# Barriers to Adopting Green Building Practices: A Case Study of Quetta, Pakistan

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***Abstract***

*Sustainable development goals can be achieved through green building practices. However, specific barriers originating from country-related design and construction factors need to be addressed in order to implement and promote green building technologies in Pakistan. This study aims to identify potential barriers to adopting green building practices in Quetta, Pakistan. The study further categorizes these barriers to identify the necessary strategies for adopting green buildings. The barriers and strategies are spotted and inspected through a literature review of published work and a survey filled in by buildings and construction practitioners in Quetta. The ranking technique analyses the probable barriers to adopting green buildings. The survey results establish the findings, and the critical barriers discover by the studies are "lack of government support" and "unawareness and knowledge" about the value of adopting green building practices, respectively. The research will help people recognize the value of green buildings. The recommended strategies would assist in policy making and introducing incentives to promote green and environmentally friendly building construction.*

***Keywords***: Construction Industry; Green Building Adoption; Balochistan; Strategies; Sustainability.

## Introduction

The construction and building industry has several effects on the natural and built environment, significantly affecting economic and social life. It also contributes considerably to global environmental problems. In

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addition, this industry utilizes up to 4 per cent of global energy, approximately 40 per cent of natural resources, and 25 per cent of water, generating over 45 and 65 per cent of global waste and waste dropped at landfill sites, and more than 40 per cent of carbon dioxide waste (Baharetha et al., 2013; Doan et al., 2017; Zea Escamilla et al., 2016). About 30% of greenhouse gas emissions are due to processes in the construction sector (Lima et al., 2021). To reduce these problems, it is necessary to construct green buildings that do not negatively affect the situation (Azeem et al., 2017; Azeem et al., 2020). Thus, it is obligatory to practice sustainable construction in every part of the world to improve the building's sustainability and enhance the movement of green buildings. Furthermore, taking into consideration a report by the United States Environmental Protection Agency (US EPA) 2004, green building practices lead to resource-efficient construction, maintenance and renovation, where a combination of some of the strategies reduces the construction industry's effect on energy consumption, human health and the environment. It also directly and indirectly affects future generations (Ali & Al Nsairat, 2009).

Researchers have done various investigations on the barriers that hinder green building adoption (Anzagira et al., 2022; Chan et al., 2018; Chen et al., 2021; Darko & Chan, 2017; Darko & Chan, 2018; Gan et al., 2022). Thus, it is essential to identify green building barriers in the designated locations. Future researchers should focus on the barriers to green building acceptance by people so that appropriate strategies can be developed to overcome them. In the context of Pakistan, the green building concept provides affordable, appropriate, and efficient use of natural resources and minimizes climate change vulnerabilities (*ADB*, 2012). The country is in a red zone area from an environmental point of view, and considering the efficient use of natural resources, it is far behind the developed countries. So, it is essential to implement the green building adoption concept into construction policies (Chan et al., 2017). Balochistan is Pakistan's largest province and has been greatly affected by the extreme energy crisis in recent years. Quetta, the capital and largest city of Balochistan, has a fast-growing population and has witnessed rapid growth and development in recent years. The core objective of this research is to discover the potential barriers to adopting green building and identify possible methods to promote green building practices in Quetta, Pakistan.

This first section provides the study's background. The literature review section discusses definitions of green buildings, barriers to adopting green buildings, and strategies to promote green buildings. The materials and methods section presents the research methods, methodology diagram, study population, sampling, and survey methods. The results and discussion sections cover the study's primary outcomes.

The last section concludes the study and provides recommendations.

## Literature Review

### *Green Building*

Many definitions exist today; the foundation of sustainable development is green building (AlSanad, 2015). Green buildings, which are said to be sustainable and high-performance buildings, are user and environment-friendly as well as cost and resource-efficient during the lifetime of the building. In green buildings, improved technologies and potential energy-saving strategies are integrated to decrease carbon footprints and minimize costs (Edwards & Naboni, 2013)Modern-day researchers view green buildings as more efficient, less energy-consuming, and with lower functioning and maintenance costs than conventional buildings. The world faces several climatic, environmental and energy-related challenges, raising the need for green and sustainable buildings. A few rating systems have been developed for energy and life cycle assessment and performance of buildings, which are also compared with the specific energy codes and standards (Hafez et al., 2023; Sartori et al., 2021; Säwén et al., 2024). This study examines the published work on green buildings as one of its critical components. It also tries to identify potential barriers and possible measures for adopting and promoting green building construction.

### *Barriers to the Adoption of Green Building Practices*

The employment of green buildings in the construction industry usually faces many challenges that impede operationalizing them. Various researchers have brought to light many potential barriers to green building construction but face difficulties in its implementation. For example, cost, time, shortage of technology, lack of knowledge and awareness, etc., are potential barriers in previous research.

After an in-depth review of the literature on barriers to green buildings, seven fundamental group barriers, i.e. economics, technology, awareness and knowledge, management, government, market, and culture, are identified. These seven fundamental groups cover twenty-nine specific potential barriers, as identified in Table 1 (along with their key references).

### *Strategies to Promote Green Buildings*

Green building design and practices have faced several barriers in the construction sector. Scholars have conducted many studies to identify the considerations and policies required to encourage sustainable/green building implementations. After a conscientious analysis of the literature, Table 2 provides twelve suggested strategies to promote green building adoption (along with their key references) in the building industry.

***Table 1: Potential Barriers to Green Buildings Adoption.***

| Code | Barriers | References |
|---|---|---|
| | Group A (Economic Barriers) | |
| B1 | Extra initial costs caused by green development | Adabre et al. (2022)<br>Agyekum et al. (2019)<br>Azeem et al. (2017)<br>Azeem et al. (2020)<br>Chan et al. (2017) |
| B2 | High equipment cost | |
| B3 | Green project materials costs are high | |
| B4 | Extra time for a comprehensive system and new technology approval process makes the currency risk of green building projects too high. | |
| | Group B (Technology Barriers) | |
| B5 | Depletion of building aesthetics | Adabre et al. (2022)<br>Agyekum et al. (2019)<br>Azeem et al. (2017)<br>Azeem et al. (2020)<br>Ohiomah et al. (2019) |
| B6 | Unreliability in the performance of green materials and equipment | |
| B7 | Misunderstanding of environment-friendly technical practices | |
| B8 | Strangeness with green technologies | |
| | Group C (Awareness and Knowledge Barriers) | |
| B9 | Lack of acceptance among people and policy makers on the worth of adopting green building practices | Ganiyu et al. (2020)<br>Azeem et al. (2017)<br>Chan et al. (2018)<br>Deng et al. (2018)<br>Ohiomah et al. (2019) |
| B10 | Unavailability of qualified practitioners | |
| B11 | Insufficient provision of specialist and training courses for eco-friendly construction ideas | |
| B12 | Investigators failed to prove the green building advantages, so there is no valid information to convince decision-makers | |
| B13 | Lack of collaboration and superintendence from the directorate on eco-friendly methods | |
| | Group D (Management Barriers) | |
| B14 | Lack of support from senior management | Adabre et al. (2022)<br>Agyekum et al. (2019)<br>Azeem et al. (2017)<br>Azeem et al. (2020)<br>Chan et al. (2018) |
| B15 | Shortage of sustainable suppliers and information | |
| B16 | Shortage of quantitative assessment tools for sustainable performance | |
| B17 | Lack of staff time for implementing green building practices | |
| | Group E (Government Barriers) | |
| B18 | Uncooperative authority guidelines and policies | Ganiyu et al. (2020)<br>Azeem et al. (2017)<br>Darko & Chan (2018)<br>Durdyev et al. (2018)<br>Ohiomah et al. (2019) |
| B19 | Unavailability of authority inducements/assistance and inadequate consultation arrangements for helping environmentally friendly construction methods | |
| B20 | No strategy to promote green buildings | |
| B21 | Absence of an official green building body | |
| | Group F (Market Barriers) | |
| B22 | Lack of cooperation among construction companies | Agyekum et al. (2019)<br>Azeem et al. (2017)<br>Azeem et al. (2020)<br>Darko & Chan (2017)<br>Persson & Grönkvist (2015) |
| B23 | Low demand for sustainable products in the market | |
| B24 | Insurance corporations lack environmental construction explicit risk strategies | |
| | Group G (Cultural Barriers) | |
| B25 | Resistance-to-change culture | Adabre et al. (2022)<br>Ali et al. (2016)<br>Azeem et al. (2017)<br>Chan et al. (2018) |
| B26 | Lack of collaboration | |
| B27 | Lack of cooperation | |
| B28 | Promoting sustainable building practices, which are hindered by a lack of research and sustainability | |
| B29 | Regional ambiguities in the green concept | |

***Table 2: Promotion Strategies for Green Buildings Adoption.***

| Code | Promotion Strategies for Green Buildings Adoption | References |
|---|---|---|
| S1 | Financial inducement and market-based Inducement | |
| S2 | Imperative governmental Plans and directives | |
| S3 | The government should sponsor green construction development and green rating and labelling | |
| S4 | Environmental labelling and information proclamation | |
| S5 | Availability of training and instruction for policymakers, engineers, and developers in sustainable building technologies | Azeem et al. (2017) |
| S6 | Establishment of public environmental concerns through seminars, workshops, and conferences | Chan et al. (2017)<br>Chen et al. (2022) |
| S7 | The public attention towards green building via the media | Olanipekun et al. (2018) |
| S8 | Availability of preferable data on benefits and cost of sustainable technologies | Sabbagh et al. (2019) |
| S9 | Effortless approach to sustainable rating and assessment tool | |
| S10 | Competent and proactive green building technologies promotion teams/local authorities | |
| S11 | Organizational belief in the long-term benefits of green building practices | |
| S12 | Well-nourished sustainable technology research and disclosure of advanced technologies | |

## Materials and Methods

This study uses a survey method for data collection. The quantitative research is applied for identification of green buildings promotion strategies and potential barriers in Quetta City. The methodology diagram in Figure 1, presents the steps and research process used for this study. These steps include theme identification, review of previous literature, pilot study, main survey, results and discussions, conclusions, and recommendations.

The corresponding information for this research are gathered through the purposive questionnaire sampling method. The purposive sampling helps illustrate research phenomena, explore certainty, or getting details on something a little is known (Kumar, 2019). The questionnaire survey is substantially complimented to surveys whose objectives are clear enough to be explained in a few paragraphs, which are anxiously selected and guaranteed in this research. Moreover, it offers well-grounded results and speedy survey management. Hence, this strategy is embraced based on previous studies (Azad & Akbar, 2015; Azeem et al., 2017; Gündoğan, 2012; Samari et al., 2013; Were, 2015).

### *Study Population*

The questionnaire-based survey study is conducted in August 2023. Participants included architects, civil, mechanical, and electrical engineers, researchers, and environmentalists from Quetta's construction industry. In the green building literature, a questionnaire survey has also been a common technique for examining the issues and challenges to the adoption of green innovation (Andelin et al., 2015).

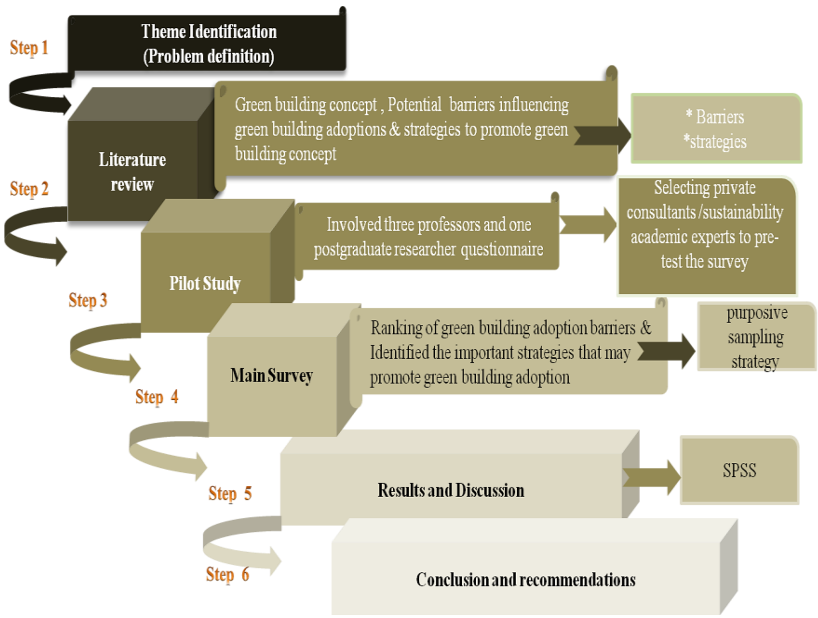


*Figure 1: Methodology Diagram.*

### *Sampling Method*

This research is evaluated using a purposive sampling technique. Purposive sampling is a non-probability technique that is very effective when there are specific types of experts in this scope area (Kumar, 2019). This sampling is used for quantitative and qualitative research techniques. The optimal sample size is decided with the following formula:

$$\text{Sample size} = [z^2 * (1-p)]\ e^2 \qquad (1)$$

Where e, z, and p represent the margin of error, z-score, and standard of deviation respectively. The sample size is determined to be 120 stakeholders based on Equation (1).

The questionnaires are personally delivered to all target stakeholders for the study, and the sample size is estimated to be 120 questionnaires sent to stakeholders. At the same time, 86 valid replies are received, with a response rate of 71.67 %.

### *Questionnaire Design*

The questionnaire provide feedback from the professionals. This survey technique is based on a standard method of green construction information to investigate the problems/barriers guiding green building practices and implementation in Quetta. Furthermore, SPSS is used to rank the barriers identified in the literature. The questionnaire consists of three significant sections; the respondents' information is collected in the first section. The questions on potential barriers to adopting green building practices are added in the second section, and the last section covers the strategies for promoting green building practices. The questionnaire had open-ended and closed questions. Each barrier is set in order and ranked according to its priority. Participants had to rank the potential barriers on a scale of 1 to 5 according to their significance; here, 5= very significant and 1= not significant (a five-point Likert scale), which provides better results that are easy to understand. The questionnaire is finalized in relevance to its comprehensive response to the received feedback from the pilot study. The pilot study involved two professors and a postgraduate researcher who are experts in the selected study area.

### *Data Analysis Methods*

Initially, Cronbach’s alpha assess the questionnaire's data reliability. Questionnaire data are coded to help in the analysis. Numerical values are assigned to the responses from closed-ended questions and quantitatively analyzed by mean item score and percentages. The Statistical Program for Social Sciences (SPSS) is used to generate frequency counts and rankings, and Microsoft Excel (XL) is used to generate tables.

### *Ranking Analysis Technique*

The collected information is analyzed using descriptive statistics. The barriers and measures are ranked using the mean item score. Where two or more factors happened to have the same mean score, standard deviation is used to assign rank.

## Results

### *Statistical Analysis*

Using the Coefficient Alpha method, the categorized data is evaluated. This technique is used for the reliability calculation of a questionnaire. The results showed that the questionnaire’s response rate is 71.67 %, with 86 out of 120 valid replies received, and the intuitive scale's Cronbach's alpha is above 0.6 (0.845 for barriers and 0.893 for strategies). The Cronbach's alpha values between 0.6 - 0.8 are considered satisfactory (Shi et al., 2012).

### *Respondents’ Profiles*

The target respondents of the questionnaire survey are architects, engineers who work in design, supervision and construction (civil, electrical, and mechanical engineers), environmentalists and researchers. Regarding respondents’ educational qualifications, the percentages are

1.2%, 1.2%, 65.1%, 29.1% and 3.5 % for diploma, postgraduate diploma, bachelor, master, and PhD degrees, respectively. Most respondents are architects and structural/civil engineers, with a percentage of 45.3% and 32.6 %, respectively. The remaining are electrical and mechanical engineers, environmentalists and researchers, with a percentage of 12.8%, 3.5%, 4.7% and 2.1%, respectively. According to the results, 46.5% of the respondents had less than five years, 26.7% had between 5 years and 10 years, and 10.5% had more than ten years of experience. Moreover, 8.1% and 8.2% had experience from 16-20, Over 20 years, respectively.

***Ranking Analysis of Barriers***

The respondents used a five-point Likert scale to mark the barriers hindering green building adoption. The descriptive statistics, i.e., means and standard deviations, are calculated, where a higher mean meant that the barrier posed a high barrier. A lower mean is interpreted as a low barrier to adopting the concept of green buildings.

Results from the empirical analysis reveal that in group A, “Economic Barriers” (B4) pose a significant barrier and ranked first. The findings also show that (B2), (B1) and (B3) ranked second, third and fourth, respectively. In group B, “Technology Barriers” (B8) is ranked in first position, and (B7), (B6), and (B5) are ranked second, third and fourth, respectively. The outcomes from the observed assessment reveal that in group C, “Awareness & Knowledge” (B9), (B10), and (B13) pose significant barriers and are ranked first, second and third in the group. In addition, (B11) and (B12) are ranked fourth and fifth, respectively.

The findings show that in group D, “Management”, (B14) is ranked first, (B15) the second, (B17) and (B16) are ranked third and fourth, respectively. In group E, “Government Barriers” (B20) is ranked first, and (B18), (B19) and (B21) are second, third, and fourth significant barriers, respectively. (B22) is ranked first, (B23), and (B24) are ranked in the second and third positions in group F “Market Barriers”. Additionally, in group G, “Cultural Barriers” (B28), (B26), and (B25) are ranked first, second and third, respectively. The results are presented in Table 3.

***Barriers to Green Building Adoption in Quetta***

The empirical analysis results reveal that group E, “Government Barriers,” is ranked as the first most critical barrier. This finding shows that the government's strategy for developing the green building adoption concept is ineffective in Quetta. Results also show that group C, “Awareness & Knowledge Barriers”, is ranked as the second most critical barrier and group D, “Management Barriers”, is ranked third. Furthermore, group B “Technology Barriers”, group F “Market Barriers”, group A "Economic Barriers", and group G "Culture Barriers", are ranked fourth, fifth, sixth, and seventh, respectively, as shown in Figure 2.

***Table 3. Ranking of Barriers Based on Mean Valuer and Standard Deviations***

| Group | Code | Frequency | | | | | Mean Value | Standard Deviation | Ranking |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | | | |
| A | B1 | 8 | 9 | 21 | 32 | 16 | 3.45 | 1.185 | 3 |
| | B2 | 9 | 13 | 14 | 38 | 12 | 3.36 | 1.207 | 2 |
| | B3 | 8 | 13 | 26 | 26 | 13 | 3.27 | 1.172 | 4 |
| | B4 | 6 | 10 | 16 | 24 | 30 | 3.72 | 1.252 | 1 |
| | Average mean value | | | | | | 3.45 | | |
| B | B5 | 9 | 14 | 37 | 16 | 10 | 3.05 | 1.116 | 4 |
| | B6 | 4 | 17 | 34 | 22 | 9 | 3.17 | 1.020 | 3 |
| | B7 | 2 | 11 | 16 | 30 | 27 | 3.8 | 1.094 | 2 |
| | B8 | 7 | 5 | 14 | 23 | 37 | 3.91 | 1.252 | 1 |
| | Average mean value | | | | | | 3.48 | | |
| C | B9 | 0 | 2 | 5 | 30 | 49 | 4.47 | 0.715 | 1 |
| | B10 | 2 | 7 | 7 | 33 | 37 | 4.12 | 1.022 | 2 |
| | B11 | 6 | 4 | 17 | 19 | 40 | 3.97 | 1.222 | 4 |
| | B12 | 5 | 11 | 18 | 19 | 33 | 3.47 | 1.252 | 5 |
| | B13 | 4 | 8 | 11 | 19 | 44 | 4.06 | 1.202 | 3 |
| | Average mean value | | | | | | 4.01 | | |
| D | B14 | 2 | 5 | 15 | 32 | 32 | 4.01 | 1.0 | 1 |
| | B15 | 3 | 9 | 18 | 42 | 14 | 3.64 | 0.993 | 2 |
| | B16 | 5 | 5 | 32 | 28 | 16 | 3.52 | 1.049 | 4 |
| | B17 | 6 | 8 | 25 | 27 | 20 | 3.55 | 1.155 | 3 |
| | Average mean value | | | | | | 3.68 | | |
| E | B18 | 5 | 5 | 7 | 28 | 41 | 4.1 | 1.148 | 2 |
| | B19 | 1 | 7 | 14 | 28 | 36 | 4.06 | 1.01 | 3 |
| | B20 | 2 | 9 | 11 | 15 | 49 | 4.16 | 1.146 | 1 |
| | B21 | 4 | 11 | 9 | 17 | 45 | 4.02 | 1.255 | 4 |
| | Average mean value | | | | | | 4.08 | | |
| F | B22 | 4 | 2 | 32 | 23 | 25 | 3.73 | 1.056 | 1 |
| | B23 | 5 | 11 | 37 | 26 | 10 | 3.57 | 1.184 | 2 |
| | B24 | 9 | 24 | 19 | 16 | 18 | 3.12 | 1.314 | 3 |
| | Average mean value | | | | | | 3.47 | | |
| G | B25 | 6 | 10 | 39 | 18 | 0 | 3.26 | 1.076 | 5 |
| | B26 | 2 | 11 | 37 | 26 | 10 | 3.26 | 1.166 | 2 |
| | B27 | 4 | 16 | 30 | 15 | 21 | 3.38 | 1.18 | 3 |
| | B28 | 5 | 12 | 24 | 20 | 25 | 3.56 | 1.214 | 1 |
| | B29 | 6 | 10 | 24 | 27 | 19 | 3.36 | 0.932 | 4 |
| | Average mean value | | | | | | 3.36 | | |

### *Promotion Strategies for Adoption of Green Building Concepts in Quetta*

This study identifies the potential strategies and measures necessary to promote green building construction practices and their adoption in Quetta. Respondents are also asked to use a five-point Likert scale to identify strategies that may increase green building adoption.

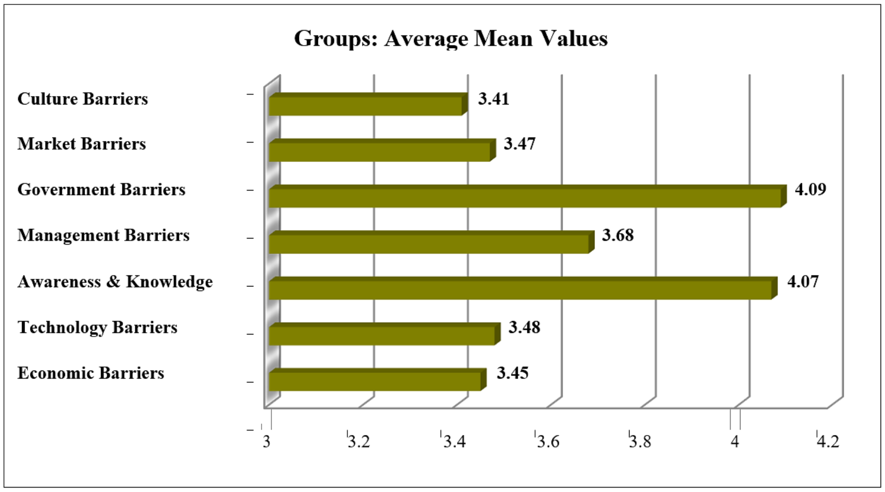


***Figure 2: Ranking of Groups Barrier Based on Average Mean Values***

Results of the empirical analysis reveal that "Availability of training and instruction for policymakers, engineers and developers in sustainable building technologies" (S5) is ranked first in the promotional strategies. "Establishment of public environmental concerns through seminar, workshop, conferences" (S6) is ranked second, and the "availability of preferable data on benefits and cost of sustainable technologies" (S8) is ranked third. The mean values and ranking of promotional strategies are illustrated in Table 4.

***Table 4. Ranking of Strategies Based on Mean Value and Standard Deviation***

| | Frequency | | | | | Mean Value | Standard Deviation | Ranking |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | | | |
| S5 | 6 | 4 | 6 | 25 | 45 | 4.15 | 1.183 | 1 |
| S6 | 2 | 6 | 20 | 14 | 44 | 4.07 | 1.115 | 2 |
| S8 | 2 | 6 | 13 | 29 | 36 | 4.06 | 1.033 | 3 |
| S2 | 4 | 6 | 10 | 27 | 38 | 4.05 | 1.133 | 4 |
| S7 | 3 | 6 | 11 | 31 | 35 | 4.03 | 1.068 | 5 |
| S11 | 3 | 5 | 15 | 28 | 35 | 4.01 | 1.156 | 6 |
| S3 | 3 | 9 | 15 | 23 | 36 | 3.93 | 1.156 | 7 |
| S12 | 5 | 8 | 14 | 27 | 32 | 3.85 | 1.193 | 8 |
| S9 | 5 | 10 | 18 | 26 | 27 | 3.7 | 1.199 | 9 |
| S1 | 6 | 4 | 29 | 25 | 22 | 3.62 | 1.129 | 10 |
| S10 | 2 | 13 | 27 | 22 | 22 | 3.57 | 1.101 | 11 |
| S4 | 5 | 10 | 36 | 29 | 6 | 3.24 | 0.957 | 12 |

## Discussion

The study results show that the identified barriers significantly affect adopting green buildings in Quetta. It recommends some strategies to overcome these problems. The following sections discuss the results, considering the seven group barriers and measures to promote them.

***Group E (Government Barriers)***

The government barrier is ranked as the first and most critical barrier within Quetta, as shown in Figure 2. The top Government barriers to green building adoption, which obtained the highest rank according to the respondents, are no strategy to promote green buildings (B20) and uncooperative authority guidelines and policies (B18). The research findings showed that most practitioners are aware of green building concepts. This finding indicated that many building construction practitioners in Quetta provide better evidence on green building concepts. Still, they did not put them into practice or integrate them into their projects because governments cannot facilitate green building adoption through various strategies. The government policy and regulation framework, energy codes, and building bylaws are not given serious attention for adopting green building concepts in Quetta.

***Group C (Awareness and Knowledge Barrier)***

The awareness and knowledge barriers are the second most important. The lack of acceptance among people and policymakers of the worth of adopting green building practices (B9) and the unavailability of qualified practitioners (B10) are top barriers under this group. In addition, training, education workshops, seminars, conferences, etc., are seen as essential tools in promoting green building adoption and modifying the capability of the user group to focus on development and environmental problems.

***Group D (Management Barriers)***

The management barriers are ranked as the third most significant. The top management barriers to green building adoption are a lack of support from senior management (B14) and the shortage of quantitative assessment tools for sustainable performance (B16). The extracted findings of research results showed that practitioners are aware of the green building concepts. Still, they did not follow the norms and practices to incorporate within their projects due to limited availability of green suppliers, poor management techniques, lack of information, and senior management not supporting the application of green building practices.

***Group B (Technology Barriers)***

The technology barriers are ranked fourth. The strangeness of green technologies (B8) and misunderstanding of environment-friendly technical practices (B7) remained the top barriers in this group. The findings show that the practitioners are still unfamiliar with green technologies, which poses a more significant challenge to adopting green building concepts. There is a lack of knowledge based on technical skill, expertise, and materials, and fewer designs are allocated for green building construction. In addition, the implementation of green construction in society still faces many problems because the construction industry still fails to produce experts in green building technology.

***Group F (Market Barriers)***

Market barriers are ranked in the fifth position. The top market barriers to green building adoption are a lack of cooperation among construction companies (B22) and low demand for sustainable products (B23). The basic requirements of green building technologies are service and maintenance. However, the industry for these services is still new in Quetta, and all these technologies are imported from other countries with no local skills and experience to maintain their services. Furthermore, many companies are trying to make quick profits through the green building business without a true commitment to the environment and customers.

***Group A (Economic Barriers)***

The economic barrier is ranked sixth. According to the respondents, the top economic barriers to green building adoption are extra time for a comprehensive system and a new technology approval process, making the currency risk of green building projects too high (B4) and high equipment cost (B2). Findings conclude that the initial budget of green buildings is higher than that of traditional buildings because of the high expenses and fees of consultants, the lack of experience of the designer team, and the high budget of assessment tools for building documentation techniques.

***Group G (Cultural Barriers)***

The cultural barriers come at last. The top cultural barrier to green building adoption is promoting sustainable building practices, which are hindered by a lack of research and sustainability (B28) and the lack of collaboration (B26). Green building implementation faces barriers due to a lack of cooperation, knowledge-sharing, and inadequate research and development. People in Quetta are familiar with traditional buildings and are unaccustomed to new materials, systems, and technologies used for green building construction. Change in the construction system may face resistance as it is part of the city’s culture, but people could accept it gradually with time through the proven outcomes of green building construction.

## Conclusion

This research investigates practitioners' awareness levels regarding major barriers hindering the implementation of green building practices in Quetta and promotion strategies based on their perceptions. A questionnaire-based survey and a literature review are used to identify and examine potential barriers to adopting and promoting green buildings. The data from the questionnaires are analyzed by implementing ranking using Statistical Package for Social Science software (SPSS). The ranking technique is used to understand the key barriers. Furthermore, the reliability of the data is checked using Cronbach's Alpha test.

This study investigates twenty-nine potential barriers and twelve strategies. These barriers fall within seven main groups: economic, technology, awareness & knowledge, management, government, market, and cultural barriers. The results from the survey revealed that the most critical barriers are "government barriers" followed by "awareness and knowledge barriers". The survey confirms that the lack of awareness of our local stakeholders about the long-term benefits of green buildings in society also creates barriers. The government and other relevant authorities should expand their understanding of these areas to successfully adopt green buildings in a local context. To promote sustainable building design in commercial and residential communities, the government must provide some financial benefits to stakeholders.

All of the twelve promotional strategies are accepted as significantly important, with the most essential being the "Availability of training and instruction for policymakers, engineers and developers in sustainable building technologies" (P5), "Establishment of public environmental concerns through seminars, workshops, conferences" (P6), "Availability of preferable data on benefits and cost of sustainable technologies" (P8), "Imperative governmental Plans and directives" (P2), "Public attention towards green building via media" (P7) and "organizational belief in long-term benefits of green building practices" (P11).

This study has identified significant barriers to adopting green buildings and strategies to promote green building practices in Quetta. The findings provide valuable information to policymakers, green building practitioners, and developers of systems for implementing green building practices in Quetta, Pakistan. The outcomes of this study are based on the observation of local stakeholders. Still, these outcomes can also be helpful for practitioners in other cities and countries with similar contexts and challenges.

The following recommendations are given considering the barriers and their ranking:

- Developing regulations, standards, and policies for green building products would promote the green market demand.
- Green building policies must be devised and implemented considering the local climate, materials, construction techniques, economic aspects, and cultural and social values.
- Incentive programs may be initiated to promote green building construction and environmentally friendly practices.
- Training sessions may be organized for experts and construction practitioners to introduce the latest advancements.
- Awareness campaigns regarding green buildings' adoption and long-term benefits must be launched.
- The research and education may focus on new technologies in the construction industry and their application in the local context.
- A rating system for appliances and certification for green buildings may be introduced.
- Knowledge sharing and collaboration among professionals and officials are essential for developing the green building industry.

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