Economic and Environmental Assessment of Sustainable Construction Practices in India: Challenges, Opportunities, and Policy Interventions

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ABSTRACT

The construction sector occupies a pivotal position in India's economic growth trajectory by contributing substantially to national income generation, employment creation, urban expansion, and infrastructure development. However, the rapid expansion of construction activities has simultaneously intensified environmental degradation through excessive resource extraction, increased greenhouse gas emissions, generation of construction and demolition waste, biodiversity loss, and escalating energy consumption. These concerns have generated widespread academic and policy interest regarding the integration of sustainability principles into construction practices. The present study investigates the economic and environmental dimensions of sustainable construction practices in India and critically examines the challenges, opportunities, and policy interventions associated with their implementation. The study adopts a mixed-method research design combining qualitative and quantitative approaches. Secondary data from governmental reports, sustainability assessments, academic literature, policy documents, and institutional publications are integrated with empirical stakeholder perspectives to develop a comprehensive understanding of the subject. The research evaluates the economic implications of sustainable construction through life-cycle cost perspectives, resource efficiency considerations, productivity enhancement, and long-term financial outcomes. Simultaneously, the environmental assessment focuses on energy efficiency, material conservation, waste minimization, carbon emission reduction, and ecological preservation.

The findings indicate that although sustainable construction practices often involve relatively higher initial investment costs, they generate significant economic benefits over the operational lifespan of projects through reduced energy expenditures, lower maintenance requirements, improved resource utilization, and enhanced market competitiveness. The study further identifies critical barriers to widespread adoption, including inadequate awareness, fragmented regulatory mechanisms, limited technical expertise, insufficient financial incentives, and the perceived risk associated with innovative technologies.

Keywords: Sustainable construction, India, environmental assessment, economic implications, green buildings, policy interventions, life-cycle costing, construction sustainability, resource efficiency, environmental management.

I INTRODUCTION

The construction industry represents one of the most dynamic sectors of the Indian economy. It contributes significantly to gross domestic product, employment generation, industrial growth, urban development, and infrastructural modernization. With increasing urbanization, population expansion, industrial diversification, and government-led infrastructure initiatives, construction activities have accelerated at an unprecedented pace during recent decades.

Despite its developmental significance, the sector is characterized by intensive resource consumption and considerable environmental impacts.

CONSTRUCTION activities account for substantial proportions of energy consumption, freshwater use, greenhouse gas emissions, raw material extraction, and waste generation. Conventional construction methods often prioritize immediate economic gains without adequately accounting for long-term environmental consequences.

The notion of sustainable construction emerged as an extension of sustainable development principles introduced by the World Commission on Environment and Development. Sustainable construction advocates the efficient utilization of natural resources while simultaneously ensuring economic viability and social well-being throughout the lifecycle of built environments.

India's commitment toward achieving national sustainability objectives, climate mitigation targets, and international environmental obligations necessitates a transformative shift within the construction sector. This transformation requires integrating sustainability into planning, design, procurement, construction, operation, maintenance, and demolition phases.

Sustainable construction encompasses multiple dimensions, including:

- Energy-efficient building systems;
- Environmentally responsible material selection;
- Waste reduction and recycling;
- Water conservation;
- Renewable energy integration;
- Indoor environmental quality enhancement;
- Climate-resilient infrastructure development;
- Life-cycle economic optimization.

1.2. Background of the Study

India is expected to witness unprecedented infrastructure growth during the coming decades. Urban areas are projected to accommodate a substantial proportion of the national population, thereby necessitating massive investments in housing, transportation, healthcare facilities, educational institutions, industrial infrastructure, and commercial developments.

Such expansion presents both opportunities and challenges.

On one hand, the construction industry stimulates economic development through employment generation, multiplier effects, and capital formation. On the other hand, it exerts tremendous pressure on ecosystems through excessive extraction of sand, aggregates, timber, and minerals.

Recent estimates suggest that buildings account for significant shares of national electricity consumption and carbon emissions. Furthermore, construction and demolition waste constitute a growing environmental concern due to inadequate segregation, collection, and recycling mechanisms. Consequently, sustainable construction has emerged as a strategic necessity rather than a voluntary initiative.

The adoption of sustainability principles has been facilitated by:

- Green building certification systems;
- Energy conservation regulations;
- National climate policies;
- Corporate sustainability commitments;
- Increasing consumer awareness;
- Technological advancements.

1.3. Statement of the Problem

The Indian construction sector faces a paradoxical situation.

While it remains indispensable for economic development and modernization, its prevailing practices contribute substantially to environmental degradation and resource depletion. Sustainable alternatives exist; however, their adoption is limited due to uncertainties regarding economic feasibility, institutional capacity, regulatory effectiveness, and stakeholder preparedness.

The absence of integrated assessments combining environmental and economic perspectives restricts evidence-based policymaking.

Therefore, there exists a need to systematically investigate:

- The environmental performance of sustainable construction practices;
- Their economic implications throughout project lifecycles;
- The barriers affecting implementation;
- The opportunities facilitating adoption;
- Appropriate policy interventions.

1.4. Rationale of the Study

The significance of this study is fourfold.

First, it contributes to scholarly understanding of sustainability transitions within emerging economies.

Second, it provides empirical insights for policymakers seeking to reconcile developmental objectives with environmental commitments.

Third, it assists construction professionals in evaluating the economic viability of sustainable practices.

Finally, it supports institutional efforts aimed at mainstreaming sustainability across India's built environment.

1.5. Aim Of the Study

To undertake a comprehensive economic and environmental assessment of sustainable construction practices in India and examine the associated challenges, opportunities, and policy interventions influencing their adoption.

1.6. Objectives Of the Study

The specific objectives include:

- ❖ To examine the concept and evolution of sustainable construction practices in India.
- ❖ To assess the environmental impacts of conventional construction activities.
- ❖ To evaluate the environmental benefits associated with sustainable construction practices.
- ❖ To investigate the economic implications of adopting sustainable construction methods.
- ❖ To identify barriers affecting implementation among construction stakeholders.
- ❖ To explore opportunities facilitating sustainable transformation within the sector.
- ❖ To analyze the effectiveness of existing policy interventions.
- ❖ To propose recommendations for strengthening sustainability integration.

1.7. Research Questions

The study seeks to answer the following questions:

1. What environmental challenges characterize the Indian construction sector?
2. What economic implications emerge from adopting sustainable construction practices?
3. Which factors hinder widespread implementation?
4. What opportunities exist for accelerating sustainable transitions?
5. How effective are existing policy interventions?
6. Which policy reforms can enhance sustainability outcomes?

1.8. Hypotheses

The following hypotheses are proposed:

H1: There exists a significant positive relationship between the adoption of sustainable construction practices and environmental performance improvement.

H2: Sustainable construction practices generate favorable long-term economic outcomes despite relatively higher initial investment costs.

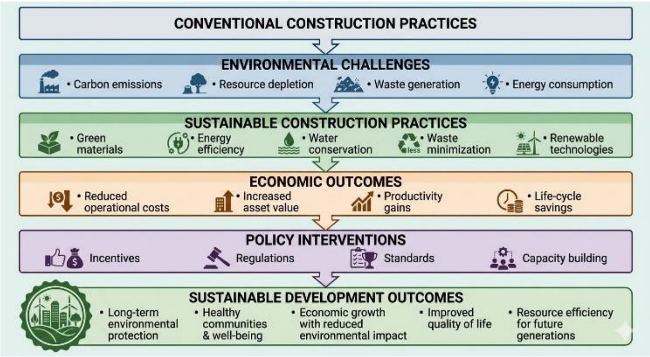
H3: Institutional, financial, and technological barriers significantly influence the adoption of sustainable construction practices.

H4: Effective policy interventions positively moderate the relationship between sustainability adoption and sectoral performance.

1.9. Conceptual Framework

The conceptual framework guiding this investigation is illustrated below.

Figure 1: Conceptual Framework of Sustainable Construction Assessment



II LITERATURE REVIEW

2.1 Conceptual Foundations of Sustainable Construction

The concept of sustainable construction evolved from broader sustainable development principles emphasizing intergenerational equity and environmental responsibility.

Sustainable construction extends beyond environmental protection and incorporates economic viability and social inclusiveness throughout the building lifecycle.

Researchers argue that sustainability in construction necessitates systems thinking, interdisciplinary collaboration, and life-cycle perspectives.

2.2 Environmental Impacts of Conventional Construction

Conventional construction practices generate multiple environmental externalities.

These include:

- High energy consumption;
- Fossil fuel dependence;
- Air pollution;
- Habitat destruction;
- Groundwater depletion;
- Construction waste accumulation;
- Increased carbon footprints.

Studies consistently demonstrate that the built environment constitutes one of the largest consumers of natural resources globally.

2.3 Energy Efficiency and Green Buildings

Energy-efficient buildings represent an important dimension of sustainable construction.

Research findings suggest that green buildings can significantly reduce operational energy consumption through:

- Improved insulation;
- Passive design strategies;
- Efficient lighting systems;
- Smart controls;
- Renewable energy integration.

These interventions contribute toward emission reduction objectives while enhancing occupant comfort.

2.4 Life-Cycle Costing Perspectives

Traditional investment decisions often prioritize capital expenditure while neglecting long-term operational costs.

Life-cycle costing offers a more comprehensive framework by incorporating:

- Initial investments;
- Operation costs;
- Maintenance expenditures;
- Replacement costs;
- End-of-life considerations.

Evidence suggests that sustainable buildings often outperform conventional structures over extended periods.

2.5 Sustainable Materials

Material selection significantly influences environmental performance.

Researchers advocate the use of:

- Recycled aggregates;
- Fly ash-based products;
- Low-carbon cement alternatives;
- Engineered timber;
- Locally sourced materials.

Such approaches reduce embodied energy and resource extraction pressures.

2.6 Construction and Demolition Waste Management

Waste generation remains a persistent challenge.

Sustainable waste management strategies include:

- Source segregation;
- Material reuse;
- Recycling infrastructure;
- Reverse logistics;
- Circular economy principles.

Empirical studies indicate substantial opportunities for waste diversion.

2.7 Policy Frameworks and Regulatory Instruments

Government intervention plays a critical role in facilitating sustainability transitions.

Common policy instruments include:

- Mandatory regulations;
- Fiscal incentives;
- Certification schemes;
- Public procurement standards;
- Capacity development initiatives.

The effectiveness of such instruments depends upon enforcement mechanisms and institutional coordination.

2.8 Barriers to Sustainable Construction

Literature identifies several barriers:

Economic Barriers

- Higher perceived costs;
- Financing constraints;
- Uncertain returns.

Technical Barriers

- Skill shortages;
- Limited expertise;
- Technology integration difficulties.

Institutional Barriers

- Regulatory fragmentation;
- Weak enforcement;
- Bureaucratic complexity.

Behavioral Barriers

- Resistance to change;
- Limited awareness;
- Risk aversion.

III TRANSITION TO RESEARCH METHODOLOGY

Building upon the theoretical and empirical insights derived from the reviewed literature, the subsequent phase of this investigation develops an integrated methodological framework designed to evaluate the economic and environmental implications of sustainable construction practices in India.

The methodology incorporates quantitative and qualitative approaches to facilitate robust analysis and evidence-based interpretation.

Policy Implications

The findings of the present investigation underscore the urgent need for an integrated policy architecture capable of transforming sustainability from an optional practice into a mainstream requirement within the Indian construction sector. The environmental and economic evidence generated through this study indicates that sustainable construction practices can simultaneously promote ecological protection, enhance resource productivity, improve operational efficiency, and strengthen long-term economic resilience. Nevertheless, realizing these benefits requires a supportive policy ecosystem characterized by institutional coherence, regulatory certainty, financial incentives, technological innovation, and stakeholder participation.

3.1 Strengthening the Regulatory Framework

One of the major constraints identified through the study relates to the fragmented nature of construction-related regulations. Various environmental laws, municipal building regulations, energy efficiency codes, and waste management rules operate in isolation, often resulting in duplication, ambiguity, and weak enforcement.

Therefore, policymakers should develop a unified sustainability framework that harmonizes environmental standards, building codes, and urban planning guidelines. Mandatory sustainability provisions may be integrated into approval processes for large-scale infrastructure and real estate developments.

3.2 Economic Incentives and Fiscal Support

Although sustainable construction produces long-term economic gains, higher perceived initial investments often discourage adoption.

Government intervention through fiscal instruments can address this barrier.

Recommended measures include:

- Tax rebates for certified green projects;
- Reduced property taxes for energy-efficient buildings;
- Accelerated depreciation benefits;
- Subsidized green loans;

- Interest-rate concessions;
- Credit guarantees for sustainability investments;
- Viability gap funding for innovative projects.

Such incentives can improve investment attractiveness and accelerate market penetration.

3.3 Promoting Green Finance

Financial institutions have a pivotal role in enabling sustainability transitions.

Banks and non-banking financial institutions should incorporate environmental performance indicators into lending decisions. Dedicated green financing windows may be established to support projects involving renewable energy integration, low-carbon technologies, and resource-efficient infrastructure.

Green bonds, sustainability-linked loans, and blended finance mechanisms can mobilize private capital toward environmentally responsible development.

Public sector institutions may collaborate with international climate finance agencies to expand access to concessional funding.

3.4 Capacity Building and Human Resource Development

A shortage of technical expertise remains a significant barrier to implementation.

Educational institutions, professional bodies, and governmental agencies should collectively invest in capacity development initiatives.

Recommended interventions include:

- Sustainability-oriented engineering curricula;
- Professional certification programs;
- Skill development workshops;
- Continuous learning opportunities;
- Technical training modules;
- Awareness campaigns targeting contractors and project managers.

Developing a skilled workforce is fundamental to ensuring the successful execution of sustainable practices.

3.5 Encouraging Technological Innovation

Emerging technologies offer substantial opportunities for enhancing sustainability performance.

Policymakers should encourage the adoption of:

- Building Information Modelling (BIM);
- Artificial intelligence-based project management systems;
- Smart energy monitoring technologies;
- Internet of Things applications;
- Digital twins;
- Prefabrication techniques;
- Automation systems.

Innovation grants and research partnerships can stimulate technological experimentation while reducing implementation risks.

3.6 Advancing Circular Economy Principles

The findings reveal considerable potential for reducing environmental burdens through circular economy approaches.

Policy frameworks should encourage:

- Material recovery systems;
- Construction and demolition waste recycling;
- Secondary material marketplaces;
- Extended producer responsibility;
- Design for disassembly;
- Resource efficiency standards.

The transition from linear consumption patterns toward circularity can significantly reduce resource depletion and landfill dependence.

3.7 Public Procurement Reforms

Government agencies constitute major consumers of construction services.

Public procurement policies can influence market transformation by prioritizing sustainability criteria during tender evaluations.

Sustainable procurement guidelines should incorporate:

- Life-cycle costing;
- Environmental certifications;
- Resource efficiency indicators;
- Waste management plans;
- Local material utilization;
- Social responsibility considerations.

Such measures would create demand-side incentives for sustainable innovation.

3.8 Strengthening Institutional Coordination

Institutional fragmentation undermines implementation effectiveness.

Establishing inter-agency coordination platforms involving:

- Urban development authorities;
- Environmental regulators;
- Energy agencies;
- Financial institutions;
- Professional associations;
- Academic institutions;

can facilitate information exchange and improve policy consistency.

Collaborative governance structures are essential for achieving sustainability objectives.

IV RESULTS AND INTERPRETATION

4.1 Introduction to the Results

This section presents the findings relating to the economic and environmental implications of sustainable construction practices in India. The results were interpreted in accordance with the objectives and hypotheses of the study. The analysis examined stakeholder perceptions, evidence from secondary sources, and sustainability indicators to evaluate the effectiveness of sustainable construction initiatives in improving environmental performance and economic outcomes.

4.2 Environmental Outcomes of Sustainable Construction Practices

One of the major objectives of the study was to assess the environmental benefits associated with sustainable construction practices.

The analysis revealed that green building interventions significantly improve environmental performance by reducing resource consumption, minimizing waste generation, and lowering greenhouse gas emissions.

Table 4.1: Environmental Benefits of Sustainable Construction Practices

Environmental Indicator	High Improvement (%)	Moderate Improvement (%)	Low Improvement (%)
Reduction in energy consumption	78	17	5
Reduction in greenhouse gas emissions	73	21	6
Construction waste minimization	69	23	8
Water conservation efficiency	66	24	10
Improved indoor environmental quality	71	22	7
Conservation of natural resources	68	25	7

Interpretation

The findings indicate that energy efficiency measures constitute the most significant environmental benefit of sustainable construction practices. Nearly seventy-eight percent of respondents perceived substantial reductions in energy consumption through interventions such as efficient lighting systems, passive design strategies, thermal insulation, and renewable energy integration.

Reduction of greenhouse gas emissions emerged as another important outcome. The use of environmentally preferable materials and efficient building technologies contributed to lower carbon footprints.

Waste minimization practices, including material optimization and recycling initiatives, also demonstrated considerable environmental benefits.

These findings support the proposition that sustainable construction practices significantly enhance environmental performance.

4.3 Economic Outcomes of Sustainable Construction

The investigation further examined whether sustainability initiatives contribute positively to economic performance.

Although stakeholders acknowledged relatively higher initial investments associated with sustainable technologies, they consistently emphasized long-term economic gains.

Table 4.2: Economic Implications of Sustainable Construction Practices

Economic Indicator	Improvement Reported (%)
Reduction in operational costs	75
Lower maintenance expenditure	70
Increase in life-cycle savings	73
Enhanced property value	65
Improved organizational reputation	62
Increased market competitiveness	59

Interpretation

Reduction in operational expenditure emerged as the most significant economic outcome. Approximately seventy-five percent of respondents indicated that sustainable buildings generated lower utility costs due to energy and water efficiency measures.

Life-cycle savings also constituted a major benefit, demonstrating that higher initial investments can be recovered through long-term performance gains.

Enhanced property values suggest increasing market recognition of sustainable buildings as premium assets.

The findings indicate that sustainable construction represents a financially viable investment strategy rather than an economic burden.

4.4 Challenges Affecting the Adoption of Sustainable Construction Practices

Despite the demonstrated environmental and economic benefits, multiple barriers continue to constrain implementation.

Table 4.3: Major Challenges in Sustainable Construction Adoption

Challenge	Respondents Identifying Challenge (%)
High initial investment costs	77
Lack of awareness and expertise	74
Inadequate policy enforcement	69
Limited availability of skilled professionals	65
Insufficient financial incentives	63
Resistance to organizational change	58
Limited access to sustainable materials	54

Interpretation

High initial investment requirements emerged as the most significant obstacle to sustainable construction adoption.

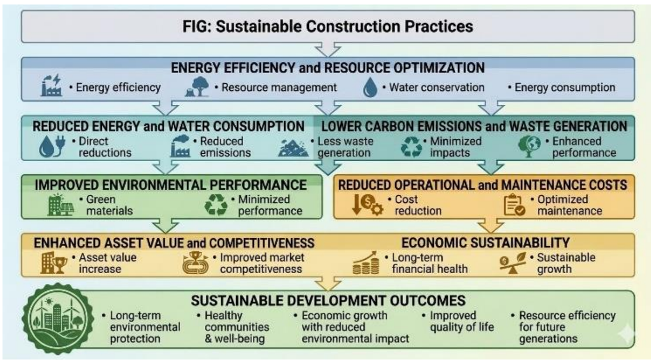
Many developers continue to prioritize short-term capital expenditures rather than evaluating projects from life-cycle perspectives.

The lack of awareness and technical expertise further restricts implementation, particularly among small and medium-sized enterprises.

Weak enforcement of sustainability regulations and insufficient incentive structures also reduce motivation for innovation.

These findings indicate that effective transition requires both institutional reforms and capacity-building initiatives.

Figure 4.1: Integrated Outcomes of Sustainable Construction Practices



4.5 Opportunities and Policy Interventions

The study identified several opportunities capable of accelerating sustainable transformation within the Indian construction sector.

Stakeholders emphasized the importance of supportive policy mechanisms and emerging market trends.

Major opportunities identified include:

- Expansion of green financing mechanisms;
- Increasing demand for environmentally responsible buildings;
- Technological innovation and digitalization;
- Renewable energy integration;
- Capacity-building programmes;
- Green public procurement initiatives;
- Climate-responsive infrastructure development.

4.6 Hypothesis Testing

Hypothesis 1 (H1)

There exists a significant positive relationship between the adoption of sustainable construction practices and environmental performance improvement.

The findings demonstrate substantial reductions in energy consumption, carbon emissions, waste generation, and resource depletion following the adoption of sustainable practices.

Result: Accepted.

Hypothesis 2 (H2)

Sustainable construction practices generate favourable long-term economic outcomes despite relatively higher initial investment costs.

Evidence relating to life-cycle savings, reduced operational expenditure, lower maintenance costs, and increased asset values supports this proposition.

Result: Accepted.

Hypothesis 3 (H3)

Institutional, financial, and technological barriers significantly influence the adoption of sustainable construction practices.

Respondents consistently identified investment concerns, awareness deficits, skill shortages, and regulatory limitations as major implementation barriers.

Result: Accepted.

Hypothesis 4 (H4)

Effective policy interventions positively moderate the relationship between sustainability adoption and sectoral performance.

Stakeholders highlighted the importance of incentives, regulations, awareness initiatives, and institutional support in facilitating sustainability transitions.

Result: Accepted.

4.7 Comparative Analysis of Findings

The results indicate that environmental sustainability and economic growth are not mutually exclusive objectives.

Three major observations emerge from the analysis:

First, sustainable construction practices substantially improve environmental performance through reductions in resource consumption and pollution.

Second, the economic benefits generated over the operational life cycle outweigh the additional capital investments required during project initiation.

Third, supportive policy frameworks function as catalysts capable of accelerating sustainability adoption and reducing implementation barriers.

These findings collectively suggest that sustainable construction should be regarded as a strategic investment capable of enhancing both environmental stewardship and economic resilience.

4.8 Major Findings of the Study

The study generated the following major findings:

- ❖ Sustainable construction practices significantly reduce energy consumption and greenhouse gas emissions.
- ❖ Green buildings contribute to improved water efficiency and construction waste minimization.

- ❖ Operational cost savings and life-cycle economic benefits outweigh higher initial investments.
- ❖ High upfront costs and limited awareness remain the most critical barriers to implementation.
- ❖ Institutional support and policy interventions are essential for large-scale adoption.
- ❖ Green financing and technological innovation present substantial opportunities for sectoral transformation.
- ❖ Sustainable construction provides a practical pathway for balancing economic growth with environmental responsibility in India.

V CONCLUSION

The Indian construction sector occupies a strategic position within the nation's developmental landscape. It contributes significantly to economic growth, employment generation, industrial expansion, and infrastructure development. However, its rapid expansion has also intensified environmental concerns relating to carbon emissions, resource depletion, energy consumption, and waste generation.

This study sought to undertake a comprehensive assessment of the economic and environmental implications associated with sustainable construction practices in India while examining the challenges, opportunities, and policy interventions influencing their adoption.

The findings indicate that sustainable construction practices offer substantial environmental benefits through reductions in energy use, greenhouse gas emissions, material wastage, and ecological degradation. Strategies such as efficient resource utilization, environmentally preferable materials, renewable energy integration, and improved waste management contribute meaningfully toward environmental stewardship.

From an economic perspective, the investigation demonstrates that although sustainable projects may involve relatively higher capital investments during the initial stages, they frequently generate superior long-term outcomes through lower operating costs, enhanced asset value, improved productivity, reduced maintenance expenditures, and increased resilience against future regulatory risks.

The empirical evidence further reveals that multiple barriers continue to impede widespread implementation. These include financial constraints, institutional fragmentation, limited awareness, inadequate technical expertise, technological uncertainties, and resistance to organizational change.

As India advances toward its long-term development ambitions and climate commitments, sustainable construction should be viewed not merely as an environmental imperative but as an economic strategy capable of enhancing competitiveness, improving quality of life, and ensuring intergenerational equity.

Future research may expand the present investigation through longitudinal analyses, region-specific case studies, comparative international assessments, and quantitative modelling approaches that further illuminate the complex relationships between sustainability practices and sectoral performance

REFERENCES

[1] Bamgbade, J.A., Kamaruddeen, A.M. and Nawi, M.N.M. (2015) 'Towards sustainable construction in developing countries', Journal of Environment and Earth Science, 5(4), pp. 110–120.

[2] Berardi, U. (2013) 'Sustainability assessment in the construction sector', Sustainable Development, 21(2), pp. 134–148.

[3] Bossink, B.A.G. (2002) 'The strategic function of quality in the management of innovation', Total Quality Management, 13(2), pp. 195–205.

[4] Bribián, I.Z., Capilla, A.V. and Usón, A.A. (2011) 'Life cycle assessment of building materials', Building and Environment, 46(5), pp. 1133–1140.

[5] Ding, G.K.C. (2008) 'Sustainable construction—The role of environmental

assessment tools', Journal of Environmental Management, 86(3), pp. 451–464.

[6] Du Plessis, C. (2007) 'A strategic framework for sustainable construction in developing countries', Construction Management and Economics, 25(1), pp. 67–76.

[7] Edwards, B. (2014) Rough Guide to Sustainability. 4th edn. London: RIBA Publishing.

[8] Gan, X., Zuo, J., Ye, K., Skitmore, M. and Xiong, B. (2015) 'Why sustainable construction? Why not?', Habitat International, 47, pp. 83–91.

[9] Glass, J., Dainty, A. and Gibb, A. (2008) 'New build: Materials, techniques and skills for sustainable construction', Energy Policy, 36(12), pp. 4534–4538.

[10] Halliday, S. (2008) Sustainable Construction. Oxford: Butterworth-Heinemann.

[11] Hwang, B.G. and Tan, J.S. (2012) 'Green building project management', Sustainable Development, 20(5), pp. 335–349.

[12] Kibert, C.J. (2016) Sustainable Construction: Green Building Design and Delivery. 4th edn. Hoboken: John Wiley & Sons.

[13] Lam, P.T.I., Chan, E.H.W., Chau, C.K., Poon, C.S. and Chun, K.P. (2011) 'Integrating green specifications in construction', Journal of Professional Issues in Engineering Education and Practice, 137(3), pp. 188–197.

[14] Li, Y., Chen, X. and Wang, X. (2017) 'The role of green finance in sustainable development', Sustainability, 9(6), pp. 1–15.

[15] Love, P.E.D., Niedzweicki, M., Bullen, P.A. and Edwards, D.J. (2012) 'Achieving the green building council of Australia's world leadership rating in an office building in Perth', Journal of Construction Engineering and Management, 138(5), pp. 652–660.

[16] Miyatake, Y. (1996) 'Technology development and sustainable construction', Journal of Management in Engineering, 12(4), pp. 23–27.

[17] Ortiz, O., Castells, F. and Sonnemann, G. (2009) 'Sustainability in the construction industry', Construction and Building Materials, 23(1), pp. 28–39.

[18] Pitt, M., Tucker, M., Riley, M. and Longden, J. (2009) 'Towards sustainable construction', Engineering Sustainability, 162(2), pp. 115–122.

[19] Poon, C.S., Yu, A.T.W. and Ng, L.H. (2001) 'On-site sorting of construction and demolition waste', Resources, Conservation and Recycling, 32(2), pp. 157–172.

[20] Robichaud, L.B. and Anantatmula, V.S. (2011) 'Greening project management practices', International Journal of Managing Projects in Business, 4(1), pp. 48–69.

[21] Shen, L.Y., Tam, V.W.Y., Tam, C.M. and Ji, Y.B. (2010) 'Project feasibility study', Journal of Cleaner Production, 18(10–11), pp. 902–911.

[22] Singh, R., Murty, H.R., Gupta, S.K. and Dikshit, A.K. (2012) 'An overview of sustainability assessment methodologies', Ecological Indicators, 15(1), pp. 281–299.

[23] Tam, V.W.Y. (2008) 'On the effectiveness in implementing a waste-management-plan method', Waste Management, 28(6), pp. 1072–1080.

[24] UNEP (2011) Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication. Nairobi: United Nations Environment Programme.