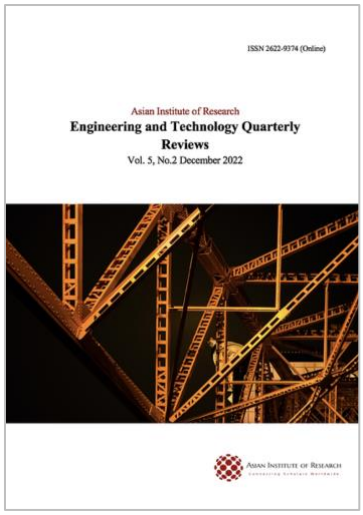

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The Major Obstacles and Factors Facing Green Building in the KSA: A Background Study

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Abstract
This research aims to highlight the obstacles to green buildings and reveal the factors that can help in reducing these obstacles. It uses a qualitative approach and collects data from previous studies. The results highlight that the literature on green buildings mentions barriers and obstacles in different categories, including financial, governmental, organizational, management, operational, technical, and socio-cultural barriers. Most of these barriers, directly and indirectly, affect the development of green buildings. To overcome these barriers, there are some important factors to be considered, including the introduction of new government rules and regulations, offering incentives to industry to encourage businesses, creating a collaborative culture among stakeholders to spread awareness and knowledge, information regarding green building, ensuring the sharing of success factors, and sharing of critical cases to add knowledge to others. Emphasis on these factors or strategies can help in the development of green buildings, which will lead to sustainable development in Saudi Arabia. Project managers can consider these results as guidelines to ensure sustainable development.

Keywords: Green buildings, Circular Carbon Economy, Saudi Arabia, Project Management

1. Introduction

Over the last few decades, sustainable development has emerged as a global trend. The world challenges like "global warming" and "energy crisis" are seen as fundamental problems that many countries face during their development journey. The International Energy Agency reported that in 2021, the energy used in buildings accounted for 30% of global final energy consumption and 27% of total energy sector emissions. Out of these emissions, 8% were direct emissions from buildings and 19% were indirect emissions resulting from the production of electricity and heat used in buildings. Both energy consumption and emissions rose to levels higher than those in 2019, after declining in 2020 due to the restrictions imposed during the Covid-19 pandemic. The World Summit of Sustainable Development (WSSD) held in Johannesburg (2002) recommends that local, national, and international authorities take serious action to promote and facilitate environmentally friendly policies and recycling services (Islam et al., 2017). The increasing deployment of fossil energy resources and concerns about pollution have put great pressure on governments to construct energy-efficient buildings. Green

buildings are an important element of sustainability and are constructed in a manner that consumes a minimum amount of natural resources, such as energy and water (Abubakar & Dano, 2020). Green buildings involve planning the construction and styling of a building in a manner that reduces or minimizes the negative environmental impact by reducing the consumption of resources and surrounding disturbances (Nain, et al. 2021). The phenomenon of green buildings aims to suggest many useful means to fulfill a wide range of global sustainability goals, such as controlling climate change, creating green and innovative localities, and pursuing overall economic progress (Balabel & Alwetaishi, 2021). Green buildings facilitate effective compliance with sustainability concerns, such as ensuring minimum water and energy consumption, improving the quality of the indoor environment, and controlling the detrimental effects of construction on the surrounding environment (Raouf & Al-Ghamdi, (2020). Green buildings bring significant improvements in human health, as they are designed to provide a healthy atmosphere inside, enhance comfort, and increase the quality of life and the indoor environment (Meena et al., 2022).

Saudi Arabia is a developing country that contributes significantly to the construction sector. According to the Statista Research Department (2022), the country's gross domestic product (GDP) generated by construction activities reaches 45.4 billion US dollars (Statista, 2022). The industrial boom is viewed as a response to the country's significant infrastructural development (Abubakar & Dano, 2020). The country has also made significant socio-economic growth, improved gender equity, education, health, increased living standards, and the implementation of eco-friendly legislation with great concern for environmental protection (Balabel & Alwetaishi, 2021). The massive construction of new roads, urban centers, and airports, and the frequent growth of the construction sector in Saudi Arabia are attracting construction experts from all over the world (Islam et al., 2017). However, many ongoing construction projects do not effectively provide customer value, as project delivery is plagued with time and cost overruns (Raouf & Al-Ghamdi, 2018) (Azeem, et al., 2017). Experienced delays and budget overruns may result in severe disputes, litigation, arbitration, and complete relinquishment, which may hamper sustainable development initiatives (Raouf & Al-Ghamdi, 2018) (Schöggl, Stumpf & Baumgartner, 2020). Moreover, many of these problems exist due to blends of certain new and incongruent improvements in ongoing project stages, such worries in managing projects met by experts and ever increased significance of the sector motivate to adopt the new technologies in the construction industry (Aljobaly & Banawi, 2019) (Al-Surf, 2021). Table 1 lists the projects registered in the LEED in the KSA.

Table 1: Total number of Projects registered and certified by LEED in KSA

Country	Rating System	No. of registered projects	Rating version	Certificate
Saudi Arabia	LEED BD + C New Construction	159	LEED 2.2 LEED 2009 LEED v4	Certified 2 Silver 7 Gold 9 Platinum 4

Source: (Yi & Yun, 2022, May)

The Circular Carbon Initiative (CCI) is a set of actions or activities performed to achieve key strategic objectives of climate protection, socioeconomic impact, and global leadership in Saudi Arabia and across the globe in broader terms. These initiatives aim to fill innovation gaps by focusing on multidisciplinary fields and providing support for progressing the Saudi government's circular carbon economy (CCE) program. CCE was first defined by Williams (2019, 2020a) in the Saudi context as an integrated and wide-ranging approach that transits towards a comprehensive, sustainable, resilient, and ecofriendly energy management system that enforces sustainable development in the country. He argued that the relations among the four key areas of CCE (e.g., reduce, recycle, reuse, and remove) are not hierarchical but are complementary in nature to reduce the effects of McDonough's concept of fugitive carbon. The concept of CCI has been further promoted in Saudi Arabia in response to climate change propaganda during 2020 by the KSA's G20 presidency, related scholarships, and circular carbon economy guides (e.g., G20 Saudi Arabia, 2020a; Williams, 2020a; van Agt, 2020). According to Williams (2020a), CCI is a systematic approach to emissions, helping to recognize national and international plug points that aim to prevent emission lanes; for example, large-scale rollout of CC(U)S. CCI presently has a weak linkage with sustainability or green concepts, but for continuous economic growth, it is necessary to decouple it from the

unsustainable use of resources. Schöggl et al. (2020) added that circular carbon initiatives largely focus on the economic and environmental pillars of sustainability but remain silent on the social dimension.

The construction of green buildings involves more complexities than traditional construction. However, the need to construct green buildings is becoming more significant in developing countries because of energy shortages and pollution (Agyekum et al., 2020), which pressurizes governments to design energy-efficient buildings. According to --- the green building is defined as, "Green buildings are considered to provide a solution to many of the infrastructural concerns impacting our ecosystem today. The green building movement, which is almost two decades old, has seen the most progressive trends and outcomes in the last few years. With the amount of awareness, knowledge, and research available on the topic, green buildings have developed as a discipline of their own." Most literature on green buildings highlights barriers that slow the adoption and implementation of green building projects. Saudi Arabia also faces many barriers to the development of green buildings. Therefore, this study aimed to review the relevant literature to identify the important barriers that delay green building adoption in Saudi Arabia. Moreover, this research also introduces helpful factors in reducing or controlling these obstacles, such as the circular carbon initiative (CCI), which may be the best solution to recent climate change issues.

2. Methodology

Every qualitative study is based on distinct/specific concepts (Duffy and Chenail, 2009). This study adopted the qualitative approach of literature review, for this purpose the study uses this method to investigate the important barriers to green building and factors to overcome these barriers for the promotion of sustainable development in the context of Saudi Arabia. The present study was based on the collection of secondary data. The secondary data are collected from the literature review, and the study considers the relevant published articles from the past 12 years (i.e., from 2010 to 2022) for this review. A search on Google Scholar using keywords such as green building, sustainable designs, construction, and Arab countries was performed on June 10, 2022, and found 66, 800 articles and books showing all keywords were found. Second, another search was performed, excluding the word Arab, and 728, 000 results were obtained. Relevant studies were selected from the search, and the present research focused on peer-reviewed journal articles based on green building and sustainable construction design.

3. Results

The notion of green buildings is defined as a "whole system" approach undertaken to design and construct efficient buildings that preserve resources such as water, energy, and materials, and, also, are comfortable, healthier, and safe (Al-Surf, 2021). Research on green buildings has gained considerable attention over the last two decades. Between 2000 and 2010, research showed a growing trend, and years later, it gained momentum. Many studies have explored the concept of green buildings and reviewed the factors that increase the acceptance of green buildings. Zuo and Zhao (2014) conducted a systematic review of the green building literature and found few research streams. The authors organized the existing studies into three key types: studies discussing the definition and scope, narrating the benefits of green buildings, and strategies for diffusing green buildings. However, they did not consider the context of their study when classifying their outcomes. In a subsequent review (2016), Darko and Chan covered the research gap and explained green-building studies in their country or institutional contexts. This study emphasizes important measures for developing and delivering green building projects. Zhao et al. (2019) reviewed the published literature on green buildings from 2000 to 2016 and conducted an extensive review of citations for bibliometric analysis to represent the important knowledge themes and major areas of green building research. Darko and Chan (2019) performed a scientometric review of the literature to demonstrate the current status and trends of worldwide research on green buildings. Ahmad, Aibinu, and Stephan (2019) systematically reviewed 77 research papers published in the field of green buildings until 2019. The study identified 323 factors in total, of which 69 were found to overlap; however, they were grouped into common categories to clarify the various domains of green building research.

In addition to the above reviews, few studies have specifically focused on a particular domain or area of green building research. Such as some studies highlight the benefits of green building (e.g., Darko, et al., 2018;), few focused on exploring the drivers of green building (e.g., Darko et al., 2018; Darko, Zhang, & Chan, 2017; Darko

et al., 2017; Ahn, et al., 2013), some specifically discusses the barriers or risks of green building (e.g., Nguyen & Macchion, 2022; Chan et al., 2018; Nguyen, 2017; Chan & Darko, 2017; Darko, & Chan, 2017), project delivery outcomes e.g., (Ahmad, & Aibinu, 2017; Korkmaz, Horman, & Riley, 2009)), and few suggests some critical success factors (e.g., Chen, et al., 2022; Gunduz, & Almuajebh, 2020; Sfakianaki, 2018) and some highlight the strategies to overcome the barriers (e.g., Sabbagh et al., 2019; Darko et al., 2018; Chan, Darko, & Ameyaw, 2017; Teng, et al., 2016; Hoffman & Henn, 2008). Balabel and Alwetaishi (2021) compared green buildings with traditional construction. The green building was compared with traditional construction to demonstrate the benefits and barriers to the adaptation of green buildings for sustainable construction in the future. Table 2 shows a comparison between conventional and green buildings.

Table 2: comparison of building construction between traditional and green building (Balabel & Alwetaishi, 2021)

	Material	Thickness (mm)	Conductivity (W/m K)	Total μ-value
Traditional construction				
External wall	Stones	450.00	1.32	1.4
Roof	Wood bars Mud	88.00 200.00	0.11 0.86	0.44
Ground	Stones	450.00	1.32	1.4
Green Building construction				
External wall	Concrete	200	1.32	3.1
Roof	Thermal insulation	125	0.04	0.22
Ground	Concrete foundation, clay, crushed soil	300 75 1000	0.87 0.55 0.70	0.35

Many studies have specifically highlighted barriers to green building, as Alattyih et al. (2020) grouped barriers into financial, functional, operational, environmental, and management barriers. Sabbagh et al. (2019) divided barriers into four main categories: environmental, human, organizational, and economic. Chan et al. (2018) discussed the costs, market prices, low awareness, few government incentives, lack of rules and regulations to monitor the working of green buildings, weak research and development facilities, vague green building rating systems, lack of professionals, competencies and skills, time constraints, delays, etc. The business benefits of green buildings are listed in Table 3.

Table 3: Business Benefits from Green Building Investments

Benefits	**New Green Building**		**Green Retrofit Response**	
	2020	2021	2020	2021
Decreased Operating Costs Over One Year	8%	9%	9%	9%
Decreased Operating Costs Over Five Years	15%	14%	13%	13%
Increased Building Value for Green versus Non-Green Projects (According to AEC Firms)	7%	8%	5%	7%
Increased Asset Value for Green versus Non-Green Projects (According to Owners)	5%	7%	4%	7%
Payback Time for Green Investments	8 years	8 years	7 years	6years

Source: Chan et al. (2018)

Islam et al. (2017) highlighted the barriers according to institutional and country backgrounds; for example, he argued that financial costs are more important barriers in the UK, USA, and Canada; Norway people consider capacity and lack of awareness as the most important barriers, and lack of sustainability and poor alignment between short-term and long-term goals as the most important ones. Different countries consider different barriers to be the most important. Barriers for Saudi Arabia include material costs and technological assistance from engineers and construction experts. Balasubramanian and Shukla (2017) categorized barriers into internal and external factors for organizations. Azeem et al. (2017) listed many barriers to green buildings in Saudi Arabia, such as high financial costs, few green building case studies, minimal customer support and expert opinion, lack of knowledge and awareness of green buildings, and low market demand for green buildings.

Mosly (2015) identifies financial, governmental, and technical barriers. Zuo and YuZhao (2014) demonstrated technical, managerial, and behavioral barriers to implementing green buildings. Al-Yami and Price (2006) viewed the lack of awareness, information, government support, vague policies and regulations for green buildings, and unavailability of local sustainable material equipment and appliances as major barriers to green construction in Saudi Arabia. Lack of knowledge and expertise in the field, complexity of rules and regulations, lower market demand, and acceptance of green buildings significantly contribute to the sustainable development of green buildings. Darko and Chan (2016) also identified many barriers such as high-risk uncertainty, insufficient resources, high complexity and technicality, minimum governmental support, and high costs. Similarly, the vast majority of literature also suggests some strategies to overcome barriers, such as introducing government incentives, revising rules and regulations, communicating the need for green buildings, introducing low-cost communities, introducing green building rating systems, and developing guidelines for developing green buildings (Azeem, et al., 2017; Zuo & YuZhao, 2014; Wirahadikusumah, & Ario, 2015; Mosly, I. 2015; Darko, 2016; Al-Yami, & Price, 2006). Hoffman and Henn (2008) proposed seven strategies to control social barriers facing the green-building movement: issue framing, targeting the right demographic, education, structural, and incentive change, indemnifying risk, green-building standard improvements, and tax reform. Sabbagh et al. (2019) proposed five strategies to respond to the issues raised by building professionals: issue-framing a supportive environment, good education to support sustainability, offering incentives to builders and professionals, and green building standards.

3.1 Major barriers to green building

The vast literature suggests substantial barriers to the progress, implementation, and adoption of sustainability and green building, which vary across businesses, industries, and countries. (Islam et al., 2017). The significant literature in the context of developing countries such as Saudi Arabia shows the important barriers to green building, and the governmental responses policies to overcome these barriers are given in Table 4 below:

Table 4: Obstacles to green building.

Sr #	**Study**	**Obstacle**
01	Risk factors impacting the project value created by green buildings in Saudi Arabia. Alattyih, Haider, & Boussabaine, (2020).	● Financial: higher costs, few funding options ● Functional: complexity and irregularity issues ● Operational: lack of expertise and, skill, knowledge and competencies ● Environmental: higher pollution, depletion of natural resources ● Management: effective communication, spread of available information collaborations among stakeholders.
02	Grease the Green Wheels: A Framework for Expediting the Green Building Movement in the Arab World. (Sabbagh et al., 2019)	● Environmental: Pollution, emission, energy, and water shortage ● Human: includes social factors covering all stakeholders, their preferences, formal and non-formal education, competence to design green building, awareness about green building. Public awareness. ● Organizational: differences in stakeholder preferences and perspectives about greening the new buildings. ● Economical: financial costs are 17% more higher than conventional buildings
03	Critical barriers to green building technologies adoption in developing countries: The case of Ghana. Chan, et al., (2018).	● Higher costs of green building technologies, and databases ● High market prices of green material, longer payback period ● Few Information and awareness about the benefits of green building. ● Minimum government incentives, regulations, and controls ● Lack of research and development facilities and local institutions

		● Absence of green building rating system ● Lack of knowledge of construction professionals about green building ● High distrust and conflicts between stakeholders ● Time constraints and delays ● Complexity and rigidity in adopting green buildings ● Lack of competencies and trainings
04	Aspects of sustainable procurement practices by public and private organizations in Saudi Arabia: an empirical study Islam, et al., (2017).	● Financial High perceived sustainability costs and financial difficulties (UK) ● Capacity Lack of awareness (Malaysia) ● vague plans and policies for sustainability implementation UN ● Lack of sustainability knowledge (Norway) ● Unaligned short term and long-term goals (Norway) ● Lack of training, skills and competencies, effective leadership and needed management support. ● Lack of suppliers providing sustainability material. Minimum transparency, decentralized structures, delays, conflicts, poor quality of sustainable goods, minimal government and political support, improper guidelines.
05	Green supply chain management: the case of the construction sector in the United Arab Emirates (UAE). Balasubramanian, S., & Shukla, V. (2017).	● External barriers: Few green professionals, few green material suppliers, time constraints, lack of and collaboration among stakeholders ● Internal barriers: few knowledge and information about green building practices
06	Examining barriers and measures to promote the adoption of green building practices in Pakistan Azeem, et al., (2017).	● Higher costs and longer payback period, limited funding opportunities ● Few governmental incentive, regulations, and controls ● Few Green building cases and high ambiguity about its benefits ● Higher functioning, operating, management costs ● Minimum customer support ● Lack of expertise and deficient professional knowledge about green buildings ● Low demand for green building ● Lack of reliability about implementing new technologies ● Weaker organizational structure, and support
07	Barriers to the diffusion and adoption of green buildings in Saudi Arabia. Mosly, I. (2015).	● Financial: perceived: higher costs of relevant technologies and construction, material prices, funding budget and financial constraints ● Governmental obstacles include absence of rules and regulation for energy efficiency, weak governmental control, lack of incentives to construct the green buildings, low electricity and water prices
08	Green building research current status and future agenda: A review (Zuo & YuZhao, 2014)	● Technical: lack of infrastructure, cost, operations, and maintenance of green building ● Managerial: organizational and procedural issues, lack of managerial support ● Behavioral and cultural issues
09	Review of Barriers to Green Building Adoption (Darko, & Chan, 2016).	● Lack of Education, Information, Knowledge, Expertise, Research, and awareness ● Too higher costs ● Lack of regulations and authority ● Minimum governmental support and few incentives ● Low market demand and customer interest ● High risk and uncertainty ● Lack of collaboration and trust among stakeholders ● High complexities and technicality ● Few resources

		● High resistance to change

3.2 Factors promoting the green buildings and sustainability

Many studies have also discussed responding policies to respective institutions, sectors, and governments to overcome the rising obstacles in the adoption of sustainable building concepts. A few studies are listed in Table 2 to highlight ways to control the barriers that delay the adoption of green buildings, particularly in the context of developing countries such as Saudi Arabia. Existing literature suggests that governments opt for many policies to improve the perception and acceptance of green buildings in their countries. Table 5 presents the factors that promote sustainable development in green buildings within the KSA.

Table 5: Factors reducing obstacles in green buildings and promoting sustainable development.

Sr #	**Study**	**Factors reducing obstacles in green buildings and promoting sustainable development**
01	Grease the Green Wheels: A Framework for Expediting the Green Building Movement in the Arab World. (Sabbagh et al., 2019)	● Government's financial incentives green building like provision of subsidize building material, availability of cheaper energy. ● Spreading the awareness about the need of green buildings among the communities and educate them about its positive role in increasing the quality of life and surrounding environment for Arab citizens. This public education can be given at two levels e.g., formal education for professionals in construction industry and secondly, the religious institutions should also take an active prat in spreading the awareness about the need of green building in local communities. ● Need to plan for smart gridding system, introducing the lower carbon generating societies, planning to design and regulate green transport system, introducing the central air conditioning system in each city. Planning walkable cities with streets. ● Need to introduce green building standards or rating system. Many serious efforts are being done in Qatar and UAE to adopt this system. The renowned examples of rating system for green buildings are LEED and BREEM.
02	Applying the self-determination theory (SDT) to explain the levels of motivation for adopting green building. Olanipekun, A. O., Chan, A. P., Xia, B., & Adedokun, O. A. (2018).	● Economic and market factors that involves chance to earn high economic gains and greater commercial potential. ● Government factors involves the governmental polies to promote the adaptation of green building for this government may induce the firms by offering incentives or subsidies. ● Education factors are also important to spread the awareness and information about green buildings ● Corporate factors involve the motivation to adopt the green building, embedded in company's vision or mission.
03	Examining barriers and measures to promote the adoption of green building practices in Pakistan Azeem, et al., (2017).	● Introducing case studies to promote the green building practices ● Educating the new technologies as key area of training ● Implanting green building rating, codes, regulations, and assessment tools. ● Initiation of financial incentives and penalties by government ● creating public awareness through conferences, public seminars, and discussions ● putting governmental pressure on construction sector to adopt green building practices ● providing guideline for implementing green building
04	Green supply chain management: the case of the construction sector in the United Arab Emirates (UAE). Balasubramanian, S., & Shukla, V. (2017).	● External Drivers including developing and implementing governmental regulations and policies to promote green buildings, Stakeholder's pressure, Competitor's pressure ● Internal Driver includes commitment to environment, increased reputation, and brand image, to save long term costs, entering in foreign markets.
05	Barriers to the diffusion	● Spreading awareness on green building and environment at

	and adoption of green buildings in Saudi Arabia. Mosly, I. (2015).	school, universities, and business level ● Converting ingoing government projects into green buildings ● Revision of water and electricity subsidies ● Designing of new governmental rules, strategies, and incentive ● Sharing successful experiences in implementing green building practices over social media ● Encourage the implementation of green building technologies ● Forming green building bodies and societies
06	Visualized analysis of global green buildings: Development, barriers and future directions. Li, et al., (2020).	● Establishing a better social image and repute by taking necessary measures to increase green awareness among consumers, build a positive energy saving image, creating a word-of-mouth effect, hiring of qualified professionals, and striving for demonstration project ● Encourage the effective utilization renewable technologies. ● Collaborate for extensive research activities among universities and cooperation and research institute ● Implementing knowledge-based market strategies. ● Introducing government subsidies to reduce initial project costs such as subsidy of incremental cost, energy savings, on lowering transaction costs, enhance bank quota and reduce the bank approval time for loan ● Opting technology innovation as core encouraging strategies for opting the new technologies ● Facilitating the cooperation between architects and professionals ● Multi-channel financing to overcome the financial problems.
07	Review of Barriers to Green Building Adoption Darko, (2016)	● Building a strong collaborative environment between government bodies, industry association and other stakeholders that are ready to construct green buildings ● The government must introduce two main types of incentives e.g., internal and external incentives to foster the implementation of green building. ● The government must device comparable policies to motivate the stakeholders for adopting the green buildings. ● External incentive includes financial incentives that help to the businesses to cover their initial costs for adopting the green building model. ● To overcome the lack of interest problem, the government must the necessary initiative to create the demand of green buildings and develop the interest of people inn new technologies by massively advertising its benefits and creating the awareness about green building at basic level. ● To control the lack of regulation problem, the government must have to consider designing appropriate rules and regulation to be implemented to ease the green building adoption process.
08	Grease the Green Wheels: A Framework for Expediting the Green Building Movement in the Arab World. Sabbagh et al., (2019)	● Framing ● Education ● Targeting right demographic ● Changes in structures and incentives ● Control risks ● Improve green building standards ● Tax reforms.
09	Awareness, drivers, actions, and barriers of sustainable construction in Kuwait. AlSanad, (2015).	● Revision in current government standards to adopt green building ● The introduction of new green building standards must enable the stakeholders to comply with given rules. ● Private and government sector collaboration ensure the implementation of laws ● The green building adoption models help in analysis of barriers and control them to minimize the risks to extend government

		intervention at the government and business levels ● The institutions must ensure the implementation of green buildings
10	Saudi Arabia's Climate Change Policy and the Circular Carbon Economy Approach, (Shehri, 2022)	● Robust energy efficiency measures ● Energy price reforms

4. Discussion and Conclusion

A critical review of previous research in the context of developing countries, with a particular focus on Saudi Arabia, revealed the key barriers and strategies to overcome these barriers (listed in the above table). The significant literature on green buildings tended to group the identified barriers into different categories, with the most common being financial, governmental, organizational, management, operational, technical, and socio-cultural barriers. Moreover, the findings revealed several strategies to overcome these barriers by introducing new government rules and regulations, offering incentives to industry to encourage businesses, creating a collaborative culture among stakeholders to spread awareness and knowledge, information regarding green building, ensuring the sharing of success factors, and sharing of critical cases to add knowledge to others. The previous articles did not mention the launch of "Mostadam", a rating system for green buildings established by the Ministry of Housing in Saudi Arabia and managed by Sustainable Building, to promote sustainable construction and the use of eco-friendly materials and techniques. The requests for a sustainable building exceeded 380% in the first half of 2022 (NABD, 2022).

The King Abdullah Petroleum Studies and Research Center recently introduced an index to track the progress of Saudi Arabia towards a circular carbon economy (CCE). The 2021 CCE Index scores for all countries included are presented in Figure 1a, which provides a breakdown of the Performance and Enablers sub-indices. Among the 30 countries featured in the index, the GCC countries were ranked between twelfth and twenty-seventh, with the UAE achieving the highest rank and Oman the lowest (Luomi et al., 2022).

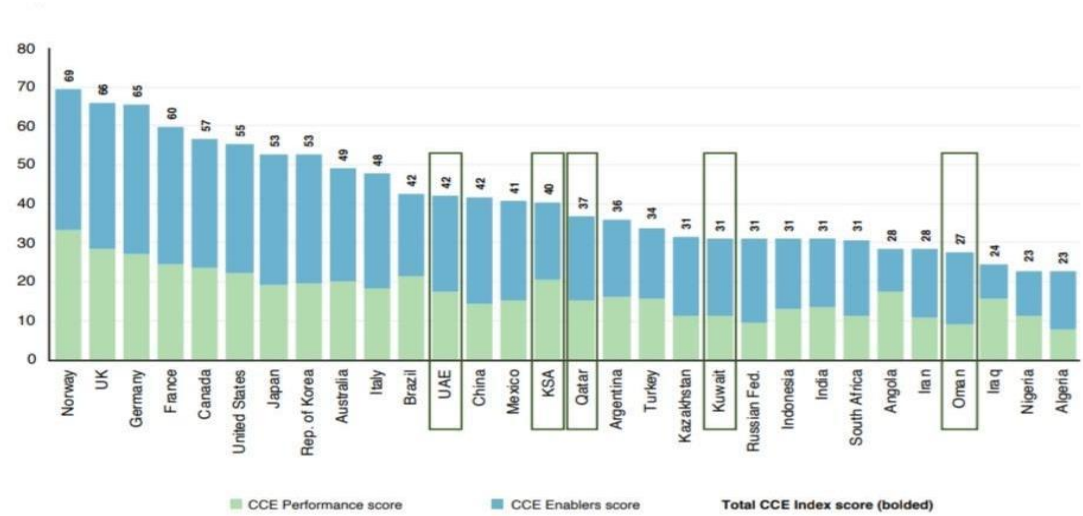

Figure1: CCE Index with the GCC countries' performance, source (Luomi et al., 2022)

The Saudi government's circular carbon initiative provides other solutions to the barriers to green building adoption, as these initiatives directly acting upon climate change ensure the reach of clean and cheap energy. All businesses are encouraged to take not only circular carbon initiatives to support the government's CCE program, but also offer different incentives for adopting environmentally friendly policies. Therefore, CCI may play an important role in eliminating key barriers to the adoption of green buildings. For this purpose, the government of Saudi Arabia has taken many initiatives in alliance with four key factors: reduction, recycling, reuse, and removal. Under the heading of reduction, the KSA launched an energy efficiency and conservation program in

2012 that covers key energy efficiency activities practiced across different sectors, including industry, buildings, and transportation, satisfying 90% of the energy demand of the country. Approximately 35 initiatives focus on capacity building, governance, public awareness, energy efficiency standards, benchmarks, and specifications (Shehri et al, 2022). Second, fuel is switched from oil to natural gas reserves to reduce the country's oil consumption for power generation by 2030. Third, there is an increased reliance on the use of nuclear and renewable energy to overcome environmental concerns. Although the Saudi government is looking for recycling solutions and possibilities for biofuel production, there is still no recycling potential in the country (IEA, 2020). Next, to build reuse capacity, the Saudi government is largely funded by research and development but still falls behind because the largest industrial city of Jubail is only partially eligible to reuse CO2, following the CCE guidelines (Shehri et al, 2022). Finally, the country is still struggling to eliminate the negative effects of carbon emissions to overcome environmental problems. Therefore, based on the initiatives taken by the Kingdom of Saudi Arabia, the study concludes by integrating green initiatives with CCI initiatives to overcome the potential barriers to the adoption of green concepts in the country, particularly green buildings. This could be the best way to encourage businesses to adopt green solutions to support the government's CCE program.

5. Implications

Sustainable development is a hot debate among project management researchers, but it is a broad concept linked to several aspects, among which the most important is the development of green buildings. Therefore, this study highlights the barriers to the development of green buildings and reveals factors that can help reduce them. It analyzed the detailed literature and gathered several pieces of literature-based evidence to highlight significant implications. Theoretically, this study mentioned all the possible barriers that can hinder the development of green buildings in Saudi Arabia. Moreover, it expands the literature on green buildings, barriers to the development of green buildings, and factors that reduce barriers to the development of green buildings. Sustainable development can be ensured by focusing on barriers and keenly working on the factors that can help reduce barriers or obstacles. Thus, this research has directed attention toward every possible barrier and factor that can reduce it. Apart from prior studies, this research is significantly different, as prior studies merely focused on highlighting the barriers or factors in reducing them. The researchers can quote the findings of this research as a reference when studying barriers to the development of green buildings and strategies for the reduction of barriers. In addition to the theoretical implications, it has also provided significant practical implications by shifting the attention of project managers and governments toward the development of green buildings without any hurdles, obstacles, or barriers. The government should spread information on the necessity of adopting sustainability measures and introducing incentives for businesses and investors to invest in green-building projects. Moreover, the need for sustainable technologies must be communicated at the school and university levels. The government must also conduct free seminars and training sessions to motivate people, particularly project managers, to focus on the development of green building models rather than traditional ones. The thrust for green initiatives must be aligned with the government's circular carbon initiatives to encourage businesses to adopt the green concept to support the government in successfully implementing its CCE program at both national and international levels. The CCI can be the best source for dealing with climate change propaganda once combined with countrywide green efforts.

Green building research in the Saudi context is in its infancy, and there is a need to conduct more studies to explore the different domains of green buildings. Another important factor behind the slow adoption of green buildings in the Saudi context is the low price of fuel and energy. As Saudi Arabia is a country with massive oil storage, people do not feel the need to move from natural to sustainable resources. Moreover, cultural and social factors are also important contributors to delays in sustainability adoption. For example, cultural rigidity prevents people from adopting new technologies and changing their ways of living. Eventually, a list of obstacles and factors should be used by other researchers in the future for further investigation and correlational studies.

6. Limitations and Recommendations

This research has significant implications and focuses on a broad area of sustainable development using green buildings; however, it has several limitations that could be considered in future studies. First, this research is

limited to the context of Saudi Arabia, and future studies can focus on any other developing or emerging country, or compare the barriers faced by project managers in developing and developed countries while developing green buildings. Second, the stance of this research is based on prior studies (i.e., previous literature), and future researchers can conduct quantitative research to examine whether the barriers mentioned in this research can actually affect the development of green buildings.

Sustainable development is a hot debate among project management researchers, but it is a broad concept linked to several aspects, among which the most important is the development of green buildings. Therefore, this study highlights the barriers to the development of green buildings and reveals factors that can help reduce them. It analyzed the detailed literature and gathered several pieces of literature-based evidence to highlight significant implications. Theoretically, this study mentioned all the possible barriers that can hinder the development of green buildings in Saudi Arabia. Moreover, it expands the literature on green buildings, barriers to the development of green buildings, and factors that reduce barriers to the development of green buildings. Sustainable development can be ensured by focusing on barriers and keenly working on the factors that can help reduce barriers or obstacles. Thus, this research has directed attention toward every possible barrier and factor that can reduce it. Apart from prior studies, this research is significantly different, as prior studies merely focused on highlighting the barriers or factors in reducing them. The researchers can quote the findings of this research as a reference when studying barriers to the development of green buildings and strategies for the reduction of barriers. In addition to the theoretical implications, it has also provided significant practical implications by shifting the attention of project managers and governments toward the development of green buildings without any hurdles, obstacles, or barriers. The government should spread information on the necessity of adopting sustainability measures and introducing incentives for businesses and investors to invest in green-building projects. Moreover, the need for sustainable technologies must be communicated at the school and university levels. The government must also conduct free seminars and training sessions to motivate people, particularly project managers, to focus on the development of green building models rather than traditional ones. The thrust for green initiatives must be aligned with the government's circular carbon initiatives to encourage businesses to adopt the green concept to support the government in successfully implementing its CCE program at both national and international levels. The CCI can be the best source for dealing with climate change propaganda once combined with countrywide green efforts.

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