which are independently handled by various project team members and stakeholders [14].

Construction projects are broadly classified into three categories: (a) Building construction projects, covering residential and commercial buildings, schools, colleges, hospitals, offices, etc., (b) Infrastructure construction projects, encompassing highways, dams, canals, tunnels, railways, airports, ports, etc., and (c) Industrial construction projects, involving manufacturing plants [15].

The research team has interconnected these classifications with the earlier project management definitions, forming key reference points for this study. This shift in focus directs the examination towards sustainability elements embedded within the project management framework and their role in contributing to economic development.

Past research indicates that the efficiency and effectiveness of construction activities significantly impact national economic growth. Long-term construction projects, characterized by substantial investments, are susceptible to fluctuations in economic activity, particularly during economic downturns, leading to potential suspensions [16]. In the exploration of the link between large-scale construction projects and economic development, factors such as projected job growth, private investment levels, and overall wage growth within the sector are deemed relevant. These factors also influence the commissioning of projects based on established priority scales [17]. A noteworthy finding from the research underscores that the impact level of economic development generated by construction projects is influenced by various factors. Specifically, variables such as project location and economic conditions play a role, and construction projects may not significantly impact national or regional economies unless they reach an extraordinary size [17].

2.2 Sustainability

Sustainability, and consequently sustainable development, is commonly articulated as development that meets the needs of the present without compromising the ability of future generations to meet their own needs [18]. A revision in 2006 further refined this definition, emphasizing a long-term vision for sustainability where economic growth, social cohesion, and environmental protection are interconnected and mutually reinforcing. Sustainability encompasses essential elements such as cleaner production, pollution prevention, control mechanisms, and designs that align with ecological principles, including structures and building architecture [19]. The expansive and evolving nature of the sustainability concept has led to the emergence of new terms and concepts, adapting to the continuously unfolding developments [19].

2.3 Sustainability in Construction Projects

Sustainable construction emphasizes minimizing environmental harm, incorporating practices such as waste prevention, reuse, and management. This approach often prioritizes societal benefits over immediate profitability [20]. Striking a balance between long-term environmental gains and short-term economic objectives is crucial, necessitating a harmonious equilibrium [21].

Conducting a feasibility study, inclusive of sustainability components, before project initiation is pivotal for overall project success [20]. Sustainability is a dynamic, process-driven journey with diverse pathways to achievement [22]. The concept of the triple bottom line, introduced in 1994, underscores the need to consider social, environmental, and economic performance in project delivery for comprehensive sustainability. Establishing a structured workflow with a sustainability focus sets the stage for subsequent project

processes, ensuring the incorporation of a sustainable framework for construction outcomes [1].

A notable finding in the literature review is the prevalence of the term sustainable building design within construction project management contexts [23, 24, 25]. Eco-design elements often face barriers during early design phases due to economic, social, and environmental constraints [24]. Project managers are identified as key players in achieving sustainable building design deliverables, highlighting the necessity for specific training to align with these objectives [23].

The term constructability brings together economic and environmental sustainability elements across various sectors, introducing change processes to enhance the environmental efficiency of construction projects. Transforming strategic sustainability objectives into project outcomes is challenging, especially in large-scale projects, where the emphasis on economic profitability may sideline environmentally sound practices [25].

Sustainability should be integral at all stages of construction projects, including renovation and deconstruction. Circular economy principles, starting with smart urban planning, can contribute to economic, social, and environmental benefits in construction, operation, and deconstruction phases. This includes considerations for zero-energy buildings, greywater recycling systems, and sustainable innovations from the early design stages [18].

A win-win outcome for sustainability seeks environmental benefits for society and competitive advantages for construction companies [20]. Social sustainability must be addressed during design, planning, and execution, recognizing the construction industry's substantial contributions to the national GDP and employment opportunities. Beyond environmental and economic impacts, social considerations such as traffic congestion and delays should be taken into account [11]. Stakeholders need to prioritize social sustainability factors, ensuring community well-being, health and safety, security, and educational opportunities prevail over project development decisions. The literature review reflects a segmented development of categories and concepts, with a predominant focus on narrower financial and traditional project success factors rather than comprehensive constructs of sustainability in construction project management [8].

2.4 Project Management for Sustainability

Applying sustainability to project management encounters a perceived tension, as exemplified by the conflicting demands at macro and microeconomic levels. The necessity for construction projects to spur economic growth may clash with the imperative for sustainable practices to address climate change effects. On a macroeconomic scale, construction projects are essential for economic expansion, while at the microeconomic level, the urgency for swift and cost-effective reconstruction after events like floods or bushfires may prioritize immediate needs over environmental sustainability. This inherent tension is evident in practical case studies, which often highlight conflicts perceived by practitioners between sustainable long-term goals and short-term project objectives [26].

The literature emphasizes the complexity at the intersection of sustainability and project management. While there's broad consensus on the term’s project and project management, the definition of sustainability within a project context lacks unanimity, hindering alignment between academics and practitioners [26,]. This divergence leaves room for opinions and personal values, contributing to tensions related to responsibility, control, and project processes. Addressing these tensions is deemed crucial for enhancing the alignment between educational outcomes and practices, ultimately improving project success [27].

The lack of convergence and persistent tensions in defining sustainability within a project may be influenced by individual motivations. Identifying these motivations is proposed as a solution to understand varying interpretations of sustainability in project contexts [26]. This exploration should extend beyond project managers to include diverse project actors, such as clients, sponsors, corporate entities, and other stakeholders, each influenced by distinct values and motivations. Corporate strategies, fiscal and economic goals, and the ability of stakeholders to contribute or withhold resources are identified as potential sources of motivations shaping differing views on sustainability in projects. The existing literature acknowledges the lack of consensus in defining sustainability within a project but is yet to develop this construct further [26].

Some project management researchers have explored related practices, such as corporate sustainability and adherence to sustainable principles through triple bottom-line reporting [28]. Stakeholder engagement has been identified as crucial for integrating the triple bottom line into projects [29]. However, these studies often do not address tensions between classic economic project constraints and the longer-term perspectives required for sustainable practices. The conflicting nature of objectives that span the project's lifespan, the product's life, and global long-term environmental challenges underpins sustainable project management [30].

Recent reviews of project management literature on sustainability have identified the importance of local embeddedness, institutional demands, and motivations for integrating project management and sustainability [26]. These reviews, while shedding light on the journey of sustainable project management, still leave gaps in understanding where and how sustainable project management can be applied. The lack of convergence in defining sustainability in project management literature

allows for varied interpretations shaped by the views and values of central actors. The balance between project constraints and environmental, social, and economic concerns in sustainable project management is likely to differ in practice, contributing to its diverse shaping across different contexts [18].

2.5 Drivers of Sustainable Construction

The construction industry, while playing a crucial role in providing infrastructure for various industries to thrive, exerts substantial pressure on global natural resources. The concept of sustainability varies among individuals, contributing to the absence of universally applicable definitions. Recognizing the principles of sustainable development in the construction industry and addressing the drivers/enablers and challenges/barriers to sustainable construction projects becomes imperative due to this inherent vagueness [31].

Achieving sustainability in the construction sector involves considerations such as appropriate project management methodologies, project complexity, the integration of innovative approaches, and the utilization of information technology applications [18]. The assessment of sustainability performance in construction projects necessitates striking a balance between social and economic development and environmental sustainability. Notably, the environmental dimension often takes precedence in the evaluation of sustainability within construction projects [23]. Despite varying capacities and shortcomings across different nations or regions, the lack of sustainability reporting in the valuation process hinders greater investment in sustainable practices [32].

Even in developed countries like the UK, many construction companies do not extensively report on sustainability practices, suggesting a shallow learning approach among office-based and site-based employees [33]. Barriers to sustainability in construction encompass limited knowledge, insufficient research on improvement strategies, technological gaps, and culturally undervalued practices [34]. Furthermore, in developing countries, barriers include limited awareness of sustainable practices, a lack of top management support, and insufficient legal enforcement by the government [35].

Research highlights the impacts of individual behavior on the sustainability performance of construction projects at the micro-level, emphasizing relationship sustainability in addition to the traditional iron triangle of time, cost, and quality [36]. Examining project citizenship behavior, encompassing aspects like helping behavior, project-based compliance, taking charge, and personal initiative, revealed significant direct correlations with sustainability performance. Individual behavior and interpersonal relationships among construction project team members play a pivotal role in promoting project sustainability, particularly when technical indicators alone may fall short of achieving sustainability goals. Complex projects tend to see a more pronounced influence of project citizenship behavior on sustainability performance compared to less complex projects [36].

In addition to the behavioral characteristics of project team members, various factors drive the environmental sustainability performance of construction projects. These drivers aim to encourage construction firms and projects to adopt practices that prioritize the use of renewable resources while minimizing waste disposal and pollution. Often, drivers of sustainability are intertwined with sustainability goals as they are closely connected [37]. Drivers represent the factors that compel firms to integrate and implement sustainability into construction projects, while goals are the desired outcomes that companies seek through the practice of sustainability in their projects [38]. Environmental challenges, such as limited natural resources, escalating energy prices [39], stakeholder demands, and stricter environmental regulations [40], act as drivers of sustainability. Conversely, financial gains, a sustainable environment [41], competitive advantage, and a green reputation [42] can be considered goals of implementing sustainability in practice. A comprehensive list of 31 drivers of environmental sustainability includes the implementation of International Standards Organization (ISO) 14000 certification [42], customers' willingness to pay for green designs, awareness of environmental impacts, and the adoption of environmental management systems (EMS) [43]. Other drivers encompass considerations such as the comfort and welfare of employees [44], improved energy efficiency, reduced whole lifecycle costs [45], the creation of new marketing opportunities, and the strengthening of partner relationships [46]. While achieving environmental and social sustainability brings economic benefits, indicators such as financial gains and reduced life-cycle costs are simultaneously viewed as both drivers and economic outcomes of sustainability practices in construction projects [18].

In terms of social sustainability in the construction industry, internal drivers within organizations influence social sustainability performance [47]. Applying the resource-based view to comprehend firm-level development through resources, the relationship between a construction firm and its natural environment is explored. Business innovativeness is identified as a driver of social sustainability, enabling firms to transition from their current technological state to a more sustainable status [47]. Another driver of social sustainability in construction projects is technology orientation, as companies with a higher technological orientation are better positioned to address social issues, employee quality of life, client expectations for better products at lower costs, and overall societal welfare [48]. Corporate social responsibility (CSR) activities, both on-site and within project communities [49], and organizational capabilities are crucial for firms to

navigate sustainability-related challenges and pressures [50]. Organizational capabilities significantly enhance social sustainability performance, directly or indirectly through technological orientation. Consequently, construction companies are urged to strengthen their organizational capabilities, foster essential capacities to enhance business innovativeness, and adapt to emerging technologies to boost social sustainability performance [47].

3. SUSTAINABLE PROJECT PLANNING OF INFRASTRUCTURE IN INDIA

Following the United Nations Climate Change Conference in Paris (2015), India, as a developing nation, embraced the usage of 17 development goals, presenting both opportunities and challenges. India is undergoing significant progress in sustainable development, particularly in the construction industry, driven by substantial investments in housing, roads, ports, water supply, and airport development. The construction sector has experienced double-digit growth, with its contribution to GDP significantly increasing over the past decade. The Planning Commission of India proposed an investment of around US$ 1 trillion in the Twelfth 5-year plan (2012–2017), doubling the allocation from the Eleventh 5-year plan. However, challenges exist, as highlighted in the report on Indian Urban Infrastructure and Services by the Ministry of Urban Development (MoUD) in 2011. Factors negatively impacting revenue include shortfalls in project awards, funding, and inefficient project execution, resulting in a projected US$ 200 million loss to GDP by 2017 [51].

India's infrastructure is deemed inadequate, unfit, and ill-designed to support the expected economic growth of 7–8% over the next decade. The anticipated 2.5-fold growth in freight traffic exacerbates the strain on India's infrastructure. Learning from past experiences and adopting global best practices, there is a push for an infrastructure strategy that minimizes investment, maximizes cost-effectiveness, and prioritizes energy efficiency. India envisions a quality, reliable, sustainable, and resilient infrastructure by 2030, emphasizing affordability, increased resource use efficiency, the use of clean technology, and environmentally sound industrial processes. This vision necessitates a focus on extensive research and development efforts and innovative approaches. It is essential to regulate infrastructure development in India, considering modeling and anticipating various risks arising from gaps between planning and execution, inconsistent implementation of world standards, lack of coordination among stakeholders, and improper professional practices [51].

Life cycle analysis appears to be a promising solution to address the identified gap in research [51, 52, 53, 54, 55, 56]. However, to identify the research gap, several considerations must be taken into account:

1. Emphasizing and achieving an optimum combination of life cycle cost analysis and value engineering to develop comprehensive guidelines or standards, thereby enabling the inclusion of hidden and social costs [52].

2. Addressing measures to reduce time and cost overrun related to environmental clearance and land acquisition, identified as major reasons for delays in the infrastructure sector. Recommendations include the improvement of technology use, transparent assessment, appointment of an independent trustworthy land evaluator, decentralization in decision making, and special capacity building for global business opportunities [53].

3. Extending the sustainable engineering infrastructure model proposed by Okon et al. [57] for applicability under Indian conditions, facilitating decision-making based on risk, return evaluation, stakeholder perspectives, and sustainability issues in infrastructure projects.

4. Exploring effective health and safety measures on construction sites as a potential area for further research in the construction industry, as recommended by Ikpe and Hammon [54].

5. Advancing the qualitative model presented by Alam et al. [55] to identify the impact levels of various life cycle analysis components associated with infrastructure projects. Researchers suggest quantitative assessment of parameters for objectivity in decision making.

6. Addressing difficulties in improving life cycle assessment of infrastructure projects, such as normalization and the use of sustainable analysis tools. Specific attributes and concerns of society need to be considered and applied in functional analysis tools [58].

10. Emphasizing the consideration of risk and sensitivity analysis in life cycle cost examination to enhance the reliability and certainty of assessed models, as recommended by Castro [56].

3. CONCLUSIONS

The importance of sustainable construction project management is becoming increasingly apparent from various perspectives. Construction projects, ranging from large-scale mega projects crucial for fostering economic growth to smaller initiatives, often confront sustainability challenges. These challenges may arise due to the intended use of the final product or the materials employed in the project's execution. While these endeavors are typically funded by governments with the aim of stimulating commercial development, sustainability considerations inevitably emerge, thereby presenting project managers with an additional layer of complexity alongside the traditional constraints of time, cost, quality, and scope.

What our research has illuminated is the notable absence of comprehensive integration of sustainability within existing

project management frameworks. This absence underscores the need for a deeper understanding of the intricate relationships within sustainable construction project management, which can be characterized as both complicated and complex. Such complexity stems from the diverse factors at play, including environmental, social, and economic considerations, as well as the interplay between various stakeholders and project objectives.

Through a thorough analysis and synthesis of the literature, we have identified three primary research streams that warrant further exploration: (a) evaluating sustainability, which involves assessing the environmental, social, and economic impacts of construction projects; (b) project management for sustainability, focusing on the integration of sustainability principles and practices into project management processes and decision-making; and (c) understanding the drivers of sustainable construction, including policy frameworks, market dynamics, technological innovations, and stakeholder expectations.

Moreover, it's essential to recognize that the implications of sustainability can vary significantly depending on the scale of the construction project. Therefore, future research endeavors should aim to delve into the specific impacts and implications of sustainability across projects of different sizes, including small, medium, and large-scale endeavors. By examining these dimensions separately, researchers can gain a more nuanced understanding of how sustainability considerations manifest in various contexts and inform tailored strategies for promoting sustainability within the construction industry.

REFERENCES

[1] Bamgbade, J.A., Kamaruddeen, A.M., Nawi, M.N.M. Malaysian construction firms' social sustainability via organizational innovativeness and government support: The mediating role of market culture. J. Clean. Prod. 2017, 154, 114–124.

[2] Agarwal, M., Krishan, A. Reusability of construction & demolition waste in bricks. International research journal of engineering and technology 2017, 4(12), 148-151.

[3] Hill, R.C., Bowen, P.A. Sustainable construction: Principles and a framework for attainment. Constr. Manag. Econ. 1997, 15, 223–239.

[4] Yu, W.D., Cheng, S.T., Ho, W.C., Chang, Y.H. Measuring the Sustainability of Construction Projects throughout Their Lifecycle: A Taiwan Lesson. Sustainability 2018, 10, 1523.

[5] Fulford, R.G. The implications of the construction industry to national wealth. Eng. Constr. Archit. Manag. 2019, 26, 779–793.

[6] Krishan, A., Agarwal, K., Srivastava, A. Use of Industrial Sludge as an Ingredient in Making of Bricks. Journal of Construction and Building Materials Engineering 2019, 5(1), 1-7.

[7] Ahn, Y.H., Pearce, A.R., Wang, Y., Wang, G. Drivers and barriers of sustainable design and construction: The perception of green building experience. Int. J. Sustain. Build. Technol. Urban. Dev. 2013, 4, 35–45.

[8] Zuo, J., Jin, X.-H., Flynn, L. Social sustainability in construction–An explorative study. Int. J. Constr. Manag. 2012, 12, 51–63.

[9] Kucukvar, M., Tatari, O. Towards a triple bottom-line sustainability assessment of the US construction industry. Int. J. Life Cycle Assess. 2013, 18, 958–972.

[10] Zhang, X., Wu, Y., Shen, L., Skitmore, M.A. prototype system dynamic model for assessing the sustainability of construction projects. Int. J. Proj. Manag. 2014, 32, 66–76.

[11] Valdes-Vasquez, R. Klotz, L.E. Social Sustainability Considerations during Planning and Design: Framework of Processes for Construction Projects. J. Constr. Eng. Manag. 2013, 139, 80–89.

[12] Almahmoud, E., Doloi, H.K. Assessment of social sustainability in construction projects using social network analysis. Facilities 2015, 33, 152–176.

[13] Francis, A., Thomas, A. Exploring the relationship between lean construction and environmental sustainability: A review of existing literature to decipher broader dimensions. J. Clean. Prod. 2020, 252.

[14] Bansal, V.K., Pal, M. Extended GIS for construction engineering by adding direct sunlight visualisations on buildings. Constr. Innov. 2009, 9, 406–419.

[15] Safa, M., Sabet, A., MacGillivray, S., Davidson, M., Kaczmarczyk, K., Haas, C.T., Gibson, G.E., Rayside, D. Classification of Construction Projects. Int. J. Civ. Environ. Struct. Constr. Archit. Eng. 2015, 9, 625–633.

[16] Chia, F.C., Skitmore, M., Runeson, G., Bridge, A. Economic development and construction productivity in Malaysia. Constr. Manag. Econ. 2014, 32, 874–887.

[17] Gkritza, K., Sinha, K.C., Labi, S., Mannering, F.L. Influence of highway construction projects on economic development: An empirical assessment. Ann. Reg. Sci. 2008, 42, 545–563.

[18] Kiani, M.R., Gengatharen, D., Kiani, M.N., Hughes, R., Campbell, A., Yates, R. Sustainability in Construction

Projects: A Systematic Literature Review. Sustainability 2021, 13, 1932.

[19] Glaviˇc, P., Lukman, R. Review of sustainability terms and their definitions. J. Clean. Prod. 2007, 15, 1875–1885.

[20] Shen, L.-Y., Tam, V.W.Y., Tam, L., Ji, Y.-B. Project feasibility study: The key to successful implementation of sustainable and socially responsible construction management practice. J. Clean. Prod. 2010, 18, 254–259.

[21] Srivastava, A., Krishan, A. A Brief Review on Fly Ash Utilization. International Journal of Scientific Research in Science, Engineering and Technology 2017, 3(8), 388-396.

[22] Bridson, P.B., Stoner, J.M.S., Fransen, M.H., Ireland, J. The aquaculture sustainability continuum—Defining an environmental performance framework. Environ. Sustain. Indic. 2020, 8.

[23] Marcelino-Sádaba, S., González-Jaen, L.F., Pérez-Ezcurdia, A. Using project management as a way to sustainability. From a comprehensive review to a framework definition. J. Clean. Prod. 2015, 99, 1–16.

[24] Lamé, G., Leroy, Y., Yannou, B. Ecodesign tools in the construction sector: Analyzing usage inadequacies with designers' needs. J. Clean. Prod. 2017, 148, 60–72.

[25] Zhong, Y., Wu, P. Economic sustainability, environmental sustainability and constructability indicators related to concrete- and steel-projects. J. Clean. Prod. 2015, 108, 748–756.

[26] Sabini, L., Muzio, D., Alderman, N. 25 years of sustainable projects. What we know and what the literature says. Int. J. Proj. Manag. 2019, 37, 820–838.

[27] Chofreh, A.G., Goni, F.A., Malik, M.N., Khan, H.H., Klemeš, J.J. The imperative and research directions of sustainable project management. J. Clean. Prod. 2019, 238, 1–14.

[28] Vuorinen, L., Martinsuo, M. Value-oriented stakeholder influence on infrastructure projects. Int. J. Proj. Manag. 2019, 37, 750–766.

[29] Martens, M.L., Carvalho, M.M. Key factors of sustainability in project management context: A survey exploring the project managers' perspective. Int. J. Proj. Manag. 2017, 35, 1084–1102.

[30] Moehler, R.C., Hope, A.J., Algeo, C.T. Sustainable project management: Revolution or evolution? Acad. Manag. Proc. 2018, 2018, 13583.

[31] Hartshorn, J., Maher, M., Crooks, J., Stahl, R., Bond, Z. Creative destruction: Building toward sustainability. Can. J. Civ. Eng. 2005, 32, 170–180.

[32] Warren-Myers, G. Is the valuer the barrier to identifying the value of sustainability? J. Prop. Invest. Financ. 2013, 31, 345–359.

[33] Alkhaddar, R., Wooder, T., Sertyesilisik, B., Tunstall, A. Deep learning approach's effectiveness on sustainability improvement in the UK construction industry. Manag. Environ. Qual. Int. J. 2012, 23, 126–139.

[34] Arif, M., Egbu, C., Haleem, A., Kulonda, D., Khalfan, M. State of green construction in India: Drivers and challenges. J. Eng. Des. Technol. 2009, 7, 223–234.

[35] Ojo, E., Mbowa, C., Akinlabi, E.T. Barriers in Implementing Green Supply Chain Management in Construction Industry. In Proceedings of the 2014 International Conference on Industrial Engineering and Operations Management, Bali, Indonesia, 7–9 January 2014.

[36] Guo, S., Wang, X., Fu, L., Liu, Y. How Individual's Proactive Behavior Helps Construction Sustainability: Exploring the Effects of Project Citizenship Behavior on Project Performance. Sustainability 2019, 11, 6922.

[37] Boons, F., Mendoza, A. Constructing sustainable palm oil: How actors define sustainability. J. Clean. Prod. 2010, 18, 1686–1695.

[38] Opoku, D.G.J., Agyekum, K., Ayarkwa, J. Drivers of environmental sustainability of construction projects: A thematic analysis of verbatim comments from built environment consultants. Int. J. Constr. Manag. 2019, 1–9.

[39] Moss, R.H., Edmonds, J.A., Hibbard, K.A., Manning, M.R., Rose, S.K., van Vuuren, D.P., Carter, T.R., Emori, S., Kainuma, M., Kram, T., et al. The next generation of scenarios for climate change research and assessment. Nature 2010, 463, 747–756.

[40] Noe, R., Hollenbeck, J., Gerhart, B., Wright, P. Human Resource Management: Gaining a Competitive Advantage; McGraw-Hill Education: New York, NY, USA, 2017.

[41] Windapo, A. Examination of Green Building Drivers in the South African Construction Industry: Economics versus Ecology. Sustainability 2014, 6, 6088–6106.

[42] Opoku, D.G.J., Ayarkwa, J., Agyekum, K.A. Conceptual Framework of Push Factors for Implementing Environmentally Sustainable Construction Practices.

In Proceedings of the ICIDA 2017 6th International Conference on Infrastructure Development in Africa, Kumasi, Ghana, 12–14 April 2017.

[43] Opoku, A., Alex Opoku, P.V.A.A.D., Cruickshank, H., Ahmed, V. Organizational leadership role in the delivery of sustainable construction projects in UK. Built Environ. Proj. Asset Manag. 2015, 5, 154–169.

[44] Aktas, B., Ozorhon, B. Green Building Certification Process of Existing Buildings in Developing Countries: Cases from Turkey. J. Manag. Eng. 2015, 31.

[45] Andelin, M., Sarasoja, A.L., Ventovuori, T., Junnila, S. Breaking the circle of blame for sustainable buildings—evidence from Nordic countries. J. Corp. Real Estate 2015, 17, 26–45.

[46] Babiak, K., Trendafilova, S. CSR and environmental responsibility: Motives and pressures to adopt green management practices. Corp. Soc. Responsib. Environ. Manag. 2011, 18, 11–24.

[47] Bamgbade, J.A., Nawi, M.N.M., Kamaruddeen, A.M., Adeleke, A.Q., Salimon, M.G. Building sustainability in the construction industry through firm capabilities, technology and business innovativeness: Empirical evidence from Malaysia. Int. J. Constr. Manag. 2019, 1–16.

[48] Costa, C., Lages, L.F., Hortinha, P. The bright and dark side of CSR in export markets: Its impact on innovation and performance. Int. Bus. Rev. 2015, 24, 749–757.

[49] Wirahadikusumah, R.D., Ario, D. A readiness assessment model for Indonesian contractors in implementing sustainability principles. Int. J. Constr. Manag. 2015, 15, 126–136.

[50] Glavas, A., Mish, J. Resources and Capabilities of Triple Bottom Line Firms: Going Over Old or Breaking New Ground? J. Bus. Ethics 2015, 127, 623–642.

[51] Kale, A.M., Pimplikar, S.S. Sustainable Project Planning of Road Infrastructure in India: A Review. In: Ranadive, M.S., Das, B.B., Mehta, Y.A., Gupta, R. (eds) Recent Trends in Construction Technology and Management. Lecture Notes in Civil Engineering 2023, vol 260. Springer, Singapore.

[52] Arditi, Messiha. Life cycle cost analysis (LCCA) in municipal organizations. J Infrastruct Syst ASCE 1999, 1–10.

[53] Madanu et al. Life-cycle cost analysis of highway intersection safety hardware improvements. J Transp Eng ASCE 2010, 25–33.

[54] Ikpe, Hammon. Cost-benefit analysis for accident prevention in construction project. J Constr Eng Manag ASCE 2012, 64–69.

[55] Alam, Kumar, Dawes. Life cycle analysis for sustainability assessment of road projects. CIB World Building Congress 2012, pp 76–88

[56] Castro. Life cycle cost analysis of road infrastructures using LCC Am/Qm software. Tecnico Lisboa 2016, 1–9.

[57] Okon, Ekpo, Elhag. A sustainable engineering infrastructure model for the 21st century. In: Proceedings of the world congress on engineering 2010, pp 35–46.

[58] Buneo, Vassello, Cheung. Sustainability assessment of transport infrastructure projects: a review of existing tools and methods 2013, 1–28.