KASBIT BUSINESS JOURNAL

Journal homepage: www.kbj.kasbit.edu.pk

Critical Obstacles to Sustainable Construction: A Multi-Criteria Decision Approach

Mohammad Sohaib [i], Syed Qasim Shah* [ii], Assad Rafaq [iii], Syed Wasiq Zahid Shah [iv]

i) MS Scholar, COMSATS university Islamabad, Abbottabad Campus, Pakistan.
ii) Lecturer, COMSATS university Islamabad, Abbottabad Campus, Pakistan.
iii) Lecturer, COMSATS university Islamabad, Abbottabad Campus, Pakistan.
iv) MS Scholar, COMSATS university Islamabad, Abbottabad Campus, Pakistan.

* *Corresponding Author:* Syed Qasim Shah*: Email:* sqshah@cuiatd.edu.pk

Received: April 10, 2026; **Reviewed:** April 24, 2026; **Accepted:** May 12, 2026

ABSTRACT

The objective of this study is to identify and prioritize key constraints in green building projects in Pakistan since increasing world attention on sustainable development has put green buildings at the center of development strategies. Identification of barriers was conducted after comprehensive literature review and then prioritization was carried out using the Analytical Hierarchy Process (AHP). The prioritization of the barriers was done through pair-wise comparisons with the input of practitioners, academics and industry professionals to determine the relativity of the barriers. The results indicate that institutional and policy-related barriers including the absence of government incentives and regulations are most important followed by financial and economic barriers including high initial costs to get started and financing difficulties to access more green financing instruments. The other issues that should be mentioned are the market-related challenges, i.e., investor awareness and perception of risks. This study is among the first to apply AHP to rank financing constraints for green buildings in Pakistan, providing a methodological and empirical contribution to sustainable construction research in developing economies. It offers a practical tool for prioritizing challenges and guiding strategic policy and investment decisions.

Keywords:
Green building, barriers, Analytical Hierarchy Process, sustainable construction.

How to Cite:
Sohaib, M., Shah, S. Q., Rafaq, A., & Shah, S. W. Z. (2026). *Critical obstacles to sustainable construction: A multi-criteria decision approach*. *KASBIT Business Journal, 19*(1), 36–52.

1. Introduction

The Sustainable Development Goals (SDGs) are a global appeal to protect the environment, combat climate change, eradicate poverty, and ensure access to a high quality of life and prosperity for all (Mishra et.al., 2024). Therefore, focus towards environmental sustainability has already pushed the importance of adopting green building practices, to limit carbon emissions and natural resources, and to promote long-term economic health (World Green Building Council, 2023; UN Environment Programme, 2025). Buildings that are designed to be green by incorporating energy savings, water savings, and sustainable materials are among the most common methods that have been highlighted to have possibilities of alleviating climate change in creating economic and social returns (Agyekum et al., 2020). Nevertheless, regardless of these benefits, one of the biggest challenges related to launching green building projects, which is a crucial bottleneck in the context of the developing economy, Pakistan included (Nasir et al., 2024).

Compared to the traditional projects, green construction can be more expensive, even considerably, and the returns are paid out in the long term (Akcay, 2023). Such lack of coordination between expenditure and returns will deter developers, financial organizations and investors to invest resources (Tetteh & Owusu Kwateng, 2025). Also, the inability to attract sufficient financing to green initiatives remains under scrutiny due to the absence of favorable administrative policy, regulatory models, and resourceful financial resources (Tetteh & Owusu Kwateng, 2025). Pakistan presents such challenges especially due to low development of the financial markets, ineffectiveness of some institutions, and the lack of understanding of sustainable finance (Hussain et al., 2023).

Although a number of studies have been conducted on impediments to the adoption of green building and the green building finance, a majority of them have focused on advanced economies, with the policy frameworks and provisions of financial instruments being at an advanced stage (Hussain et al., 2023; Debrah et al., 2024). There is a lack of research on emerging economies, and particularly the case of Pakistan. Also, prior research tends to report barriers without ranking them according to their importance, which may be confusing to policymakers and practitioners who do not know which issues should be prioritized (Tetteh & Owusu Kwateng, 2025). To fill this loophole, this study utilizes the Analytical Hierarchy Process (AHP) to rank the most important impediments to green building project in Pakistan.

This study adds in two aspects. Theoretically, it contributes to the literature about sustainability fund flows and project management by using empirical determination of prioritisation of the barriers in the environment of the emergent economy (Hussain, Naqvi, et al., 2023). In practice, it makes it much easier to organize the work of decision-makers and prioritize such obstacles for the adoption of green buildings, thus, allowing constructing effective policy, institutional, and financial policies to promote such sustainability as fast as possible (World Green Building Council, 2023).

2. Literature Review

Green buildings have become a significant reaction to the world-wide problems of climatic change, energy crisis and environmental deterioration. Nevertheless, there is a serious financing limitation to their adoption especially in the developing economies such as Pakistan. Various researchers have identified various obstacles related to the financing of green buildings, which can be grouped into four broad themes that include economic and financial barriers, institutional and policy barriers, market-related barriers, and awareness and capacity barriers.

2.1 Economic and Financial Barriers

The greatest barrier to the implementation of green building, which is the most often mentioned, is the initial high cost as compared to the traditional mode of construction. Sustainable technologies, renewable energy systems and energy efficient materials are expensive in terms of capital allocation, which puts off developers and financiers (Ahmad et al., 2025). Such investments are also long-term operations that will save on costs but cannot compete in terms of financial appeal due to the long payback period (Zatini et al., 2025).

The provision of financing mechanisms of green buildings is underdeveloped in most countries. Lack of access to green financial tools like concessional loans, green bonds, tax incentives has been documented at different studies (Debrah et al., 2024). Pakistan because banks and other financial institutions are not always willing to finance green projects, as they see it as a risk, there are no collateral, and they do not have enough information (Hussain, Naqvi, et al., 2023). This funding disparity is a challenge that is vital to scaling sustainable building.

2.3 Market-Related Barriers

The adoption of green building practices is also determined by market maturity. The real estate market of most developing economies is not clear that the building with green certification can attain higher resale value or rental premium (Agyekum et al., 2020). Investors are thus still wary and view green projects as risky financial undertakings (Tetteh & Owusu Kwateng, 2025).

In addition, markets in secondary products of green financial products have poor performance, thus restricting diversification and risk-sharing (Debrah et al., 2024). These restrictions further strengthen the uncertainty of investors, and it becomes harder to obtain proper financing by developers (Chien et al., 2021).

2.4 Awareness and Capacity Barriers.

The other hindrance is in the lack of awareness and technical know-how among the stakeholders. A great number of developers, contractors, and even policymakers lack the knowledge of financial and environmental benefits of green buildings (Zatini et al., 2025; Zhang et al., 2022). The misunderstandings about the prices and advantages lead to the unwillingness to turn to green practices.
Also, there is a lack of qualified specialists who can design, assess, and deploy green technologies, which poses other limitations (Chien et al., 2021). This knowledge gap and lack of awareness in Pakistan

has a major impact on decreasing the readiness of investors and developers to develop green construction projects (Ye et al., 2024).

We identified different barriers in different domains to prioritize obstacles and barriers in green building. Mainly there are three barriers i.e. financial, market related and awareness. This makes us to develop priority scale on green building with the help of AHP.

3. Methodology

This paper uses Analysis Hierarchy Process (AHP) to find and rank the obstacles and impediments to the funding of green building projects in Pakistan. The AHP is an established multi-criteria decision-making (MCDM) methodology that allows breaking down the complex issues into a hierarchical structure of interrelated criteria and sub-criteria (Saaty, 1980; Gashaw et al., 2023). It combines both qualitative and quantitative analysis and thus provides a methodical way to access the relative significance of various aspects. This means that since the barriers related to green building financing are complex, and dependent on each other, AHP is a suitable framework of priorities that can be determined by the expert opinion.

3.1 Research Framework

The methodological procedure to be used in this research is based on three major steps:

1. Determination of the barriers by a comprehensive literature review and verification by experts;
2. Arranging of the hierarchical model with domains (categories of the barriers) and sub-domains (to which particular barriers belong); and
3. Barrier prioritization based on pairwise comparisons of barriers based on expert judgment assessed through the AHP model.

Conceptual hierarchy of the problem was created whereby the goal (Green Building Barriers) was typed at the top, then the major domains, Economic and Financial Barriers, Institutional and Policy Barriers, Market-Related Barriers, and Awareness and Capacity Barriers and ultimately the specific sub-barriers within each domain.

3.2Expert Selection and Data Collection

Expert opinion were used to obtain data in pairwise comparison. A type of purposive non-probability sampling, the expert sampling technique was used to choose the individuals who possess the knowledge and experience in the field of green building development and finance (Kamranfar et al., 2022). The experts selected for this study are professionals working in construction, real estate, sustainable development in Pakistan. We chose experts who have expertise of understanding the regulations, having financial autonomy and knowledge of technology, head of the organizations working in construction industry and having 10+ years of experience to have significant insight into the barriers, financing, and implementation of green building projects. The experts hold positions of chief engineer (CE), Executive Engineer (XEN), Superintendent Engineer (SE) from public sector department.

All in all, 20 experts were contacted. Pairwise comparisons between identified barriers were determined using their responses. Expert judgment is also in line with the AHP methodology that has the use of informed human judgment in cases where quantitative data are insufficient (Saaty, 1980; Borade et al., 2013).

3.4 Analytical Hierarchy Process (AHP)

The Analytical Hierarchy Process (AHP) procedure is applied to calculate the weights of the criteria in the decision-making process

The AHP method was used in four steps that were systematic:

Defining the Problems and Stratification:

The overall goal (prioritization of barriers) was placed on the first level, and then domains and sub-barriers in their hierarchical order were placed.

Pairwise Comparison:

Each barrier was equated to another at the same level by experts who used Saaty 9-point scale where a rating of 1 signifies equal importance and 9 extreme importance of one criterion over a different one (Saaty, 1977; 1980).

Pairwise Comparison Process

After hierarchy construction, pairwise comparison matrices are developed to capture expert judgments. For a set of n elements, a reciprocal comparison matrix A = [a_{ij}] is constructed such that:

- a_{ij} represents the relative importance of element i over element j
- The matrix is reciprocal: aij=1/aji
- Diagonal values are 1: $a_{ii} = 1$

$$A = \begin{bmatrix} 1 & a_{12} & \cdots\cdots & a_{1n} \\ \frac{1}{a_{12}} & 1 & \cdots\cdots & a_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \vdots & \vdots & \ddots & \vdots \\ \frac{1}{a_{1n}} & \frac{1}{a_{2n}} & \cdots\cdots & 1 \end{bmatrix}$$

Calculations of Weights and Consistency:

Local and global weights were computed through a geometrical average of the responses of the experts. The consistency of decisions was tested using Consistency Ratio (CR) which should be lower than 0.1 to satisfy the comparisons (Saaty, 1980; Noorul Haq and Kannan, 2006).

Synthesis of Priorities:

The end global weights were calculated by multiplying the local weights of sub-barriers and domain weights respectively. These composite weights of priorities around the world show the comparative weight of each of the barriers in the comprehensive system.

3.5 Data Analysis Tools

The results of the expert surveys were calculating through Microsoft Excel to construct the pairwise matrix, normalize and compute the consistency. The calculated weights were ranked to determine the most important areas and sub-barriers in green building financing. The research process is transparent and reproducible and fits the known application of AHP in sustainability and project management studies (Mubarik et al., 2021; Kamranfar et al., 2022).

4. Results and Analysis

4.1 Overview of the AHP Framework

This study employed a three-tier AHP hierarchy to systematically prioritize barriers to green building project financing in Pakistan. The framework comprised three domain-level categories (Financial, Regulatory, and Awareness barriers) and nine dimension-level sub-barriers. Expert judgments from 20 construction industry professionals were collected through structured pairwise comparisons using Saaty's 1–9 fundamental scale. The analysis generated priority weights at both domain and dimensional levels, culminating in global composite rankings that reveal the relative significance of each barrier within the overall financing ecosystem.

Table 4.1: Hierarchical Structure of Barriers to Green Building Financing

Domain	Dimensions
Financial	Insufficient incentives, Limited funds, High expense
Regulatory	Regulatory structure, Unclear policies, Lack of government support
Awareness	Limited understanding of advantages, Lack of technical knowledge, Resistance to change

4.2 Domain-Level Analysis

4.2.1 Pairwise Comparison Results

The domain-level analysis evaluated the relative importance of Financial, Regulatory, and Awareness barriers. Table 4.2 presents the aggregated pairwise comparison judgment matrix (PCJM) derived from expert responses.

Table 4.2: Domain-Level Priority Weights and Rankings

Domain	Weight (%)	Rank
Financial barrier	24.2	2
Regulatory barrier	22.8	3
Awareness barrier	52.7	1

Consistency Ratio (CR): 0.7%, Expert Consensus: 71.7%

4.2.2 Interpretation of Domain-Level Priorities

Awareness barriers emerged as the dominant constraint (52.7%), significantly outweighing both financial (24.2%) and regulatory (22.8%) domains. This finding underscores a fundamental challenge within Pakistan's construction sector: the pervasive lack of technical expertise, professional capacity, and stakeholder understanding regarding green building methodologies. As noted by Anzagira et al., (2022) professionals and end-users in developing economies frequently lack comprehensive knowledge about the operational cost savings and long-term benefits of sustainable buildings, thereby constraining market demand irrespective of financing availability or policy frameworks.

Financial barriers ranked second, reflecting persistent challenges in Pakistan's green building financing landscape. High upfront costs, limited specialized green finance instruments, and inadequate public-private funding mechanisms collectively impede sustainable practice adoption (Akerele et al., 2025; Rahman et al., 2022). Poor investor confidence regarding green project returns further compounds these financial constraints.

While regulatory barriers occupied third position, their impact remains substantial. Pakistan's fragmented regulatory environment—characterized by inconsistent building codes across jurisdictions and absence of unified green building policies—creates significant implementation barriers. The lack of a national green building code, limited enforcement capacity, and insufficient inter-agency coordination have been well-documented (Ye et al., 2024). However, experts perceived cognitive and financial constraints as more immediately pressing than regulatory deficiencies.

The exceptionally low CR value (0.7%) validates the logical consistency of expert judgments, while the 71.7% consensus rate demonstrates substantial agreement across diverse professional backgrounds and sectors, thereby enhancing the robustness of these findings.

4.3 Dimension-Level Analysis

4.3.1 Financial Barriers

Within the Financial domain, three dimensions were evaluated: High Expense, Limited Availability of Finance, and Insufficient Incentives. Table 4.3 presents the priority weights and rankings.

Table 4.3: Financial Barrier Dimensions—Priority Weights and Rankings

Dimension	**Weight (%)**	**Rank**
Insufficient Incentives	19.9	3
Limited Availability	31.0	2
High Expense	49.1	1

Consistency Ratio (CR): 0.5%, Expert Consensus: 46.9%

High Expense emerged as the dominant financial barrier (49.1%), reflecting perceptions within Pakistan's construction industry that green technologies and sustainable materials are prohibitively expensive. The substantial initial costs associated with energy-efficient systems, renewable energy integration, and green certifications deter even motivated developers, particularly in markets prioritizing short-term profitability over lifecycle cost savings (Tabatabaee et al., 2022).

Limited Availability of Finance ranked second (31.0%), highlighting deficiencies in Pakistan's green finance infrastructure. Financial institutions have yet to develop specialized green loan products, and sustainability considerations rarely feature in credit risk assessments (Khan et al., 2024). Banks demonstrate limited capacity to quantify risk-return profiles of green projects, resulting in either outright loan rejections or prohibitively high interest rates. Moreover, Pakistan remains poorly integrated into international mechanisms such as green bonds and climate finance grants.

Insufficient Incentives received the lowest weight (19.9%), not due to insignificance but rather reflecting stakeholders' adaptation to their absence. Pakistan lacks systematic fiscal incentives—including tax rebates, performance-linked bonuses, and insurance mechanisms—that have catalyzed market transformation in developed economies (Rahman et al., 2022).

4.3.2 Regulatory Barriers

The Regulatory domain encompassed three dimensions: Lack of Government Support, Unclear Policies, and Regulatory Structure. Results are presented in Table 4.4.

Table 4.4: Regulatory Barrier Dimensions—Priority Weights and Rankings

Dimension	Weight (%)	Rank
Regulatory structure	12.6	3
Unclear policies	31.4	2
Lack of government support	56.0	1

Consistency Ratio (CR): 0.2%, Expert Consensus: 59.7%

Lack of Government Support dominated this domain (56.0%), revealing critical leadership deficits. Despite sustainability provisions in Pakistan's climate change policies, implementation within the construction sector remains minimal. Large-scale public green building projects, financing structures, legal protections, and procurement guidelines necessary to catalyze private sector adoption are absent. This leadership vacuum creates market uncertainty, deterring investor confidence and public sector engagement (Babalola & Harinarain, 2021).

Unclear Policies ranked second (31.4%), confirming findings by Khan et al. (2024) regarding ambiguities and contradictions in Pakistan's green building standards, environmental codes, and urban planning regulations. National frameworks such as the Pakistan Climate Change Act 2017 exhibit poor and inconsistent implementation across provincial and municipal jurisdictions. Confusion regarding mandatory versus recommended environmental standards creates developer hesitancy toward sustainability investments.

Regulatory Structure received the lowest weight (12.6%), reflecting institutional inefficiencies including outdated systems, inadequate staffing, and insufficient digital infrastructure. However, experts prioritized policy content and institutional leadership over administrative mechanisms, suggesting that strategic reforms and leadership commitment are more urgent than procedural improvements.

The low CR (0.2%) and moderate consensus (59.7%) validate these findings, indicating that green building finance enhancement in Pakistan requires coherent, enforceable regional policies coupled with strong public sector commitment.

4.3.3 Awareness Barriers

The Awareness domain—identified as most critical at the domain level (52.7%)—comprised three dimensions: Lack of Technical Knowledge, Limited Understanding of Benefits, and Resistance to Change. Results appear in Table 4.5.

Table 4.5: Awareness Barrier Dimensions—Priority Weights and Rankings

Dimension	Weight (%)	Rank
Limited Understanding	26.3	2
Lack of technical knowledge	51.3	1
Resistance to change	22.4	3

Consistency Ratio (CR): 0.6%, Expert Consensus: 30.3%

Lack of Technical Knowledge emerged as the paramount awareness-related barrier (51.3%), corroborating literature regarding Pakistan's construction workforce being predominantly trained in conventional technologies. Architects, civil engineers, and contractors generally lack the expertise, training, and exposure necessary to implement green building standards effectively, thereby undermining project quality, cost-efficiency, and scalability (Anzagira et al., 2022).

Limited Understanding of Benefits ranked second (26.3%), revealing stakeholder disconnection from green building outcomes. Long-term operational cost savings, enhanced occupant satisfaction, and health benefits of sustainable designs remain poorly understood by many developers. Consequently, green features receive inadequate valuation in marketing and investment decisions (Agyekum et al., 2020).

Resistance to Change ranked third (22.4%), indicating construction industry entrenchment in established practices and cultural inertia. Preferences for familiar materials, apprehension regarding construction delays, and reluctance toward performance monitoring systems contribute to low sustainable alternative adoption. Attitudinal resistance can impede innovation even when knowledge exists, particularly absent local success precedents (Al-Otaibi, 2024).

Despite lower consensus (30.3%), the excellent CR (0.6%) confirms logical consistency in expert judgments. These results underscore urgent needs for nationwide awareness campaigns, capacity development initiatives, curriculum revisions, and institutional partnerships to cultivate a sustainability-informed workforce in Pakistan.

4.4 Global Composite Priority Weights

Global composite weights were calculated by multiplying each dimension's local weight by its respective domain weight, enabling comprehensive ranking of all nine barriers across domains. Results are presented in Table 4.6.

Table 4.6: Global Composite Priority Weights—Overall Barrier Rankings

Domain	Domain Weight	Dimension	Local Weight	Global Weight	Overall Rank
Financial	0.244	Insufficient incentives	0.199	0.0486	7
		Limited availability	0.310	0.0756	6
		High expense	0.491	0.1198	4
Regulatory	0.228	Regulatory structure	0.126	0.0287	9
		Unclear policies	0.314	0.0716	6
		Lack of govt support	0.560	0.1277	3
Awareness	0.527	Limited understanding	0.263	0.1386	2
		Lack of tech knowledge	0.513	0.2704	1
		Resistance to change	0.224	0.1180	5

4.4.1 Synthesis of Global Rankings

Lack of Technical Knowledge achieved the highest global priority weight (0.2704), reinforcing dimensional analysis findings that awareness barriers constitute the most critical constraint. This aligns with Agyekum et al. (2020), who emphasize that deficient green-specific technical knowledge fundamentally limits sustainable construction development in emerging economies.

Limited Understanding of Benefits ranked second (0.1386), highlighting needs for educational initiatives and demonstration projects engaging clients and stakeholders. Lack of Government Support ranked third (0.1277), confirming institutional leadership as pivotal for sustainable policy implementation (Babalola & Harinarain, 2021). High Expense (0.1198) and Resistance to Change (0.1180) occupied fourth and fifth positions respectively, representing important yet secondary financial and psychological barriers. Lower-ranked dimensions including Unclear Policies (0.0716), Limited Availability of Finance (0.0756), Insufficient Incentives (0.0486), and Regulatory Structure (0.0287), while significant, were perceived as less immediately pressing by experts.

These findings suggest that green building adoption in Pakistan is constrained more by human capacity deficits and institutional vision gaps than by purely economic obstacles. Results indicate that first-order interventions should prioritize awareness enhancement, technical training, and regulatory leadership over immediate financial mechanism reforms.

4.5 Validation and Consistency

All AHP matrices demonstrated exceptional consistency, with domain-level CR at 0.7%, financial barriers at 0.5%, regulatory barriers at 0.2%, and awareness barriers at 0.6%—all substantially below the 0.10 threshold established by Saaty (1980). These values confirm the logical soundness and reliability of expert judgments across all hierarchical levels.

Consensus rates varied: domain-level consensus reached 71.7%, regulatory barriers achieved 59.7%, financial barriers attained 46.9%, and awareness barriers recorded 30.3%. While lower consensus in some dimensions reflects diverse expert perspectives, the consistently low CR values validate that disagreements remained within logically consistent bounds rather than indicating random or contradictory judgments.

5. Discussion

5.1 Principal Findings and Theoretical Implications

This study employed the Analytical Hierarchy Process to systematically prioritize barriers impeding green building project financing in Pakistan. The empirical findings reveal that awareness-related barriers (52.7%) substantially overshadow financial (24.2%) and regulatory (22.8%) impediments. At the dimensional level, lack of technical knowledge emerged as the paramount constraint (global weight = 0.2704), followed by limited understanding of benefits (0.1386), insufficient government support (0.1277), high expenses (0.1198), and resistance to change (0.1180).

These findings challenge conventional assumptions that financial constraints constitute the primary impediment to sustainable construction in developing economies. While economic barriers undeniably influence adoption rates, our results suggest that human capital deficits and institutional leadership gaps exert more profound systemic effects. This discovery aligns with innovation diffusion theory (García-Avilés, 2020), which posits that knowledge dissemination and social acceptance often precede economic feasibility in technology adoption trajectories. The predominance of awareness barriers indicates that Pakistan's green building sector remains in the early "knowledge" and "persuasion" stages, wherein stakeholders lack sufficient information to form favorable attitudes toward sustainable practices.

From an institutional theory perspective (North, 1990), the prominence of regulatory and awareness barriers reflects weak formal institutions (laws, regulations) and underdeveloped informal institutions (norms, cognitive frameworks). The lack of government support (third-ranked globally) exemplifies formal institutional deficiencies, while technical knowledge gaps represent informal institutional underdevelopment. This institutional void creates path dependencies that perpetuate conventional construction paradigms despite superior long-term value propositions offered by sustainable alternatives.

5.2 The Awareness Imperative

The identification of technical knowledge gaps as the most critical barrier (0.2704 global weight) carries profound implications for Pakistan's construction sector capacity building. This finding corroborates international research in Ghana (Anzagira et al., 2022), Nigeria, and Malaysia, suggesting that technical knowledge deficits constitute a universal constraint in developing economies' green building transitions. In Pakistan's context, architects and engineers lack exposure to passive design principles and energy modelling, contractors demonstrate limited familiarity with green construction techniques, and financial analysts cannot adequately evaluate green project risks due to insufficient understanding of lifecycle cost analysis (Nasir et al., 2024).

Limited understanding of benefits (0.1386) reveals persistent information asymmetries. Despite extensive international evidence documenting 20-30% energy savings and 7-16% property value premiums (Eichholtz et al., 2013), these benefits remain poorly understood within Pakistan's construction ecosystem. This knowledge gap stems from lack of comprehensive local performance databases, limited public education campaigns, and insufficient dissemination of green building research through professional channels. The resulting market failure prevents economically rational investments from being realized, as stakeholders' incomplete information and short decision horizons prevent optimal resource allocation.

Resistance to change (0.1180) represents the most intangible yet persistent barrier. Behavioral economics literature (Kahneman, 2011) offers explanatory frameworks including status quo bias, loss aversion, and anchoring effects that cause stakeholders to fixate on high initial costs while discounting lifecycle savings. Pakistan's fragmented construction sector—dominated by small-scale contractors and family-owned firms—exhibits particularly strong resistance due to limited international exposure and intergenerational business practice continuity.

5.3 Financial and Regulatory Constraints

High upfront expenses (0.1198), while ranking fourth globally, reflect legitimate economic challenges. Import dependencies for specialized products, nascent supply chains lacking economies of scale, and limited local manufacturing capacity drive substantial cost premiums. However, prominence of cost concerns may partially reflect misperception rather than objective reality, as international research indicates green buildings can achieve cost parity when sustainable strategies integrate early in design processes (Matthiessen & Morris, 2007).

The moderate ranking of financing availability (0.0756) likely reflects measurement limitations rather than capital abundance. Pakistan's financial sector lacks dedicated green loan products, with banks demonstrating limited capacity to quantify green project risk-return profiles (Khan et al., 2024). The absence of specialized appraisal methodologies prevents lenders from recognizing sustainability premiums, effectively reducing loan-to-value ratios for green projects.

Insufficient government support (0.1277) emerged as the highest regulatory constraint, underscoring the pivotal role of public sector commitment. Despite high-level policy pronouncements, Pakistan demonstrates weak implementation, limited resource allocation, and minimal enforcement mechanisms. This rhetoric-reality gap creates credibility deficits wherein private actors discount government sustainability commitments. Public procurement rarely incorporates sustainability criteria, and government buildings perpetuate conventional practices rather than serving as demonstration projects (Naeem et al., 2023).

Policy ambiguity (0.0716) creates regulatory uncertainty deterring investment. Pakistan operates multiple parallel frameworks without unified national standards, creating situations wherein buildings certified as "green" in one jurisdiction may not satisfy requirements in another. This plurality particularly affects foreign investors requiring regulatory predictability for capital allocation decisions.

This research contributes empirically by providing the first systematic barrier prioritization for Pakistan's green building financing challenges, methodologically by demonstrating AHP application in emerging market sustainability contexts, and practically by offering evidence-based guidance for policymakers, financial institutions, and industry stakeholders. Future research should address temporal dynamics through longitudinal studies, regional variations through geographic disaggregation, and barrier interdependencies through network analysis methodology.

References

Agyekum, K., Opoku, A., Oppon, A. J., & Opoku, D.-G. J. (2020). Obstacles to green building project financing: an empirical study in Ghana. *International Journal of Construction Management*, *22*(15), 1–9. https://doi.org/10.1080/15623599.2020.1832182

Ahmad, F., Boumaiza, A., Sanfilippo, A., & Al-Fagih, L. (2025). A Detailed Comprehensive Role of Digital Technologies in Green Finance Initiative for Net-Zero Energy Transition. *Advanced Energy and Sustainability Research*. https://doi.org/10.1002/aesr.202500066

Akcay, E. C. (2023). Barriers to Undertaking Green Building Projects in Developing Countries: A Turkish Perspective. *Buildings*, *13*(4), 841. https://doi.org/10.3390/buildings13040841

Akerele , E., S Folorunso, O., Bashir, A., Babalola , W. A., Lawal , O., & Adedayo, O. L. (2025). Barriers to Green Building Adoption in Tourism and Hospitality Facilities in Nigeria: An Empirical Review. *International Journal of Research and Innovation in Social Science*, *IX*(XIV), 924–931. https://doi.org/10.47772/ijriss.2025.914mg0071

Al-Otaibi, A. (2024). Barriers and Enablers for Green Concrete Adoption: A Scientometric Aided Literature Review Approach. *Sustainability*, *16*(12), 5093–5093. https://doi.org/10.3390/su16125093

Anzagira, L. F., Duah, D., Badu, E., Simpeh, E. K., & Marful, A. B. (2022). Stimulation strategies to promote green building uptake in developing countries: the case of Ghana. *Journal of Engineering, Design and Technology*. https://doi.org/10.1108/jedt-12-2021-0719

Babalola, A., & Harinarain, N. (2021). Policy barriers to sustainable construction practice in the Nigerian construction industry: an exploratory factor analysis. *Journal of Engineering, Design and Technology*, *ahead-of-print*(ahead-of-print). https://doi.org/10.1108/jedt-07-2021-0375

Bashir, M. T., Khan, A. B., Munir, M., Rasheed, K., Saad, S., & Farid, F. (2024). Evaluating the Implementation of Green Building Materials in the Construction Sector of Developing Nations. *Journal of Human Earth and Future*, *5*(3), 528–542. https://doi.org/10.28991/hef-2024-05-03-015

Borade, A. B., Kannan, G., & Bansod, S. V. (2013). Analytical hierarchy process-based framework for VMI adoption. *International Journal of Production Research*, *51*(4), 963–978. https://doi.org/10.1080/00207543.2011.650795

Chien, F., Ngo, Q.-T., Hsu, C.-C., Chau, K. Y., & Iram, R. (2021). Assessing the mechanism of barriers towards green finance and public spending in small and medium enterprises from developed countries. *Environmental Science and Pollution Research*. https://doi.org/10.1007/s11356-021-14907-1

Debrah, C., Ping, A., Darko, A., Ries, R. J., Ohene, E., & Mershack Opoku Tetteh. (2024). Driving factors for the adoption of green finance in green building for sustainable development in developing countries: The case of Ghana. *Sustainable Development*. https://doi.org/10.1002/sd.3022

Fan, C., & Li, X. (2024). Exploring effective incentive policies for sustainable development of green buildings in China: based on evolutionary game theory and numerical simulation analysis. *Engineering Construction and Architectural Management (Print)*. https://doi.org/10.1108/ecam-06-2023-0622

García-Avilés, J. A. (2020). Diffusion of Innovation. *The International Encyclopedia of Media Psychology*, 1–8. https://doi.org/10.1002/9781119011071.iemp0137

Gashaw, R., Belay, S., Gizat, A., Hailu, S., Saeed Rokooei, & Matos, J. (2023). Development of an integrative green building rating system for the Ethiopian public building projects using analytic hierarchy process. *Cogent Engineering*, *10*(2). https://doi.org/10.1080/23311916.2023.2283324

Hussain, B., Naqvi, S. A. A., & Anwar, S. (2023). Analyzing the Impact of Critical Barriers on the Stakeholder's Adoption Behavior toward Green Building Technologies in Pakistan. *International Journal of Management Research and Emerging Sciences*, *13*(1). https://doi.org/10.56536/ijmres.v13i1.371

Hussain, S., Rasheed, A. A., & Rehman, S. (2023). Driving sustainable growth: exploring the link between financial innovation, green finance and sustainability performance: banking evidence. *Kybernetes*, *53*(11). https://doi.org/10.1108/k-05-2023-0918

Kamranfar, S., Azimi, Y., Gheibi, M., Fathollahi-Fard, A. M., & Hajiaghaei-Keshteli, M. (2022). Analyzing Green Construction Development Barriers by a Hybrid Decision-Making Method Based on DEMATEL and the ANP. *Buildings*, *12*(10), 1641. https://doi.org/10.3390/buildings12101641

Khan, M., Irfan, M., Habib, M., Mahar, W. A., & Asma Batool. (2024). Barriers to Adopting Green Building Practices: A Case Study of Quetta, Pakistan. *The Sciencetech*, *5*(3), 180–196. https://journals.qurtuba.edu.pk/ojs/index.php/tst/article/view/85929

Mishra, M., Desul, S., Santos, C. A. G., Mishra, S. K., Kamal, A. H. M., Goswami, S., ... & Baral, K. (2024). A bibliometric analysis of sustainable development goals (SDGs): a review of progress, challenges, and opportunities. *Environment, development and sustainability*, *26*(5), 11101-11143.

Marín-Rodríguez, N. J., González-Ruiz, J. D., & Botero, S. (2024). Evolution of Green Finance: Mapping Its Role as a Catalyst for Economic Growth and Innovation. *Journal of Risk and Financial Management*, *17*(11), 507–507. https://doi.org/10.3390/jrfm17110507

Mubarik, M., Raja Mohd Rasi, R. Z., Mubarak, M. F., & Ashraf, R. (2021). Impact of blockchain technology on green supply chain practices: evidence from emerging economy. *Management of Environmental Quality: An International Journal*, *32*(5), 1023–1039. https://doi.org/10.1108/meq-11-2020-0277

Naeem, K., Adel Zghibi, Adel Elomri, Mazzoni, A., & Chefi Triki. (2023). *A Literature Review on System Dynamics Modeling for Sustainable Management of Water Supply and Demand*. *15*(8), 6826–6826. https://doi.org/10.3390/su15086826

Nasir, N., Ahmed, W., & Muhammad Ammar Basharat. (2024). Emerging Pathways of Green Financing and its Role in Inducing Sustainable Development in Pakistan. *Journal of Finance and Accounting Research*, *6*(1), 129–155. https://doi.org/10.32350/jfar.61.06

Noorul Haq, A., & Kannan, G. (2006). Effect of forecasting on the multi-echelon distribution inventory supply chain cost using neural network, genetic algorithm and particle swarm optimisation. *International Journal of Services Operations and Informatics*, *1*(1/2), 1. https://doi.org/10.1504/ijsoi.2006.010186

Rehman, H. S. U., Raza, M. A., Masood, R., Khan, M. A., Alamgir, S., Javed, M. A., Roy, K., & Lim, J. B. P. (2022). A multi-facet BIM based approach for Green Building design of new multi-family residential building using LEED system. *International Journal of Construction Management*, 1–15. https://doi.org/10.1080/15623599.2022.2033419

Saaty, T. L. (1980). The analytic hierarchy process: Planning, priority setting, resource allocation. McGraw-Hill.

Saaty, T. L., & Vargas, L. G. (2012). Models, methods, concepts and applications of the analytic hierarchy process (2nd ed.). Springer.

Tabatabaee, S., Mahdiyar, A., Mohandes, S. R., & Ismail, S. (2022). Towards the Development of a Comprehensive Lifecycle Risk Assessment Model for Green Roof Implementation. *Sustainable Cities and Society*, *76*, 103404. https://doi.org/10.1016/j.scs.2021.103404

Tetteh, F. K., & Owusu Kwateng, K. (2025). Green building practices: a literature review of barriers and solutions for sustainable development. *Journal of Facilities Management*. https://doi.org/10.1108/jfm-10-2024-0126

Thanki, S., Govindan, K., & Thakkar, J. (2016). An investigation on lean-green implementation practices in Indian SMEs using analytical hierarchy process (AHP) approach. *Journal of Cleaner Production*, *135*, 284–298. https://doi.org/10.1016/j.jclepro.2016.06.105

UN Environment Programme. (2025). *Global Status Report for Buildings and Construction 2024/2025*. UNEP - UN Environment Programme. https://www.unep.org/resources/report/global-status-report-buildings-and-construction-20242025

World Green Building Council. (2023). *WorldGBC Net Zero Carbon Buildings Commitment expands to include embodied carbon*. World Green Building Council. https://worldgbc.org/article/worldgbc-net-zero-carbon-buildings-commitment-expands-to-include-embodied-carbon/

Ye, J., Fanyang, Y., Wang, J., Meng, S., & Tang, D. (2024). A Literature Review of Green Building Policies: Perspectives from Bibliometric Analysis. *Buildings*, *14*(9), 2607. https://doi.org/10.3390/buildings14092607

Zatini, G., Porta, A. D., & Stefano, Z. (2025). Deciphering Barriers and Strategies in Environmental Management Accounting (EMA) Adoption: A Comprehensive Two-Decade Analysis. *Corporate Social Responsibility and Environmental Management*. https://doi.org/10.1002/csr.3130

Zhang, S., Li, Z., Ma, S., Li, L., & Yuan, M. (2022). Critical Factors Influencing Interface Management of Prefabricated Building Projects: Evidence from China. *Sustainability*, *14*(9), 5418. https://doi.org/10.3390/su14095418