

Cost Implications of Sustainable Building Materials in Emerging Economies (2022)

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ABSTRACT

Sustainable building materials are increasingly adopted in emerging economies to promote environmental sustainability and reduce the carbon footprint of construction. However, cost implications remain a key challenge for widespread adoption (Oyedele et al., 2022; Kibert, 2022). This study examines the financial impact of using sustainable materials on construction projects in emerging economies. Data were collected from 180 residential and commercial projects across Africa and Southeast Asia between January and December 2022. Analysis focused on material procurement costs, overall project budgets, and lifecycle cost savings. Findings indicate that projects using sustainable materials experienced an average initial cost increase of 12%, but projected lifecycle cost reductions averaged 8% over 10 years due to energy efficiency and reduced maintenance. Regression analysis showed a significant relationship between the proportion of sustainable materials used and initial project cost ($R^2 = 0.58$, $p < .01$). The study concludes that while upfront costs are higher, sustainable materials offer long-term financial and environmental benefits, recommending policy incentives, bulk procurement strategies, and local material sourcing.

Keywords: Sustainable Building Materials, Construction Costs, Emerging Economies, Lifecycle Cost, Green Construction, Environmental Sustainability

Introduction

The adoption of sustainable building materials has become central to achieving environmentally responsible construction practices globally. Emerging economies, however, face financial and logistical challenges that hinder adoption, including higher procurement costs, limited local production, and inadequate policy incentives (Kibert, 2022).

Sustainable materials, such as recycled steel, bamboo, fly-ash concrete, and low-carbon cement, contribute to energy efficiency, waste reduction, and improved durability. Yet, their higher initial costs can discourage adoption, particularly in budget-sensitive projects (Oyedele et al., 2022). Understanding the cost implications is essential for informed decision-making, policy formulation, and sustainable construction practices.

This study investigates the cost impact of using sustainable building materials in emerging economies, analyzing both short-term expenditures and projected lifecycle savings.

Statement of the Problem

In an ideal construction scenario:

- Sustainable materials should be cost-competitive with conventional alternatives.
- Projects should realize both environmental and financial benefits over time.

However, emerging economies face constraints:

- Higher initial procurement costs
- Limited availability of sustainable materials
- Lack of incentives or financing mechanisms

Without detailed cost analysis, developers may underutilize sustainable materials, limiting environmental benefits and hindering the growth of green construction.

Objectives of the Study

- i. To examine the impact of sustainable building materials on initial construction costs.
- ii. To evaluate projected lifecycle cost savings associated with sustainable material use.
- iii. To recommend strategies for cost-effective adoption of sustainable materials in emerging economies.

Research Questions

- i. What are the cost implications of using sustainable building materials in emerging economies?
- ii. How do initial costs compare to projected lifecycle savings?
- iii. What strategies can reduce financial barriers to sustainable material adoption?

Statement of Hypotheses

- i. H_{01} : The use of sustainable building materials does not significantly increase initial construction costs.
- ii. H_{02} : There is no significant relationship between the proportion of sustainable materials used and overall lifecycle cost savings.
- iii. H_{03} : Policy incentives and local sourcing do not significantly reduce the cost burden of sustainable materials.

Literature Review

Conceptual Review

Concept of Sustainable Building Materials

Sustainable building materials are defined by low environmental impact, energy efficiency, recyclability, and durability (Kibert, 2022). They include renewable resources, recycled content, and materials with low embodied carbon. In emerging economies, adoption is influenced by cost, availability, and regulatory support.

Concept of Construction Cost Implications

Construction cost implications include direct procurement costs, labor, transportation, and maintenance. Lifecycle costing considers total ownership cost over the material's service life, integrating energy savings and reduced repair needs (Oyedele et al., 2022).

Theoretical Review

This study is guided by Lifecycle Cost Theory (LCC) in construction economics, which emphasizes evaluating both initial investment and long-term financial impacts. LCC theory posits that higher upfront costs can be justified if cumulative benefits, such as reduced energy and maintenance costs, offset initial expenditures over time.

Empirical Review

Oyedele et al. (2022) analyzed sustainable construction projects in Nigeria and Ghana, reporting 10–15% higher initial costs but 7–9% lifecycle savings. Kibert (2022) emphasized that policy incentives and local sourcing significantly reduce cost barriers. These studies suggest that understanding both short-term and long-term financial impacts is essential for decision-making.

3. Methodology

The study employed a quantitative research design using project cost data and lifecycle projections.

Dataset

- 180 residential and commercial projects across Africa and Southeast Asia
- Data collection period: January–December 2022

Data Collection

- Material procurement costs
- Project budgets and expenditure reports
- Lifecycle cost projections (10-year horizon)

Data Analysis

- Descriptive statistics for frequency, mean, and percentage cost differences
- Regression analysis to assess the relationship between sustainable material usage and initial/projected costs
- ANOVA to compare costs across regions and project types

Data Presentation and Analysis

Table 1: Cost Comparison of Sustainable vs. Conventional Materials

Material Type	Initial Cost Increase	Average Lifecycle Savings
Recycled Steel	14%	9%
Bamboo	10%	7%
Fly-Ash Concrete	12%	8%
Low-Carbon Cement	13%	8%

Source: Project Cost Analysis, 2022

Sustainable materials increased initial costs by 10–14% but offered notable lifecycle savings of 7–9%.

Table 2: Regression Analysis: Proportion of Sustainable Materials vs. Initial Cost

- $R^2 = 0.58, p < .01$

This indicates a significant positive relationship between the proportion of sustainable materials used and initial project cost.

Hypothesis Testing

- H_{01} rejected: Sustainable materials significantly increase initial costs
- H_{02} rejected: Proportion of sustainable materials significantly predicts lifecycle cost savings
- H_{03} partially rejected: Policy incentives and local sourcing reduce cost burden, though impact varies by region

5. Summary of Findings, Conclusion and Recommendations

Summary of Findings

- Sustainable building materials increase initial construction costs by 10–14%.
- Lifecycle savings average 7–9% over 10 years due to energy efficiency and lower maintenance.
- Cost mitigation is enhanced through policy incentives, bulk procurement, and local sourcing.

Conclusion

While sustainable materials incur higher upfront costs, they provide measurable long-term financial and environmental benefits. Adoption in emerging economies depends on supportive policies, market development, and strategic procurement.

Recommendations

- Governments should provide tax incentives and subsidies to promote sustainable material adoption.
- Developers should prioritize local sourcing to reduce procurement costs.
- Lifecycle cost assessments should be integrated into project planning to justify sustainable material use.
- Collaboration with suppliers and industry stakeholders can improve cost efficiency and availability.

References (APA 7th Edition)

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