Global Research Journal in Engineering, Science, Technology and Management (GRJESTM)
Volume 01, Issue 05 (September-October) 2025, pp. 194-199
GRJESTM :: An odaswa™ Journal
ISSN : 3107-3611 (Online)

REVIEW ARTICLE

Challenges in Estimating Transaction Costs in Green Building Projects - A Review

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Abstract. As the global construction sector shifts toward more sustainable practices, green building projects are rapidly increasing in number and scope. These developments are essential in reducing environmental impact, improving building efficiency, and promoting healthier living environments. However, one major financial barrier remains insufficiently studied: transaction costs. These are indirect and often hidden costs related to planning, regulatory approval, certification, coordination, stakeholder communication, and legal procedures. Inaccurate estimation of these costs can result in serious budgeting errors, delayed project delivery, and investor hesitancy. This paper examines the key sources and implications of transaction costs in green construction, particularly in emerging markets such as Oman. A mixed-methods research design was employed, utilizing literature review, professional surveys, and case study analysis. The results reveal that complex certification processes, lack of technical expertise, and regulatory uncertainty are significant contributors to transaction costs. This study offers strategic recommendations, including early-stage cost modelling of transaction expenses, workforce upskilling, and regulatory streamlining. These measures can significantly enhance cost predictability and project viability in the green building sector.

Keywords: Green building, sustainable practices, environmental impact, building efficiency, transaction costs, budgeting errors

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1. Introduction

The construction industry plays a central role in national development and economic productivity. In recent years, increasing pressure to address climate change and reduce carbon emissions has prompted a shift toward sustainable building practices, often referred to as "green building." Green buildings are designed to minimize resource consumption, improve energy efficiency, and reduce environmental impact over their lifecycle. Despite these benefits, green projects are frequently criticized for their higher upfront costs and unpredictable financial management challenges. Among the most difficult and least understood elements are transaction costs.

Transaction costs refer to the indirect costs incurred during planning, executing, and managing construction projects. These include expenses related to negotiating contracts, ensuring regulatory compliance, acquiring environmental certifications, coordinating with multiple stakeholders, and managing administrative processes (Williamson, 1985) [1]. Unlike direct costs such as labour or materials, transaction costs are often intangible, varying widely across projects and locations, and can be easily overlooked in early budget planning.

In traditional construction, transaction costs are more predictable and standardized. However, in green building projects, they are significantly elevated due to the complexity of sustainability requirements. Developers must comply with stringent environmental regulations, pursue third-party certifications like LEED or BREEAM, and coordinate with specialized consultants. This added complexity increases both the risk and the financial burden of the project, especially in countries like Oman where green building practices are relatively new.

The aim of this study is to identify and analyse the nature of transaction costs in green building projects and to explore the difficulties involved in estimating them accurately. The research also seeks to provide practical recommendations to support better cost control and planning in green construction. Studies of Alnaser & Flanagan from the Gulf region indicate that countries that have embraced sustainable design encounter increased initial administration and compliance costs due to limited availability of local expertise [2].

2. Literature Review

2.1. Transaction Costs in Green Building

Transaction costs in green building extend beyond traditional administrative fees and encompass broader categories such as information asymmetry, stakeholder misalignment, and technical uncertainty. Mokhlesian and Holmén (2012) argue that green projects often demand a change in the underlying business model, requiring coordination between government, private investors, and certification bodies [3]. This creates new layers of compliance and negotiation that increase total costs. Similarly, Ürge-Vorsatz et al. (2010) note that transaction costs may account for 20% or more of total costs in green retrofitting projects, particularly in energy efficiency upgrades [4]. Various studies have identified that the complexity arising from sustainability requirements increases transaction costs greatly, especially in stages involving early planning and coordination [5].

2.2. Regulatory Complexity and Delays

One of the most prominent contributors to transaction costs is regulatory complexity. Zhang et al. (2011) found that approval procedures for green buildings involve multiple departments and often lack clarity [6]. Projects can face delays of several months due to environmental assessments, planning reviews, and permit inconsistencies. Each delay not only affects the project timeline but also generates financial burdens such as extended equipment rentals and increased staff wages. Moreover, frequent changes in policy and unclear enforcement mechanisms further complicate cost prediction.

2.3. Certification Processes and Compliance

Green certification programs such as LEED, BREEAM, and Estidama require rigorous documentation, testing, and validation. These certifications not only demand time but also specialized personnel who can interpret and apply guidelines. The costs associated with preparing documentation, coordinating site inspections, and responding to certification feedback are often not included in initial budgets, resulting in significant financial overruns [7]. Other certification systems, like Green Globes, have similar patterns in cost, in which documentation and assessment fees are added to the overall transaction costs of the project [8].

2.4. Professional and Technical Skill Gaps

Wu et al. (2019) highlight that green building demands specialized knowledge in areas such as renewable energy systems, recycled materials, and lifecycle analysis [9]. When construction teams lack this knowledge, organizations are forced to hire external consultants or provide training, both of which increase transaction costs. These costs may include fees for hiring sustainability experts, hosting workshops, or purchasing new modelling software.

2.5. Stakeholder Coordination and Communication

Coordination between architects, engineers, contractors, environmental consultants, and government bodies is essential in green projects. However, stakeholder misalignment and poor communication can lead to design revisions, regulatory conflicts, or contract renegotiations. Darko et al. (2018) argue that transaction costs associated with meetings, workshops, and conflict resolution processes must be factored into project budgets [10].

2.6. Investment Uncertainty and Risk Perception

Dobson et al. (2013) argue that green construction is seen as risky by many investors due to uncertainties in cost-benefit outcomes [11]. Transaction costs such as unpredictable approval timelines or expensive audits reinforce this perception, deterring potential backers. The lack of financial clarity further complicates cost forecasting, especially in developing regions.

2.7. Market Limitations and Public Perception

While demand for green buildings is growing, market infrastructure and awareness are still developing in many parts of the world. According to the Canada Green Building Council (2016), public awareness campaigns and investor education play a role in increasing adoption [12]. However, marketing and stakeholder engagement incur additional transaction costs, especially when sustained over long project durations. Research also emphasizes that little awareness, along with fragmented regulation, acts as the critical barrier toward applying sustainable buildings, which raises transaction costs even further [13]. In Oman's context, it is reported that even though green buildings have the potential to reduce very long-term operational costs, they face significantly high administrative and coordination costs during the stages of approval and planning [14].

3. Methodology

3.1. Research Design

This study employs a mixed-methods research design combining quantitative and qualitative approaches to explore transaction cost challenges in green construction. This method ensures data richness and triangulation, enhancing the validity of the results.

3.2. Data Collection Methods

- Primary Data: A structured questionnaire was administered to professionals in the construction industry, including quantity surveyors, engineers, project managers, and green consultants. The questions addressed the types of transaction costs encountered, their impact on cost estimation, and current management practices.
- Secondary Data: Relevant documents from completed green projects were re-

viewed. These included feasibility studies, post-completion reports, and budget audits to compare projected versus actual expenditures.

3.3. Data Analysis

Quantitative responses were processed using statistical tools to identify trends and frequency distributions. Qualitative data from open-ended responses were analysed through thematic coding to capture common themes and concerns across stakeholder groups.

3.4. Ethical Considerations

All responses were treated confidentially. Participation was voluntary and respondents were informed of the study's purpose. Data collection followed institutional ethical guidelines.

4. Results and Discussion

4.1. Nature and Scope of Transaction Costs

Survey data indicated that 83% of participants had encountered transaction costs that exceeded initial projections. The most frequent sources were:

- Regulatory delays (82%)
- Consultant fees (75%)
- Certification documentation (70%)
- Stakeholder coordination (66%)

These findings confirm that transaction costs are widespread and under-acknowledged in green construction. Apart from that, the certification-related costs, for instance, LEED registration and review fees, add up significantly to the hidden transaction cost in green construction [15].

4.2. Estimation Challenges

Approximately 64% of respondents admitted to rarely including transaction costs in early-stage budgets. The main reasons cited were lack of standard benchmarks, unclear policies, and limited technical capacity. Many projects faced mid-execution budget revisions to accommodate unexpected costs.

4.3. Case Study Insights

Secondary data analysis of three completed green projects in Oman revealed an average of 8–12% deviation between projected and actual costs, largely due to unanticipated regulatory requirements and prolonged certification processes. In one case, a project delayed by eight weeks resulted in additional site maintenance and consultancy fees exceeding OMR. 15,000.

4.4. Implications

Failure to incorporate transaction costs early on increases the risk of project overruns and may erode stakeholder confidence. Transaction costs should be recognized as strategic financial factors, not merely operational expenses. Their integration into project feasibility studies is essential. As argued by the World Green Building Council, the financial benefits accruable to the green building are still outshone by high upfront soft costs of certification, consultation, and compliance processes [16].

5. Conclusions

Transaction costs are an integral yet often overlooked element of green building projects. From regulatory delays to stakeholder coordination, these costs affect both budget predictability and project viability. In Oman and similar contexts, the lack of standardized methodologies and technical capacity further complicates estimation efforts. If not addressed, transaction costs can undermine sustainability objectives by increasing financial risks.

6. Recommendations

- Develop Transaction Cost Guidelines: Institutions should publish frameworks to help practitioners identify and estimate transaction costs accurately.
- Invest in Technical Training: Regular workshops and certification programs can reduce reliance on external consultants.

- Policy Simplification: Government agencies must simplify and unify permit processes to minimize uncertainty.
- Budget Contingencies: Planners should allocate a fixed percentage of the total budget (e.g., 10%) to cover potential transaction costs.

Acknowledgement

Authors are indebted to the University of Technology and Applied Sciences for providing the facility for conducting this research. We express our heartfelt gratitude to the Head of Department Dr. Aliya Al Alawi and Head of section Dr. Samiya Al Mabsali for the continuous encouragement in carrying out the research works in the Civil and Architectural Engineering unit. We express our gratitude to all those who cooperated with this study.

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DEDICATION

This research is dedicated to the Quantity Surveying and Cost Engineering Specialization of UTAS Muscat.

BIOGRAPHY

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Hadaya Mohammed is currently in the final year student of Quantity Surveying and Cost Engineering at the University of Technology and Applied Sciences Muscat. I have a strong passion for sustainable construction, and my academic focus is on improving cost estimation methods in green building projects. I hope to contribute to the development of Oman's construction sector through smart, sustainable solutions.

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