Breaking the Cost Wall: Tackling Barriers to Sustainable Construction in Johor Bahru

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ABSTRACT

Sustainable construction is gaining traction globally, yet its adoption in Malaysia remains uneven, particularly within the residential sector. In rapidly expanding urban hubs like Johor Bahru, the transition to sustainable housing is frequently stalled by financial apprehensions. This study aims to identify specific cost-related barriers hindering sustainable residential projects and evaluate practical mitigation measures to overcome them. A quantitative, cross-sectional survey was conducted involving 63 construction practitioners, including contractors, consultants, and developers in Johor Bahru. Respondents were selected via non-probability purposive sampling from professional industry directories. Data were analysed using descriptive statistics and the Relative Importance Index (RII) to rank the criticality of barriers and the effectiveness of strategies. The results indicate that perceived risks and uncertainty regarding the financial and technical performance of sustainable buildings constitute the most critical barrier (RII = 0.898). This is closely followed by financial constraints of clients/contractors and limited access to capital. Conversely, government investment, local production of green materials, and accessible green financing emerged as the most effective strategies to mitigate these costs. The study suggests that overcoming cost walls requires a coordinated approach. Policymakers must move beyond advocacy to provide tangible financial mechanisms, while the industry must strengthen local supply chains to reduce reliance on expensive imported green materials. While previous studies have examined national-level barriers, this research offers context-specific empirical evidence for Johor Bahru's residential sector, providing targeted recommendations for developers and policymakers operating in high-growth urban environments.

Keywords: sustainable construction, cost barriers, financial constraints

INTRODUCTION

Sustainable construction has become a central agenda in many developing countries, a trend highlighted in global studies on climate change and urban development. In Malaysia, as noted by Chen and Luo (2020), the construction sector continues to grow rapidly, especially in cities such as Johor Bahru, yet the integration of sustainable practices remains inconsistent. Industry research has shown that environmental advantages, including reduced carbon emissions, improved energy efficiency and lower long-term operating cost, are well recognised among practitioners (Ojo-Fafore et al., 2018). Despite this awareness, project level adoption continues to face significant obstacles. Jaffar et al. (2022) observe that financial concerns remain one of the strongest deterrents for contractors, developers and clients. Even with sustainability commitments publicly stated by government linked developers, actual implementation in Johor still falls short of expectations (Johor Land Berhad, 2021). Market realities in Johor Bahru, including strong price sensitivity, cautious investment patterns and continued reliance on imported sustainable materials, further limit the transition toward greener residential construction.

Problem Statement

Sustainable construction has gained increased attention in Malaysia as environmental pressures and urban growth intensify. According to Chen and Luo (2020), long term environmental and economic benefits are well

established, yet progress in adopting sustainable practices remains uneven. Studies such as Ojo-Fafore et al. (2018) and Roslee et al. (2022) show that high upfront costs, limited incentives and financial uncertainty continue to discourage developers and contractors. Most existing research examines these issues at a broad national scale, which leaves a gap in understanding local cost pressures experienced specifically in Johor Bahru. Earlier studies, including work by Samari et al. (2013), seldom explore how local financing constraints, market behaviour and supply chain limitations influence adoption in this rapidly developing region. Yi (2022) similarly notes that residential development in Johor Bahru carries unique economic considerations that are not captured in wider national research.

Research Objectives

Existing research on sustainable construction in Malaysia largely focuses on national-level issues or general challenges without narrowing down to the localised economic conditions of Johor Bahru. Furthermore, while international studies propose broad strategies, there is a scarcity of empirical work offering context-specific measures tailored to Johor Bahru's residential development landscape. To bridge this gap, this study aims to:

1. Identify the key cost barriers affecting the adoption of sustainable construction in residential projects in Johor Bahru.
2. Propose appropriate measures that can reduce or overcome the identified cost barriers.

LITERATURE REVIEW

The literature on sustainable construction highlights growing interest in reducing environmental impact and improving long-term project performance, yet adoption remains slow in many developing contexts due to financial pressures, policy gaps and uneven industry readiness. Studies repeatedly show that cost concerns, limited incentives, weak supply chains and a shortage of technical skills continue to influence decision-making among construction practitioners. These challenges are particularly relevant in settings where market sensitivity and project affordability shape development choices. The following review brings together the main themes discussed in past research, focusing on cost barriers, policy and institutional issues, industry capacity and structural limitations, as well as the effectiveness of measures proposed to address these constraints.

Cost Barriers in Sustainable Construction

According to Durdyev et al. (2018), Ifijie and Aigbavboa (2020), and Wang et al. (2021), cost related pressures continue to dominate as the main barriers to sustainable construction across many regions. High initial investment and the premium on certified green materials consistently restrict adoption, especially where affordability remains a concern. Research in developing contexts shows that firms often work within narrow financial margins, which causes sustainable construction to be viewed as a costly commitment rather than a long-term benefit (Agetepey et al., 2015; Aigbavboa et al., 2017; Fathalizadeh et al., 2021). In Malaysia, earlier and recent studies highlight technical gaps, fragmented policy direction, and uneven industry readiness as limiting factors (Samari et al., 2013; Wong et al., 2021; Roslee et al., 2022).

Ahzahar et al. (2022) and Szydlik (2014) state that energy-efficient systems, specialised equipment, and certified materials typically require higher expenditure, and the lack of clear life-cycle cost information makes justification difficult for many firms. Price escalation, market volatility, and uncertain performance outcomes also contribute to hesitation among developers (Tafazzoli, 2017). The cost burden becomes more apparent where sustainable materials must be imported. Evidence from Malaysia and other developing regions indicates that transportation charges and currency movement raise total project expenditure (Samari et al., 2013; Roslee et al., 2022). These conditions strongly influence decisions in Johor Bahru's residential sector, where buyers remain highly price sensitive.

Institutional and Policy Barriers

Institutional clarity and policy support play central roles in shaping adoption. According to Ahzahar et al. (2022) and Jaffar et al. (2022), incentive schemes remain underutilised in Malaysia because they are not widely

communicated or easily accessed. Similar patterns are reported internationally, where weak enforcement and limited funding reduce policy effectiveness. Research from China, Nigeria, Chile, and Kuwait confirms that unclear guidelines and inconsistent support limit industry uptake (Chang et al., 2016; Babalola & Harinarain, 2024; Serpell et al., 2013; AlSanad, 2015). For Malaysian developers and contractors, this lack of consistent support reinforces perceptions that sustainable construction increases cost rather than generating future savings, especially in residential markets.

Industry Readiness and Professional Capacity

Industry readiness remains a concern. Jaffar et al. (2022) and Roslee et al. (2022) found that many professionals have limited exposure to sustainable methods, which restricts their ability to implement or advocate for green features. Conventional construction practices still dominate, partly due to fragmented training and limited demonstration opportunities (Serpell et al., 2013; Dalirazar & Sabzi, 2022). These capacity constraints are linked to wider labour issues. Green installations require specialised skills, yet many workers in Malaysia's labour-dependent sector lack formal training. Wang et al. (2021) explain that this raises project cost and creates hesitation among firms that face strong price expectations in residential work.

Structural and Supply Chain Limitations

Structural conditions within the construction ecosystem also influence adoption. Developing countries often struggle to build reliable supply chains for sustainable materials because demand remains lower than required to support local manufacturing (Akindele et al., 2023). When regulations attempt to strengthen sustainability, small and medium-sized contractors may face higher compliance costs, which add further pressure (Ahmed et al., 2023). Studies from China and Nigeria show that weak coordination among regulatory bodies and limited financial commitment restrict the effectiveness of sustainability frameworks (Chang et al., 2016; Babalola and Harinarain, 2024). These systemic issues are similar to those found in Malaysia, where local supply chains for green materials are still growing and industry demand remains modest.

Efficiency-Based Measures and Their Limitations

Some scholars argue that improved coordination, scheduling, and cost management can strengthen project performance. Durdyev et al. (2018) emphasise that efficiency gains help minimise delays and unnecessary spending. However, operational improvements alone do not address the inherent cost premiums associated with sustainable materials. Findings from Malaysia and Iran indicate that high material prices, limited financing, and immature supply chains persist even with better management practices (Fathalizadeh et al., 2021; Samari et al., 2013). While efficiency contributes to smoother project delivery, it does not fully resolve affordability concerns.

METHODOLOGY

This study applies a quantitative, cross-sectional survey design to address the two research objectives, which involve identifying cost barriers to sustainable residential construction in Johor Bahru and determining the relative importance of measures that can reduce these barriers. As highlighted by Apuke (2017) and Daniel (2016), quantitative methods allow structured responses to be collected from a broad group of practitioners and enable statistically meaningful analysis. Such approaches are common in sustainable construction research, where surveys are frequently used to explore how practitioners assess the links between barriers and mitigation strategies (Fathalizadeh et al., 2021; Jaffar et al., 2022; Wang et al., 2021; Zulu et al., 2022). The use of this design also supports comparison with earlier studies carried out both in Malaysia and internationally, as demonstrated by Ahzahar et al. (2022) and Roslee et al. (2022). Although operational improvements such as enhanced coordination, improved scheduling and cost control can reduce inefficiencies, Durdyev et al. (2018) explain that these measures alone cannot resolve the financial pressures associated with sustainable construction. Evidence from Malaysia and Iran further shows that cost challenges and supply chain constraints persist even when management practices improve (Fathalizadeh et al., 2021; Samari et al., 2013). These findings reinforce the need for a structured quantitative approach to examine the barriers and the measures intended to address affordability concerns within this context.

Sampling

Sampling involves selecting a portion of the population that can reflect the characteristics of the wider group, a principle explained by Etikan and Bala (2017). Guided by this understanding, the study adopted a non-probability purposive sampling strategy. This approach is appropriate when respondents must possess specific technical knowledge and direct exposure to sustainability related construction practices, rather than being selected through a randomised process. Researchers examining sustainable construction barriers often rely on similar sampling techniques because practitioner expertise is central to generating meaningful findings (Fathalizadeh et al., 2021; Jaffar et al., 2022).

The sampling frame consisted of construction professionals in Johor Bahru, including contractors, consultants and developers. These groups are closely involved in decisions concerning project cost, technology selection and the application of sustainable features. To identify suitable respondents, firm directories issued by the Construction Industry Development Board (CIDB), the Association of Consulting Engineers Malaysia (ACEM) and the Johor Master Builders Association (JMBA) were reviewed. Additional consideration was given to companies and professionals with experience in green construction principles or those known to actively support sustainable development initiatives in Malaysia.

Contractors were prioritised as the main respondent group due to their direct involvement in on-site cost decisions and the practical implementation of sustainable materials and technologies. From the directories, 107 suitable firms were identified. To determine the minimum required sample size, Slovin's formula was applied:

$$n = \frac{N}{1 + N(e^2)}$$

Where:

- n = required sample size
- N = 107 firms
- e = precision level (0.05)

$$n = \frac{107}{1 + 107(0.05^2)} = 85$$

Thus, 85 practitioners were identified as the target sample. Out of these, 63 completed responses were obtained and used for analysis. This response rate aligns with typical participation trends in construction-management studies using purposive sampling (Zulu et al., 2022; Olahan & Oyentuji, 2021).

Survey Instrument

The questionnaire consisted of three sections: demographic information, cost barriers to sustainable construction and measures to overcome these barriers. Respondents evaluated each item using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The instrument was adapted from previous sustainable construction studies and reviewed by two experts to refine the wording and content relevance. A pilot test involving 10 professionals was conducted to confirm clarity and internal consistency.

Data Analysis

Data were analysed using descriptive statistics and the Relative Importance Index (RII). Means and standard deviations summarised perceptions of barriers and measures (Jowwad & Gupta, 2019). RII was applied to rank the significance of each cost barrier and the perceived effectiveness of each mitigation strategy. following widely used formulas in construction-management research (Kassem et al., 2020). SPSS provided computational support for numerical analysis, ensuring methodological consistency with similar studies (Wang et al., 2021; Zulu et al., 2022).

The use of purposive sampling may introduce selection bias as participation depended on the accessibility and willingness of professionals. The findings reflect practitioners' perceptions rather than actual project cost data. Despite these limitations, the results provide a useful indication of cost-related challenges within Johor Bahru's residential construction sector.

RESULT

Demographic Analysis

Table 6.1: Demographic Profile

Category	Options	Frequency	Percentage
Working Sector	Public Sector	23	36%
	Private Sector	33	52%
	Self Employed	7	12%
Career Background	Client or Developer	9	14%
	Contractor	10	16%
	Project Manager	12	19%
	Architect	5	8%
	Engineer	9	14%
	Quantity Surveyor	17	29%
Working Experience	Less than 1 year	6	10%
	1 to 2 years	4	6%
	3 to 5 years	15	24%
	5 to 10 years	15	24%
	More than 10 years	23	36%
Experience in Sustainable Construction	Practical experience	43	68%
	Theoretical knowledge	16	25%
	No experience	4	7%

The demographic characteristics of the 63 respondents are summarised in Table 6.1. The survey respondents predominantly operate within the private sector (52%), aligning with the study's focus on residential development. Professionally, the sample is heavily weighted towards roles central to cost management and execution, with Quantity Surveyors (29%) and Project Managers (19%) constituting the largest groups. This distribution is particularly significant as these professionals possess direct insight into the financial intricacies of construction projects.

The respondents exhibit a high level of seniority, with 60% possessing more than 5 years of experience, including 36% with over a decade in the industry. Most critically, the data validates the reliability of the findings, as 68% of respondents reported having practical experience with sustainable construction, ensuring that the identified barriers are based on actual field exposure rather than theoretical knowledge alone.

Cost Barriers to Sustainable Construction

Table 6.2: Cost Barriers to Sustainable Construction

Statements	Mean	RII	Rank
Perceived risks and uncertainty related to sustainable buildings	4.492	0.898	1
Financial constraints of clients and/or contractors	4.476	0.895	2
Limited access to capital	4.333	0.867	3
Lack of awareness and expertise of construction professionals	4.349	0.857	4
High wages of skilled labour due to complex design and engineering requirements	4.286	0.857	5
Lack of government incentives/subsidies	4.270	0.854	6
Limited market demand	4.206	0.841	7

Limited availability and higher costs of sustainable materials	4.159	0.832	8
Higher insurance premiums	3.984	0.797	9
Appraisal and valuation challenges	3.746	0.749	10

The findings in Table 6.2 show that perceived risks and uncertainty (RII = 0.898) emerged as the most significant barrier, signalling that industry stakeholders remain cautious about the financial and technical performance of sustainable buildings. This hesitation is consistent with earlier studies demonstrating that unclear payback periods, fluctuating material prices and inconsistent operational outcomes cause developers to view green projects as high-risk investments (Gan et al., 2015; Wang et al., 2021). Malaysian studies, including work by Roslee et al. (2022) and Ahzahar et al. (2022), indicate that many firms remain uncertain about the performance of sustainable technologies due to limited evidence and inconsistent institutional support. This lack of clarity reinforces cautious decision-making and contributes to risk-averse behaviour in project planning. The next barrier, the financial constraints of clients and contractors (RII = 0.895), reflects a wider pattern across developing construction markets. High construction costs, narrow profit margins and restricted fiscal flexibility often lead firms to prioritise cost containment over sustainability features. Research from Ametepey et al. (2015) and Aigbavboa et al. (2017) shows that initial capital outlay remains a major deterrent to adopting green practices in many regions. Evidence from Iran and Malaysia further supports this trend, with Fathalizadeh et al. (2021) and Jaffar et al. (2022) reporting that rising material prices and limited client willingness to incur additional costs continue to restrict adoption. The third-ranked barrier, limited access to capital (RII = 0.867), highlights the financial difficulties firms face when attempting to incorporate sustainable technologies. In many emerging economies, financing instruments designed specifically for green buildings are scarce, and mainstream lenders are often hesitant to support such innovations without clear valuation frameworks, as shown by Durdyev et al. (2018) and Ahmed et al. (2023). Studies from Chile and Kuwait present similar findings, with Serpell et al. (2013) and AlSanad (2015) noting that insufficient financial mechanisms continue to hinder progress toward sustainable building practices. Together, these top-ranked barriers reveal that risk perception and financial limitations dominate industry decision-making in sustainable residential projects. The results suggest that improving adoption requires more than environmental advocacy. Instead, the sector needs targeted financial incentives, accessible green financing schemes and clearer economic evidence to reduce perceived exposure and strengthen investor confidence.

Measures to Overcome Sustainable Construction

Table 6.3: Measures to Overcome Sustainable Construction

Statements	**Mean**	**RII**	**Rank**
Government should invest more on sustainable construction	4.556	0.911	1
Production of green construction materials locally	4.444	0.889	2
Green financing options and loans with favourable terms	4.429	0.886	3
Encouraging sustainable design–build practices to streamline project costs	4.333	0.867	4
Regulatory support and streamlined permitting processes	4.270	0.854	5
Procurement policies and green public procurement	4.270	0.854	6
Collaborations with sustainable technology providers and manufacturers for cost-effective solutions	4.254	0.851	7
Education and awareness programs on the long-term financial benefits of sustainable construction	4.254	0.851	8
Collaborative partnerships and consortiums	4.222	0.844	9
Government incentives and subsidies for sustainable projects	4.190	0.838	10

The findings in Table 6.3 show that practitioners place the highest priority on government investment as the most effective measure for reducing cost barriers, reflected by the highest RII value of 0.911. This outcome mirrors evidence from earlier studies which report that strong and consistent public-sector support is essential for driving sustainable construction, particularly in developing economies where market confidence is still limited. Research from Malaysia, Chile and China demonstrates that well-funded government programmes, research grants and long-term policy commitments help reduce uncertainty and encourage wider adoption of

sustainable building practices. Evidence from Ahzahar et al. (2022), Serpell et al. (2013) and Chang et al. (2016) shows that clear policy direction and stable funding streams increase confidence among developers and contractors. The second most important measure reported by respondents is the local production of green materials. This aligns with concerns highlighted in earlier studies, where reliance on imported products increases transportation expenses, exposes firms to price fluctuations and contributes to delays. Akindele et al. (2023) and Durdyev et al. (2018) note that several regions in Africa and the Middle East face similar problems, and local supply chain development is widely regarded as an effective way to lower project costs. Respondents in the present study also emphasise that local manufacturing improves stability, availability and affordability of materials. Green financing options received strong support as well, reflecting the view that access to affordable capital is central to adoption. Previous work by Gan et al. (2015) and Ahmed et al. (2023) found that loan schemes with favourable terms, green mortgages and sustainability linked credit facilities significantly strengthen the feasibility of cost sensitive sustainable construction projects. Measures that appear in the middle range, such as streamlined permitting, design and build approaches and green public procurement, highlight the need for structural improvements that enhance efficiency and reduce administrative burden. Although incentives and subsidies are ranked lowest, respondents still acknowledge their value when integrated with broader financial and regulatory reforms. Overall, the results suggest that meaningful progress requires a combination of financial support, supply-chain strengthening and policy reform.

DISCUSSION

The findings of this study provide a clear understanding of the cost barriers affecting the adoption of sustainable residential construction in Johor Bahru and the strategies that practitioners consider most effective in overcoming them. The results show that perceived risks, financial constraints and limited access to capital are the most significant obstacles. These barriers reflect patterns reported in earlier studies across Malaysia and other developing economies, where uncertainty about long-term cost recovery, escalating material prices and limited financial capacity contribute to cautious decision-making among developers and contractors (Gan et al., 2015; Aigbavboa et al., 2017; Fathalizadeh et al., 2021). Respondents in this study demonstrated similar concerns, emphasising that inconsistent performance data, lack of reliable cost benchmarks and limited institutional support continue to undermine industry confidence. These observations reaffirm the structural nature of the cost challenges and suggest that sustainability ambitions remain constrained by financial risk and market hesitation.

In relation to the measures that address these challenges, the results highlight a preference for interventions that directly reduce cost pressures. Government investment is viewed as the most influential measure, consistent with evidence that sustained policy commitment and targeted financial programmes can reduce market uncertainty and encourage wider adoption of sustainable practices (Chang et al., 2016; Ahzahar et al., 2022). The strong support for local production of green materials further indicates a desire to stabilise supply chains and mitigate the cost impacts associated with imported products, a concern previously noted in studies from Africa, the Middle East and Southeast Asia (Akindele et al., 2023; Durdyev et al., 2018). Respondents also expressed high confidence in green financing mechanisms, reinforcing the need for accessible capital and financial products that reduce the upfront burden traditionally associated with sustainable construction (Ahmed et al., 2023).

The prominence of regulatory streamlining, design and build adoption and green public procurement within the mid-ranked measures indicates that the industry recognises the importance of systemic reforms that improve efficiency and reduce administrative delays. These strategies can complement financial interventions by lowering indirect costs and encouraging more predictable project workflows. Although respondents agreed on the value of incentives and subsidies, their lower ranking suggests that financial rewards alone are insufficient without broader structural changes.

In conclusion, sustainable residential construction in Johor Bahru remains held back by a "Cost Wall" built on financial risk, capital scarcity, and fragmented supply chains. This study shows that economic pressures are not simply one factor among many but the central force slowing adoption, with developers facing the high cost of imported technologies and a market that has yet to recognise the long-term value of sustainability. The findings indicate that meaningful progress requires more than operational improvements and instead calls for structural change in how green projects are supported and delivered. Policy implications point to the need for sustained government involvement that reduces risk through clearer incentives, planning support and long-term funding

commitments. At the same time, barriers such as cautious lending behaviour, uneven industry capacity and limited local production of green materials may restrict the impact of recommended measures. Strengthening interagency coordination, widening access to green financial products and encouraging local manufacturing can help address these challenges. Future research may examine actual project cost data, the role of financial institutions in shaping investment decisions and buyer attitudes toward green housing. When policy support, financial reform and local supply chain development move together, they can create a more stable environment that reduces uncertainty and supports the wider uptake of sustainable residential construction in Johor Bahru.

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