

Barriers to the Diffusion and Adoption of Green Buildings in Saudi Arabia

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Abstract

Many countries around the globe have recently pursued sustainability. The public and governments are demanding sustainability due to worldwide environmental disasters caused by pollution and man-made activities that impact the ecological system. Green buildings represent a significant component of sustainability, as their construction is intended to reduce natural resources consumption through energy and water conservation. Saudi Arabia is one of the world's richest countries, but its number of certified green buildings is notably low. In addition, all of these buildings are certified by the US Green Building Council LEED rating system and not by a national organization. It seems that numerous barriers exist, slowing the development and diffusion of green buildings in Saudi Arabia. Through a systematic qualitative research approach, this research aims to explore barriers to the diffusion and adoption of green buildings in Saudi Arabia, which will facilitate the development of green buildings in Saudi Arabia. This research concludes the identification of 14 green building barriers, with lack of skilled personal and unsupportive government policies and regulations being the most significant barriers.

Keywords: Barriers, green buildings, Saudi Arabia, sustainability

1. Introduction

Enormous amounts of natural resources are being consumed daily around the world. Governments and the public worldwide are responsible for controlling this consumption and looking for innovative and efficient alternatives that potentially lead to sustainable development. Energy shortages and environmental pollution have put significant stress on governments, and building energy efficiency buildings thus have become very important (Zhang & Wang, 2013). International efforts are working to promote innovative approaches to reduce carbon dioxide (CO₂) emissions that result from building construction and operation activities (GhaffarianHoseini et al., 2013). CO₂ emissions and global warming are serious international issues (Park et al., 2013). Several countries (e.g., Australia, the United Kingdom, the United States of America, New Zealand and the European Union) set tough environmental laws due to climate change and environmental issues (Eves & Kippes, 2010). The enforcement of such energy regulations will result in a decrease in energy demand, the number of power plants, consumed natural resources and atmospheric emissions (Iwaro & Mwashu, 2010). Thus, significant attention is given to green buildings and their innovative efficiency and renewable systems. The momentum of the green building movement is increasing as the environmental impact of building activities becomes more obvious and significant (Chan, Qian, & Lam, 2009). In developing countries, the need for green building adoption becomes more significant with time. It is predicted that 80% of developing countries' populations will be living in urban areas by 2030 (UNFPA, 2007). Heavy migration from rural to urban area is thus to be expected, which puts considerable stress on the built environment; extra units will need to be built to accommodate the demand. In the meantime, governments worldwide are pursuing solutions in the social and economic sectors to achieve sustainable development (Zhang, Platten, & Shen, 2011). The sustainable development of the built environment is vastly affected by the energy performance of green buildings (GhaffarianHoseini et al., 2013).

In 2012, Saudi Arabia was the world's largest producer and exporter of petroleum liquids (EIA, 2013). It is also considered to be the largest consumer of petroleum liquids in the Middle East (EIA, 2013). Saudi Arabia has an oil-based economy, in which the energy sector is fully dependent on fossil fuels (Rahman & Khondaker, 2012).

The country thus faces a distinctive problem with green gashouse emissions (Rahman & Khondaker, 2012). Because the market offers cheap fuel, investing in renewable energy sources and use of public transportation is discouraged (Rahman & Khondaker, 2012). Saudi Arabia is ranked 61st in the Climate Change Performance Index of 2014, which is last position in the index (Burck, Marten, & Bals, 2013). It thus urgently requires methods of reducing its environmental footprint and enhancing building sustainability (Taleb & Pitts, 2009). One of these methods was recently set in terms of a goal: producing half of its power from renewable fuels by 2020 (EIA, 2013). This goal seeks to meet the growing domestic power demand and save a portion of oil and natural gas for export (EIA, 2013). If Saudi Arabia maintains the status quo, by the end of the decade, 3 million barrels of crude oil could be lost to local consumption each day instead of being exported (EIA, 2013). With the building sector's increasing significance in the provision of energy consumption and carbon emissions, it is now necessary for Saudi Arabia to move toward energy efficient and sustainable buildings (Alrashed & Asif, 2012). To account for a significant reduction of greenhouse gas emissions, public awareness, access to appropriate technology, a legislative framework, and energy pricing policies must be developed to reach maturity (Rahman & Khondaker, 2012). For instance, there are no regulations or mandatory building codes that integrate sustainable architecture principles (Taleb & Sharples, 2011). Unfortunately, although Saudi Arabia is experiencing vital infrastructure development, including residential building construction, energy efficiency is not given serious attention in regard to Saudi building designs (Taleb & Sharples, 2011).

Green strategies aim to increase sustainability, reduce operation costs, maintain occupants' health, and conserve energy (Zhang et al., 2012). Barriers to green buildings must be understood to promote these buildings (Chan, Qian, & Lam, 2009). The step of identifying green building barriers becomes essential here. These barriers differ from one country to another. Cultural, environmental, economic and political factors can influence the quantity and severity of these barriers. Like any new concept, the penetration and quick diffusion is challenging within any market. By identifying green building barriers and setting strategies to overcome these barriers, stakeholders will gain confidence in their continuous implementation (Paul & Taylor, 2008). Furthermore, the right combination of conditions must exist to attract all parties, including government and industry, to promote green buildings (Chan, Qian, & Lam, 2009). This study aims to identify the major barriers to green building in Saudi Arabia and hopes to assist in promoting sustainable development in the Saudi building sector.

2. Literature Review

Many definitions of green buildings exist today, a green building can be defined as the practice of building structures and implementing procedures that are responsible toward the environment and resource-efficient throughout the life-cycle of the building (EPA, 2014). The rate at which these green buildings are spreading in Saudi Arabia is very slow compared with other developing countries, such as the United Arab Emirates (UAE), Brazil, India and Turkey. There are 808 LEED-certified green building projects in the UAE, 638 in Brazil, 405 in India, and 194 in Turkey (USGBC, 2013). Official statistics on the number of certified green buildings in Saudi Arabia are not easily available online because there is no national entity that certifies green buildings in Saudi Arabia. External bodies, such as the US Green Building Council (USGBC), certify all green buildings in Saudi Arabia. In addition, Saudi Arabia has a low number of USGBC-certified buildings. A number of barriers have caused slow development in Saudi Arabia's green building sector and have made it lag behind other countries. These green building barriers must be identified to set strategies for fast adaptation and diffusion of green buildings in Saudi Arabia. According to some estimates, the number of barriers is generally high in the building sector compared with any other sector (Iwaro & Mwashia, 2010). A number of studies that explored barriers of green buildings and its systems started by categorizing these barriers under broad groups related to the barriers (Azadian & Radzi, 2013; Dahle & Neumayer, 2001; Jarnehammar et al., 2008; Kennedy & Basu, 2013; Zhang & Wang, 2013). Here, the barriers can be mainly categorized under the following broad groups:

- 1) Financial
- 2) Governmental
- 3) Technical
- 4) Cultural and market

2.1 Financial Barriers

Financial barriers exist in many forms in the context of green buildings. This group of barriers is related to financial consideration of green buildings. For instance, in developing countries, the number of new buildings is increasing dramatically. Unfortunately, energy prices are low, and the use of efficient technologies and renewable energy technologies is thus not encouraged (Hui, 2000). People start to do basic calculations and discover that

the prices of green building systems are high and require long payback periods, so they opt instead for traditional applications. A number of researchers identified the high cost of green buildings and technologies as a barrier (Alrashed & Asif, 2012; Chan, Qian, & Lam, 2009; Hwang & Ng, 2013; Iwaro & Mwashu, 2010; Lidula et al., 2007; Richardson & Lynes, 2007; Samari et al., 2013; Taleb & Pitts, 2009; Zhang, Platten, & Shen, 2011). In China, the high additional cost of green technologies is considered the top implementation barrier (Zhang, Platten, & Shen, 2011). Similar to green building technologies, the prices of green materials are also considered high. Green building practitioners estimate that green material costs are 3 to 4 percent higher than conventional material costs (ULI, 2002). Even in developed countries such as Canada, high initial cost of green buildings is considered a barrier. A study on greening campuses of higher education institutions found that people generally believe that green buildings incur higher initial costs (Richardson & Lynes, 2007). Developers' importation of new technology from other countries also influences implementation costs (Iwaro & Mwashu, 2010). It is thus feasible to say that although implementing high technology and equipment saves energy in buildings, cost is considered a prime challenge (Iwaro & Mwashu, 2010). Lack of funding or financing difficulties are also financial barriers for green building systems (Lawrence et al., 2005; Lidula et al., 2007; Zhang & Wang, 2013). With regard to these barriers, lenders do not provide special funds to support technologies for building development (Zhang & Wang, 2013).

2.2 Governmental Barriers

Considerations to governmental barriers are discussed in this group. Governments play very significant roles in the promotion or demotion of green buildings. They are capable of setting a number of regulations that favor energy conservation and energy efficiency, which results in the public obliged to green building applications. At the same time, the reverse outcome can be realized when no serious attention is given to energy regulations. Thus, the unavailability or limited existence of a government policy framework for energy conservation and efficiency represents a barrier to green building development (Alrashed & Asif, 2012; Chan, Qian, & Lam, 2009; Lidula et al., 2007; Samari et al., 2013; Zhang, Platten, & Shen, 2011; Zhang & Wang, 2013). Enforcing regulations is essential for the success of government strategies; the absence of an enforcement body can threaten the realization of these strategies, which include new established regulations related to green buildings. For instance, in China, legal penalties exist, but due to the weak legal system, they are hardly enforced (Zhang & Wang, 2013). Thus, the supervision and monitoring systems are very weak in China's building system (Zhang & Wang, 2013). Another government barrier is the lack of appropriate incentives for green buildings systems and technologies. Incentives have a major function because they motivate people to purchase government-listed products. They help reduce the costs of green building systems and technologies, thus making the more attractive. For example, several European countries implemented special funds, which were critical in promoting energy-saving work (Zhang & Wang, 2013). A study on the green building market in developed Asian cities also acknowledges the lack of government incentives and recommends their adoption to promote green buildings (Chan, Qian, & Lam, 2009).

2.3 Technical Barriers

Here, concerns that are associated with technical barriers of green buildings are presented. Newly introduced technologies or concepts (e.g., green buildings) and their systems usually experience technical issues. Technical barriers include lack of professional personnel, information, and reliability. Many studies have identified technical barriers as obstacles to green building diffusion (Alrashed & Asif, 2012; Chan, Qian, & Lam, 2009; Hwang & Ng, 2013; Lawrence et al., 2005; Lidula et al., 2007; Samari et al., 2013; Zhang, Platten, & Shen, 2011). The presence of skilled personnel is important for the correct design, operation, and maintenance of a green building, as these buildings have unconventional systems and technologies and requires at least the supervision of a professional in the field. Different information sources (e.g., technical data and technical manuals on operation and maintenance) for green technologies and systems are essential for their adoption. Product reliability is essential for its market endurance. Green technologies and systems must be proven to be reliable; otherwise, the lack of reliability will act as a strong barrier against its diffusion. Lack of awareness about the performance of green technologies may influence outcomes (Hwang & Ng, 2013).

2.4 Cultural and Market Barriers

In this section, concerns of cultural and market barriers are discussed jointly. Cultural and market barriers were joined under one group because they are seen interrelated with respect to the concept of green buildings in Saudi Arabia. The country's culture affects its market and thus accepts certain products and rejects others. For instance, resistance to change makes it difficult for innovative and new products (e.g., green technologies) and systems to achieve market diffusion. In China, the public's receptivity to energy-efficient building products is low (Zhang &

Wang, 2013) and consumers are rarely willing to invest in these products (Zhang & Wang, 2013). In several developing countries, corruption acts as a barrier to energy regulation practices (Iwaro & Mwashu, 2010; Mohanty, 2012). Corruption-infested cultures represent a hindrance to green building development, as they will resist system changes and will always seek the status quo for their survival. Lack of collaboration and knowledge sharing is another barrier for green building implementation (Richardson & Lynes, 2007). Chances for improvement in all green building aspects are missed when stakeholders do not collaborate or share knowledge.

3. Methodology

This research followed a qualitative approach, as it systematically worked to solve the research problem and accomplish the research aims. The research problem is as follows: “What barriers obstruct the diffusion and acceptance of green buildings in Saudi Arabia?”

To answer this research problem, a literature review on green building barriers and related subjects was conducted, followed by a series of interviews carried out by the author with different industry experts. The data collection for this research was made over two rounds of interviews. The first round of interviews was conducted in January 2014 and the second round of interviews was conducted in August 2015. Both rounds of interviews provided consistent results with no major differences. A number of interviews were conducted among top officials and professional personnel in Jeddah, Saudi Arabia. These face-to-face, in-depth interviews were organized around open-ended questions. The face-to-face approach was chosen to allow the researcher to focus on participant body language when discussing these areas (Zuo et al., 2012). Table 1 details the total sample size of 10 professional practitioners. The duration of the interview ranged from 1 to 2 hours, wherein interviewees had the chance to freely express all of their thoughts and ideas in detail. All interviewees’ personal information was kept confidential. The interviewee selection criteria were as follows:

- 1) Top senior officials in the building and construction sectors and professionals in the green building field
- 2) Experienced, knowledgeable and able to elaborate on the interview questions
- 3) Interested in and keen on being part of the research

Table 1. Interview sample

Interviewee	Sector	Degree
I1	Public	PhD in Civil Engineering
I2	Public	PhD in Architecture
I3	Public	BS in Civil Engineering
I4	Private	PhD in Civil Engineering
I5	Private	PhD in Civil Engineering
I6	Private	BS in Urban Planning
I7	Private	PhD in Architectural Engineering
I8	Private	MS in Architecture
I9	Private	MS in Architecture
I10	Private	BS in Architecture

The number of participants was low due to the limited number of people who fitted the abovementioned criteria and expressed their willingness to participate in this research. Qualitative data analysis was done with the aid of QSR NVivo 10 software. Because all interviews were in Arabic, the interview recordings were first transcript and then translated into English. The final outcome of this research will make it possible to answer the research problem and achieve its aims in a comprehensive manner.

This research will assist in the development of green buildings in Saudi Arabia by investigating the barriers behind its low diffusion. Furthermore, the research will discuss recommendation that can help in overcoming these diffusion barriers and accelerate the development of green buildings in Saudi Arabia. This research aims to accomplish the following:

- 1) Explore local experts opinion on the adoption of green buildings in Saudi Arabia
- 2) Identify the barriers to the diffusion of green buildings in Saudi Arabia
- 3) Provide recommendations on how to overcome these barriers

4. Results

This section presents the results of the interviews conducted for the purpose of research. Interviewees provided

several detailed barriers on green building diffusion in Saudi Arabia. More than one interviewee mentioned a number of these barriers. At the same time, some interviewees were the sole providers of a couple of barriers, which resulted from their different backgrounds, exposure and experiences with regard to green buildings. In total, 14 barriers to the diffusion and adoption of green buildings in Saudi Arabia were identified (see Table 2). These identified barriers are categorized under the four previously identified broad groups: financial, governmental, cultural and market, and technical.

Table 2. Identified barriers to the diffusion and adoption of green buildings in Saudi Arabia

Group	Barrier	Identified by									
		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10
Financial	Low electricity and water prices	√		√				√		√	
	Lack of funding and support from the private sector	√	√		√		√	√		√	
	High initial cost of green technologies and systems	√	√	√						√	√
Governmental	Unsupportive government policies and regulations	√	√	√	√	√	√	√	√	√	√
	Unavailability of incentives	√	√	√	√	√			√		
	No strategy to promote green buildings	√					√	√			
	Absence of an official green building body				√				√	√	√
Cultural & market	Lack of environmental concerns		√	√						√	
	Bad after-sale services		√							√	√
	Resistance-to-change culture	√	√			√	√			√	√
	Lack of collaboration	√							√		
	Corruption			√							
Technical	Lack of skilled personnel	√	√	√	√	√	√	√	√	√	√
	Lack of information and awareness	√	√	√	√	√		√	√	√	√

The cultural and market group had five identified barriers—the most among barrier groups. The governmental group had four barriers; the financial group had three barriers; and the technical group had the least with two barriers. Among the identified barriers, all interviewees discussed two barriers: *lack of skilled personnel*, and *unsupportive government policies and regulations*. All interviewees emphasized the importance of these two barriers. On the other hand, the barrier *corruption* was discussed by only one interviewee.

4.1 Financial Barriers for Green Buildings in Saudi Arabia

A number of interviewees admitted the *high initial cost of green technologies and systems* used in green buildings. They shared the same thoughts with regard to high cost, mainly due to importation of these equipments from other countries, which leads to higher prices compared with those of traditional equipments assembled or manufactured locally. Interviewee I1 provided the following comment during the discussion about the high initial cost of green buildings:

“In the meantime, to own a green building in Saudi Arabia, you will have to pay extra initial costs. This is due to many factors, the most important are as follows: (1) Most materials and green systems will be imported specifically for this unique project; (2) it is a first-time experience for a lot of personnel on the project; and (3) there will defiantly be a lot of corrections and redoing in all phases of project.”

The interviewee pinpoints the factors that lead to the high initial cost of green buildings in Saudi Arabia. In addition to equipment and material importation, he believes that the lack of experience in the green building field is another contributing factor.

A couple of interviewees see *low electricity and water prices* as a barrier to green building diffusion in Saudi Arabia. Numerous subsidies are given to electricity and water utilities to lower their prices for the public. Unfortunately, the majority of the public does not realize the importance of conserving electricity and water. The public generally links the low electricity and water charges with as abundance of resources and sees no need to pay more for green buildings. In addition, many do not believe there is a need to reduce consumption and save the environment. Interview I3 mentioned the following statement about low utility prices in Saudi Arabia:

“Most people see that the cost of energy in Saudi Arabia is low and thus do not lend importance to sustainability and green buildings, but, in the end, the government pays for the subsidies dedicated to low electricity prices.”

The successful diffusion of green buildings in Saudi Arabia depends on support from both public and private sectors. A number of interviewees perceived a *lack of funding and support from the private sector* in green

building development in Saudi Arabia. They specifically touched on the important role of banks in lending funds to green building projects. The extra liquidity in a new green building market will attract many people to become involved, leading to this field's development and maturity in a shorter period of time. Interviewee I2 provided the following comment on the *lack of funding and support from the private sector*:

"I think banks can help a lot in with the uprise of green buildings in Saudi Arabia. They have special departments that study the market and know how to make profits at the same time."

4.2 Governmental Barriers for Green Buildings in Saudi Arabia

Governments have leading roles in sustainable development. They can set laws and regulations related to green buildings, which usually fall under a country's plan for strategic development. All interviewees expressed their concerns about governments' current regulatory efforts relating to green buildings. All interviewees generally agreed that present policies and regulations do not support the diffusion of green buildings in Saudi Arabia and that many more need to be imposed. They believe that new policies and regulation must to be created, and these measures must also be mandatory. Some interviewees think that most top governmental officials do not understand or have knowledge of green buildings, which has led to a delay in setting policies and regulations that favor green buildings. Interviewees also added that the government should start the green building movement by converting all major government projects into green buildings. Interviewees I10 and I3 provided the following statements, respectively, with regard to *unsupportive government policies and regulations*:

"Enforcement of regulations by law is very significant for the success of government plans. If green building regulations are to be introduced, they have to be enforced by law, or they will not succeed."

"The government should take the first step in green building adoption, by making all major governmental projects, such as office buildings, universities, medical centers, hospitals, and schools, green."

To encourage people to invest in green buildings, it is necessary to make these types of buildings attractive, which can be accomplished by providing incentives to those who build green. These incentives can take many forms (e.g., an exemption from certain service fees or an allowance for extra building area). Interviewees identified the *unavailability of incentives* as a barrier for green buildings in Saudi Arabia. The existence of incentives is as important as the existence of penalties. Interviewee I5 gave the following comment on the *unavailability of incentives*:

"To my knowledge, government support for green buildings in the form of incentives does not exist; we need incentives. Subsidies for green building systems will be a good form of incentives."

To successfully implement green buildings in the long term, the government should consider green buildings and sustainability in its strategies. In the meantime, there is no clear strategy for promoting green buildings in Saudi Arabia, which seriously undercuts the success of these buildings and lengthens the time required to secure public acceptance. Interviewee I1 expressed his opinion on *no strategy to promote green buildings*:

"There is no clear strategy by any organization to promote green buildings in Saudi Arabia. Not even the current Saudi Green Building Council! Look at their online website, which is the main source of information to the public; it is empty!"

Saudi Arabia currently lacks an official body that acts as a reference for green building stakeholders. In countries with mature green building market (e.g., the United States), green building stakeholders will return to such an official body (e.g., United States Green Building Council) for accreditation and/or advice. Unfortunately, green building stakeholders do not have such a resource in Saudi Arabia; although a Saudi Green Building Council exists, it is not active in reality. According to interviewee I4, the absence of an official green building body is a barrier to the Saudi green building market:

"We have big companies that are currently working on constructing green buildings without getting approval or advice from the Saudi Green Building Council."

4.3 Cultural and Market Barriers for Green Buildings in Saudi Arabia

Unfortunately, environmental pollution is not an important subject to the majority of the public in Saudi Arabia. People tend to throw all types of waste on land and in the sea without thinking of the negative impact on their natural environment. Indeed, there is a lack of concern on environment in Saudi Arabia. This represent a barrier toward green building implementation as the majority have no interest on reducing the load held on environmental resources. Interviewee I3 provided the following comment on the *lack of environmental concerns*:

"Of course the subject of environmental impact is very important. We are now polluting the Kingdom's environment, and we have to lower the level of pollution. Unfortunately, our environment doesn't receive any

attention from us. The Red Sea coral reefs are being destroyed by us.”

As with any other tool, green building technologies and systems require service and maintenance. In the case of Saudi Arabia, the market for these products is still new, and all of these technologies and systems are being imported from other countries with no local experience on how to maintain them. Without true commitment to customers or the environment, many companies are trying to get in the green building business to make quick profits. Thus, according to interviewee I2, *bad after-sale services* for green building technologies and systems appear to be a barrier for green building diffusion:

“Operation and maintenance are essential for green building technologies. Many companies come and display their green products. When we ask them how the maintenance is, they simply answer, ‘Just like any other device’. Clearly, they just want to sell their products, make a profit, and disappear.”

People in Saudi Arabia are accustomed to building in a certain way, and introducing new types of materials, technologies and systems will not be directly accepted. Resistance to change is considered to be part of Saudi culture, but there could be gradual acceptance over time through the proven results of green buildings. Interviewee I5 identified *resistance-to-change culture* as a barrier:

“Generally speaking, people find it difficult to accept change. The number of certified green buildings in Saudi Arabia is very low and will continue to be low until green buildings are proven effective or enforced by law.”

Collaboration and knowledge sharing among field professionals and top officials are significant for the market development of green buildings. Such collaboration enables professional personnel to pass on information, discuss updates, solve issues, and share best practices with regard to green buildings. Therefore, collaboration can accelerate the process of green building maturity in Saudi Arabia. In contrast, lack of collaboration limits access to green building information and thus acts as a barrier to green building diffusion. Interviewee I1 states that collaboration between green building professionals does not occur in Saudi Arabia:

“It seems that there is no collaboration between the few green building professionals in Saudi Arabia. Everyone is working on his own trying to get the most credit.”

Corruption is a serious barrier to green building diffusion in Saudi Arabia. People who would like to maintain the status quo and stop development in the building sector will use their authority to suspend the development of green buildings in Saudi Arabia, specifically through building regulations and laws. Sadly, corruption is apparent, and its main causes are connections and bribery. The Saudi government has acknowledged the existence of corruption, which led to the establishment of the National Anti-Corruption Commission in 2011. Interviewee I3 identified *corruption* as a barrier to green building diffusion:

“When the Ministry of Finance applied value engineering some government bodies applied it and trained their staffs on it, while others didn’t do anything. No one came from the Ministry of Finance and followed up with the decision.”

4.4 Technical Barriers for Green Buildings in Saudi Arabia

The availability of skilled green building personnel is important for these buildings’ acceptance in Saudi Arabia. They play an important role in the design, construction, operation and maintenance of green buildings as well as the education of others. In the meantime, the number of green building professionals in Saudi Arabia is too low for a green building evolution. All interviewees agreed that there is a *lack of skilled personnel* in the country, which is a barrier that must be tackled promptly. Interviewee I4 gave the following statement about the *lack of skilled personnel*:

“We do not have the sufficient numbers of specialized personnel in green buildings in the private or public sector.”

Information on green buildings is important for decision making. People need to have access to reliable information sources to learn the benefits of green buildings and understand their objectives. Moreover, information will assist them in financial analysis decisions (e.g., payback for a green technology). Once information is available to the public, green building awareness will increase. In Saudi Arabia, the majority of the public does not know what a green building is. Awareness and education are vital at this initial stage of development. Unfortunately, Saudi Arabia does not have a national information source on green buildings. Anyone who wants to learn about green buildings must search for available online resources from other countries. In general, the interviewees agree that the concept of green building in Saudi Arabia is new and is unknown to many; even if someone has heard of green buildings, he or she will not be able to know exactly what they are. Interviewee I9 provided the following comment about the *lack of information and awareness*.

“There is no sufficient data out there on green buildings and its systems for the public to review and study.”

5. Discussion and Recommendations

The interview results show that a number of barriers exist pertaining to the diffusion and adoption of green buildings in Saudi Arabia. Now that these barriers have been identified, they must be studied to eliminate them or at least reduce their negative impact by setting suitable strategies. Although green buildings are popular in many countries, Saudi Arabia still lags behind these countries. The interviews conducted for the purpose of this research showed that there are 14 barriers to green building implementation in Saudi Arabia. The interviewees identified a wide range of barriers, and most of these barriers were categorized under the culture and market group, followed by governmental group, the financial group and then the technical group. In general, the discussions indicated that the green building market in Saudi Arabia is still immature. The majority of the public, government officials, and practitioners in the construction and building fields are still unaware of green buildings. The following recommendations can assist in overcoming the identified barriers (see Table 3):

- Recommendation 1 (R1) - Raise awareness on green buildings and the environment in schools, universities, and business events
- Recommendation 2 (R2) - Convert government building projects into green buildings
- Recommendation 3 (R3) - Review electricity and water subsidies
- Recommendation 4 (R4) - Set government regulations, incentives, and strategies in favor of green buildings
- Recommendation 5 (R5) - Share success experiences related to green buildings over social media
- Recommendation 6 (R6) - Encourage green building research
- Recommendation 7 (R7) – Establish an official green building body

Table 3. Recommendations corresponding to identified barriers

Barrier	Recommendation						
	R1	R2	R3	R4	R5	R6	R7
Low electricity and water prices			√			√	
Lack of funding and support from the private sector				√		√	√
High initial cost of green technologies and systems				√		√	
Unsupportive government policies and regulations		√	√	√		√	
Unavailability of incentives			√	√		√	
No strategy to promote green buildings		√	√	√		√	
Absence of an official green building body						√	√
Lack of environmental concerns	√					√	√
Bad after-sale services						√	
Resistance-to-change culture		√		√		√	√
Lack of collaboration	√				√	√	√
Corruption						√	
Lack of skilled personnel	√			√		√	√
Lack of information and awareness	√			√	√	√	√

Introducing the concepts of green buildings, environmental protection, global warming, and sustainability in schools and university curricula can raise awareness. Furthermore, conferences and exhibitions on green buildings will assist in raising public awareness and awareness among field practitioners. These awareness-raising measures will help create a society for green building enthusiasts and provide the opportunity for collaboration and knowledge sharing. Resistance to change is very obvious in the market and requires government intervention, which includes taking the lead in constructing new green buildings and introducing new green building regulations (e.g., penalties and incentives). Large government projects primarily propel the Saudi building sector; converting these government projects into green projects will thus have a positive impact on the built environment. Moreover, electricity and water subsidies should be reviewed to ensure that these prices remain affordable for the public and encouraging to conservation. The revision should be made in favor of green building systems and technologies to make their prices more feasible when considering their lifecycle savings. The government should set up regulations, incentives, and strategy plans that focus on green buildings and sustainability to clarify the future outlook. By setting up such regulations, incentives, and strategy plans, the government will give the public more confidence in investing in this new green concept, which will help

promote green buildings in Saudi Arabia's public sector and, in turn, the private sector. Moreover, because Saudi society depends on word of mouth, social media channels can help reduce this resistance to change, especially when people start to share successful experiences with green buildings and their realized benefits. The usefulness of social media channels lies in the fact that text, pictures, voice memos, and videos relating to green building practices can be shared very quickly. Green building research must focus on studying the benefits of green buildings and expand on these buildings' positive applications in Saudi Arabia. Furthermore, green building research must also look into solving issues associated with green buildings in the environment of Saudi Arabia. The government should fund the initial stage of green building research through researchers and academics in universities and research institutions. The establishment of an official green building body in Saudi Arabia is an important step toward recognition of these buildings. It will act as a reference for all green building stakeholders in terms of standards and certifications. Furthermore, it can contribute significantly in raising awareness and education of the public and professional practitioners. Moreover, the green building body can assist in knowledge sharing through training workshops, seminars, and publications. The private sector can be encouraged by this body to sponsor green building events and as a result become positively engaged in the maturity of the green building industry.

6. Conclusions and Future Work

Although green buildings are being erected in many countries around the world, they do not have the same popularity in Saudi Arabia. This is observed by the absence of policies and regulations that promotes sustainability and green buildings in the country. This research investigated the barriers behind this lack of demand and acceptance of green buildings, identifying 14 barriers as the main reasons for the slow development of green buildings in Saudi Arabia. These barriers fall within four main groups: cultural and market, governmental, financial, and technical groups. Out of the 14 barriers, two seemed to be commonly agreed upon by the professional practitioners who participated in this study, these barriers are: 1. Unsupportive government policies and regulations, and 2. Lack of skilled personnel. The research touched on a number of potential recommendations that could help in overcoming these barriers and accelerate the green building development in the country.

This research qualitatively explored the barriers of green buildings in Saudi Arabia through a series of interviews with professional practitioners in the field. Different stakeholders may take part in a future study that could follow a quantitative approach. Future work may involve a wider range of participants with the aim to study in depth green building opportunities in Saudi Arabia.

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