Al-Azhar University Civil Engineering Research Magazine (CERM)
Vol. (43) No . (3) July . 2021

Barriers to environmental sustainability of construction projects.

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الملخص العربي:

تكتسب المفاهيم الخضراء شعبية، مما يشجع قطاع البناء على زيادة التزامه بالتنمية المستدامة. لا يزال اعتماد هذه التقنيات يواجه تحديات على الرغم من الترويج لتقنيات المباني الخضراء. بالإضافة إلى تحديد العقبات الرئيسية التي تحول دون اعتماد مبادئ المباني الخضراء، يهدف هذا البحث إلى دراسة واكتساب فهم أفضل للمخاطر المرتبطة بتطوير مشاريع البناء المستدام. تم مراجعة شاملة للأدبيات وتوزيع استبيانات على 129 من خبراء البناء، وتم اكتشاف 48 من عوامل الخطر وتصنيفها إلى ست فئات. تم اعتبار 29 عامل للمخاطر على أنها بالغة الأهمية في تحليل المخاطر. والمخاطر الخمسة الأكثر أهمية هي كما يلي: قوانين البناء واللوائح الخاصة يجب أن تواكب الاتجاه نحو البناء الأخضر والاستدامة. نقص في التعليم والمهارات. هناك غياب أو نقص في المناهج التعليمية التي تساعد الخريجين في فهم الاستدامة والبناء الأخضر. من الصعب العثور على محترفين مهرة أو خبراء في مجال البيئة. يرجع انخفاض الاستثمار في البناء الأخضر إلى نقص الطلب من سوق البناء المحلي.
علاوة على ذلك، يبدو أن انخفاض الاستثمار بسبب نقص الطلب هو أكبر نلك العوائق الخمسة لتبني المباني الخضراء، خاصة في منطقة الخليج العربي. ساهمت الدراسة الحالية في تكوين الجسم المعرفي الحالي. ستفيد هذه النتائج صانعي السياسات والممارسين في الصناعة في اتخاذ خطوات ملموسة للتغلب على هذه الحواجز وتعزيز البناء المستدام. لمزيد من الدراسات المستقبلية المطلوبة للتنمية المستدامة لمشاريع البناء. يوصى بشدة بإجراء دراسات مفصلة في مجال تحديد الحلول لتلك المخاطر الحرجة، ويوصى أيضا بإجراء دراسات تفصيلية باستخدام نماذج BIM لتحديد مسؤوليات جميع أطراف البناء، وقد تساهم في تحسين مراحل التقييم ويمكن أن تساعد في تلبية مطالب مستدامة.

ABSTRACT.

Green concepts are gaining popularity, which encourages the building sector to increase its commitment to sustainable development. The adoption of these technologies still faces challenges despite the promotion of green building technologies. In addition to identifying key obstacles to the adoption of green building principles, this research aims at studying and gaining a better understanding of the risks associated with the development of sustainable construction projects. A comprehensive literature review and questionnaires were distributed to 129 construction experts. 48 risk factors were discovered and classified into six categories. 29 risk variables were considered as critical in the ranking analysis. These are all the five main

risk factors: Building codes and special regulations must keep up with the trend toward green construction and sustainability. a lack of education and skills. There is an absence or a lack of an educational curriculum that assists graduates in understanding sustainability and green. It is difficult to find skilled or expert green professionals. Low green investment is due to a lack of demand in the local construction market. Furthermore, low investment due to lack of demand appears to be one of the top five green adoption obstacles, especially in the Gulf regions. The current study contributed to the formation of the existing body of knowledge. Such findings will benefit policymakers and industry practitioners in taking concrete steps to overcome those barriers and promote sustainable construction projects. Further studies are required for the sustainable development of construction projects. It is highly recommended to conduct detailed studies in the field of determining the solutions to those critical risks, and detailed studies utilizing BIM models to determine the responsibilities of all building parties are strongly recommended. They may contribute to improving the assessment phases and can help meet the demands of sustainability.

KEY WORDS:

Sustainability; Green initiatives; Risk identification; Construction; Barriers.

INTRODUCTION

Building contributes significantly to the global economy and the expanding industry [1], [2] and [3]. The building industry, on the other hand, is widely known to have a serious effect on the natural environment [4], [5], [6] and [7]. Construction has a negative influence on the environment. About 70% of the energy created and 17% of the water resources are consumed. Natural resources are utilized, materials disposed of in places of waste are generated at approximately 50% and CO2 emissions are produced at around 35%. [4], [8], [9] and [10]. The environmental consequences of buildings are growing and significant, since buildings produce a high quantity of CO2 and require a huge amount of energy and resources [12] [13]. Their influence on buildings is rising. It would appear that the green building revolution mitigates these impacts and improves buildings [14], [15], [1], and [16]. Emphasizing sustainability in the construction industry typically does not have a significant negative impact on the environment [2] and [(17). Sustainable construction, which considers the environment and is more concerned about climate change, is being created globally as an alternative to traditional buildings [18]. In the construction business, green buildings are becoming more popular [19]. With the rise in use of materials, energy, increased consumption and other issues, people have been looking for sustainable construction [20], [2], [21] [1].

The movement towards sustainable building projects is steadily on the rise and political leaders in certain countries promote sustainable building projects to protect resources and the environment [2] and [22]. Sustainability is based on three pillars: the environment, the

economy, and social well-being [23] as well as [3]. The main elements are greenhouse gases and climate change. In order to accomplish the objective of sustainability, these key aspects need to be met, and sustainable growth needs to guarantee that these three aspects remain stable and equitable [3]. For that reason, buildings may be specified in the form of green buildings [5], [24] and [25] in an efficient manner, utilizing the principles of environmental utilization. It refers to the quality and characteristics of the current structure established on the basis of sustainable building principles and methodologies [4].

In the previous three decades, [26] and [5,] green construction initiatives have grown. However, these structures consist of a number of components [5], [27], and [28], and [29], including products and materials. The world today demands sustainable practices in all areas, including the most resource-intensive industries [30]. During the construction process, several risks arise [31]. Sustainable techniques need to be developed [32]. Sustainable building practices are focused on the implementation of modern technology that requires people and materials [3]. The most serious barriers to the implementation of this form of construction are [6], [20], [33], [34] and [35] Sustainable building is totally different from traditional construction. Consequently, it needs new ways of thinking, and more collaboration between stakeholders [36], [37] and [7]. Sustainable development objectives address wide-ranging issues such as climate change, conservation of energy, and clean air and water. Although these broad aims are not simple to fulfill, green building experts might find it difficult to avoid uncertainties and risks [8] and [38]. Despite the considerable focus on green construction opportunities, the risks of these projects [9] and [39] have received little attention. In order to accomplish their project objectives, investors, contractors, suppliers, and other stakeholders dealing with green projects should be aware of their proposed risks and of their measures against the possible negative outcomes of these risks [5], [40], and [28].

Risk management in a construction project emerges as a consequence of numerous stakeholder sources of uncertainty, both positive and negative, as a result of project changes [10]. As a technique for the building industry to reduce costs and time, risk management is employed. However, despite the fact that many projects fail to meet their goals [41], the construction sector has a bad reputation for handling these risks. The potential risks and measures to avoid difficulties in the future of the project [42] and [43] consequently need to be recognized. Moreover, there is a lack of research into the identification and implementation of green projects [1] of the risks involved with sustainable management of buildings. This provides a pathway for further investigation. To study the differences between present and contemporary philosophy. This work could therefore contribute to the present understanding.

LITERATURE REVIEW

There is a considerable amount of literature on risk management and sustainability. Construction industry experts in the sector have not gained proficiency in risk management because they do not have access to relevant information to comprehend and identify risks connected to applying sustainability to building operations and products [12]. In construction, a number of risk evaluations are conducted using previous experience [19]. Literature, theories, and methods are in short supply, and that causes literature, theories, and practices to be undervalued [11]. Green attributes and features, including efficient use of natural resources, preserving the environment, reducing waste, encouraging the use of environmentally friendly materials, and reducing life-cycle costs, are still inadequately covered by specifications, standards, and laws [44]. Standardization and promotion of sustainability through regulations and policies are both vital to advancing sustainability as a priority aim [47] There are a wide variety of optional green standards that are now available [12]. There are a wide variety of optional green standards that are now available [12].

Despite many attempts to achieve sustainability goals, there are drawbacks, as well as barriers to successful green initiatives. Several nations have implemented ecological scenarios based on varied priorities and legal constraints, and this is just the beginning. Most of the literature on risk and sustainable building projects notes that there are risks, but it isn't as simple as this though, because experience and execution differ from theory 19]. Gaps have emerged in risk identification and building procedures, in particular. A significant number of risk management studies have been done in different nations [19]. Because this research is being performed in the Gulf region, with Qatar as the case study, it is essential to identify the most often encountered barriers within that region, to have a deeper understanding of them, and to analyses the key obstacles. The decade of prosperity and increasing oil production witnessed a major increase in building activity in the Arabian Peninsula region [52], [53], [54], and [55]. However, it is a significant source of carbon dioxide emissions per capita [56] and [53]. It has been observed that during the previous several years, they have all examined environmental regulations in order to aid the sustainable building industry [57] and [58].

The Gulf states confront a range of construction supply difficulties, which constrain local industry and imports from other countries, resulting in a high-cost enterprise filled with risk due to currency fluctuations [59], [34], and [28]. As a result, [55] studies the implementation of sustainability in Oman's construction sector and finds certain challenges. Numerous obstacles exist, including lower cost effectiveness than anticipated, schedule delays, restricted access to renewable resources, and a lack of knowledge and education. The government has taken measures to strengthen the Scientific Committee's authority through increased funding and other incentives, but further assistance is required. [28], stated, "There has been a major change in the direction of sustainable construction initiatives in (UAE). Green building entails

greater risk than traditional construction. According to his study, the five most significant obstacles in sustainable construction are a lack of client funds, insufficient or inaccurate sustainable design data, design changes, an unrealistically short timeframe for sustainable building, and a poor scope definition. and also stated that risk evaluation is a critical component of project risk management because it permits the appropriate planning and monitoring of risk responses [28].

Saudi Arabia, on the other hand, notes that while building rules for materials and procedures are already in place, renewable energy buildings are still a relatively recent development in the industry [60]. There is now no widespread awareness of the ideas of energy-efficient housing and low-energy building. The research reveals the following: In the Saudi building sector, sustainability has not yet gotten the recognition it needs. Sustainable approach is found to be strongly correlated with academic performance and work experience [60]. Qatar has a broad resource base that includes both non-renewable (gas and oil) and renewable energy sources. The land and marine ecosystems are the bedrock of Qatar's distinct culture and history, which include pearl diving, falconry, and truffle hunting. Additionally, because of the hostile climate, specifically modified species can be employed for advanced biotechnology [53]. Nonetheless, the present population growth, along with an increasing economy, has increased pressure on all aspects of the country's environmental and historical resources [53]. The transition facilitated by sustainable growth will considerably increase manufacturing production through technological advancements consistent with urban expansion [61], [57], [59], and [62]. Pursuing environmental sustainability in Qatar is complicated by the country's strong reliance on non-renewable energy sources and its growing industrial population [53], [57], and [52]. However, given the country's limitless desire, several opportunities for industrial expansion exist. It fundamentally requires a great deal of leadership; which Qatar delivers [53].

Qatar is suffering from a building material scarcity, which has forced the country to import resources from other nations [15] and [57]. Qatar has had significant economic development during the last decade, notably in building and transportation infrastructure. The Qatar Green Building Council is founded on three pillars, one of which is sustainable development, which is a stated aim of Qatar's National Vision 2030. Promote long-term, strategic, and cost-effective expansion. Encouraging the creation, promotion, and application of concepts for green construction and sustainable practices might help establish a culture of green buildings and sustainability in the country, as well as educate citizens about sustainable development (QGBC, Qatar Green Building Council, 2019). In addition to the aforementioned difficulties, Qatar has a severe shortage of construction supplies. Qatar has been subject to a diplomatic embargo since 2017, imposed by many of its strong Arab neighbors in response to the Arab Gulf diplomatic crisis. Additionally, Qatar Airways' borders and ports with Saudi Arabia, the United Arab Emirates, Bahrain, and Egypt have been closed, prohibiting Qatar Airways from

flying through those nations (BBC.com,2017, Qatar crisis: Saudi Arabia and allies restore diplomatic ties with emirate). And, in order for FIFA to certify the World Cup preparations for 2022, Qatar has been forced to discover new suppliers of building materials in order to meet new construction requirements and regulations (BBC.com, 2017). All of this demonstrates why Qatari businesses are an excellent candidate for doing research into the sustainability concerns associated with the construction sector. Additionally, discover how Qatari businesses approach risk and sustainability management.

OBJECTIVE OF RESEARCH

This study aims to examine the construction environment by determining and evaluating possible risk factors related to green construction projects in the Gulf region, with an emphasis on the State of Qatar, and to categorize these threats based on their significance and roots, as well as to allocate risks based on construction parties' responsibilities. This study will also benefit industry professionals since it presents a comprehensive list of essential factors that may assist construction parties in improving the adoption of green building projects. This study will focus on the identification of risks related to the adoption of green-built projects.

METHODOLOGY:

After a comprehensive review of the current literature on green building barriers, several factors were recognized which have the potential to stand against the adoption of green buildings in Qatar. The following parts of this research will include these risk factors.

Identification of risk factors associated with green buildings adoption.

The first step in the comprehensive concept was to describe, identify, and comprehend the risks in literature reviews for sustainable development projects. This included scientific articles, essays, and publications that addressed challenges and risks associated with sustainable construction projects. These risks were gathered from several sources [47] as cited in (Rawlinson, 1988); suggests that well-chosen variables be used to allow respondents to respond effectively. Due to most of this research being cited or reported, data on a broad spectrum of variables has been collected in different situations, geographies and contexts. We need to choose and concentrate on our aim of studying. The second step was to determine the obstacles to sustainable development in Qatar. Based on a careful analysis of studies, 48 possible obstacles to the use of green construction as set out in the table below were found. This is a list of variables which are well known and thus more relevant to the Qatar construction market. The 48 risks identified in the study are more significant and represent most of the risks that could exist in Qatar's sustainable construction projects.

Classification of risks into six categories.

The 48 risk categories were divided into six different categories based on the origin of risk factors, with the first being stakeholders and management-related risk factors (RF-S), the second being regulations and standards-related risk factors (RF-R), the third being technical risk factors (RF-T), and the fourth being financial risk variables (RF-F), risk factors associated

with design concerns (RF-D). Finally, the last category of risk factors relating to materials and supplies was labeled as (RF-M). The following table (1) would provide additional information to aid in the display and comprehension of the data. The risk factors described in the tables therefore serve as barriers to green and sustainable initiatives. All risk factors associated with categories were labeled and coded, such as the first category of risk factors associated with stakeholders and management as identified in S01, S02, and so on, and R01, R02, and so on, to the second category of regulations, etc., that facilitate usage and support perceptions.

Ques	**Risk factors relating to stakeholder and management. (RF-S)**	**References**
S01	Believe that green construction is not important.	[63], [38],[41].
S02	Resistance to change in current practice.	[2], [63], [64], [41], [65], [28]
S03	No culture for green construction between construction stakeholders.	[2], [63], [64], [41], [66], [28], [67].
S04	Unfamiliarity with waste management system or specifications.	[4], [66], [28], [2], [51], [67].
S05	Size of project or maturity of Contracting or consulting	[1], [28], [2].
S06	Unfamiliarity with the new green products or technologies.	[2], [63], [64], [41], [66], [28], [67].
S07	Resistance from the clients to adopt new green ideas.	[2], [63], [64], [41], [65], [28]
S08	Poor scope definition or understanding of green or sustainability.	[28], [68], [69], [70], [30],
S09	Fears of new changes.	[69] , [71], [1], [4], [66].
S10	Difficulty for finding experienced or expertise workers to green projects.	[4], [68], [64], [72], [41], [65], [28].
S11	Concerns of the high cost of investing in green construction.	[73], [24], [74], [72], [75], [66].
S12	Lack of awareness and training.	[17], [76], [77], [2], [74].[26], [16], [78], [79], [64], [55], [63], [51], [28].
S13	Difficulty persuading employees to change to what is new.	[66], [2], [1], [28].

Ques	**Risk factors relating to regulations and standards (RF.R)**	**References**
R01	Absence or lack of educational curricula that help to understand sustainability and green for graduates.	[1], [41], [77], [58], [2].
R02	Lack of promotion for sustainable projects.	[80], [81], [82], [55].
R03	Lack of initiative by the government/ private bodies.	[55], [1], [28], [58].
R04	No local green certification available or the difficulty for obtaining them.	[49], [30], [39].
R05	Lack of pressure from the government in the direction of green construction.	[30], [66],[38], [49], [63].
R06	Improper or shortage or incomplete specifications for green and sustainability.	[5], [24], [83], [28], [2], [51].
R07	Lack of local documents and information about green technologies.	[51], [77], [1], [28].
R08	Building codes and special regulations need to keep pace with the new in green building and sustainability.	[28], [62], [77], [41].
R09	Lack of strategies for promoting sustainable construction.	[80], [81], [82], [55].

Ques	**Risk factors relating to technical issues. (RF-T)**	**References**
T01	Fears about probability of failure to meet green code or certification requirements.	[66], [28], [39], [51].
T02	Lack of government approvals for green construction.	[28], [75], [49], [39].
T03	lack of searching for local green alternatives materials or products that support sustainability.	[34], [84], [85], [86]
T04	Lack of encouraged local models that can be considered.	[49], [45], [66], [87], [88], [20], [89]

T05	Lack of local database and information relating to green and sustainable products.	[90], [91], [25], [92], [93], [2].
T06	Lack of local measurement for carbon footprint of each green product.	[90], [91], [25], [92], [93], [2], [94]
T07	Lack of local updated evaluation for Suppliers of green.	[90], [91], [25], [92], [93], [2], [95], [66], [96]
T08	Fears of probability of increasing documentation that required or Extensive Pre-contract planning for sustainable projects.	[97], [98], [28], [26], [99], [5], [100]
Ques	**Risk factors relating to financial and external issues (RF-F)**	**References**
F01	Believe that cost of green construction will be more.	[70], [90], [4], [86], [66], [97], [89], [101], [102], [42]
F02	Inflation in prices of green materials and products.	[77], [103], [104], [28], [97], [52], [100]
F03	Fears about probability of additional costs due to using of green materials or products.	[77], [103], [104], [28], [97], [52], [105] , [100]
F04	Politics and economic crisis affecting the importing of green materials and prices.	[87], [89], [96], [106], [28], [97], [52]
F05	Low investment in green due to the lack of demand from the local construction market.	[88], [90], [28], [97], [52], [66], [17], [76], [39], [77], [2], [74].[26], [16], [78], [79], [64], [55], [63], [51]
Ques	**Risk factors relating to design issues. (RF-D)**	**References**
D01	Limited creativity and innovation of designs in green and sustainability.	[107], (Paul et al.,2017), [77], [5], [107], [109], [4].
D02	Lack of experience of designers in green projects.	[26], [34], [28], [110], [3], [111], [77], [97], [112]
D03	Long approval process for using new green design and products.	[4], [72], [39], [110], [51], [5], [28]
D04	Uncertainty of long-term performances of green materials or products.	[4], [104], [28], [5], [106]
Ques	**Risk factors relating to materials and supply. (RF-M)**	**References**
M01	Lack of demand for green construction products.	[88], [90], [28], [97], [52], [66], [17], [76], [39], [77], [2], [74].[26], [16], [78], [79], [64], [55], [63], [51]
M02	Lack of local production, and unavailability of green products.	[72], [3], [2], [41], [74], [28], [4]
M03	Need special storage for green products.	[2], [41], [74], [28], [4], [113]
M04	Limited number of suppliers for green.	[4], [72], [93], [28]
M05	Need for importing the green materials or products from foreign markets.	[4], [72], [93], [28]
M06	probability of Poor quality of local green materials or products.	[4], [104], [28], [5], [106]
M07	Need for working with new suppliers.	[77], [4], [104], [28], [5], [106]
M08	Limited reliability in suppliers of green materials and products.	[77], [4], [104], [28], [5], [106]
M09	Shortage of locally available green materials and long supply period.	[87], [77], [4], [104], [28], [5], [106], [114], [72]

Table (1) Identification of Risk factors relating to risk categories and references.

Data collection

After reviewing and identifying the most effective factors, interviews with selected Qatari construction industry professionals were undertaken to confirm that the stated risks were appropriate and applicable to Qatar's construction sector. Furthermore, to make certain that the survey questionnaire was accurate, 10 different industry experts first participated in pilot tests to validate and verify the questionnaire. Feedback from the pilot test was used to update the survey. Since Qatar's experts and practitioners understand the significance of these risk

factors, they are rated on a scale of importance in order to identify which risk factors are of high importance for the adoption and execution of green building projects.

The best data gathering approach for this study was an interview to build a questionnaire. (Erikssons and Kovalainen (2015)) note that three different forms of interviews may be used in qualitative studies, as referenced in [5]. Semi-structured interviews are perfect for exploring an area of interest if they are used in conjunction with various questions [115]. To design a new concept, we employ this form of interview because we want to understand and develop the concepts from the participants' and the concept's perspectives [116]. We must consider everything, both known and unknown. To achieve the objectives, it will be necessary to conduct a comprehensive case study in which the subjects can be studied, as well as empirical research [69]. In some cases, we were able to communicate the intended purpose of those inquiries using short and straightforward statements such as bullets or tables. Next, we asked them to describe their contributions from their point of view and listed them according to the topics each covered.

In order to find out what risk factors the experts highlighted, all the replies and feedback were carefully reviewed in order to identify and integrate the findings. Additionally, that pilot test aimed to reveal many variables that may have an influence, in order to discover everything that concerns the adoption of the green construction sector in Qatar. Participants were given a questionnaire that included the six categories of Risk Factors (RFs') stated above and were asked to assess the degree of negative impact (importance) of each risk factor on the adoption of green and sustainable initiatives based on their perceptions. As indicated earlier, these factors were based on most citations and expert recommendations. Respondents were asked to prioritize each risk factor based on its individual impact on green building uptake in Qatar and, we utilized a Likert-style scale with values ranging from one to five: one implies a small or no impact, while five represents an extremely significant influence. Additionally, if the study includes participant perspectives, a variety of stats primarily based on data collected for various purposes that includes only preliminary details and written summaries that may be presented with the intent of including new and different facts, interpretations, or conclusions would be beneficial. Cited by [5] and [117].

Selecting a sample of respondents.

For better comprehension and interpretation, questions that were confusing were modified, and all questions were translated into Arabic and English. The questionnaire was then structured in Google Docs as a series of drop-down buttons. The first section outlines the primary roles of work and the participant's workplace, such as the government, consulting or contracting organizations, supplying firms, and other entities involved in or connected to green and environmental challenges in construction. And what is their occupation and how many years of experience in construction? The next section was then separated into six categories, within each series of questions or variables. Finally, on a scale of 1 to 5, assess the

degree or relevance of each variable's influence on the adoption of green buildings. For risk importance, use a five-point rating scale where 1 = least important and 5 = most significant, i.e. 1 means very low, 2 low, 3 average, 4 high, and 5 means very high. Additionally, there was a section at the end of the questionnaire for respondents' comments or suggestions. And the method for selecting a representative sample of respondents involved choosing respondents to whom the questionnaire would be mailed. Several recommendations focused on local governments and professional organizations that had previously worked on similar projects and would be capable of implementing the snowball concept.

The thought then arose of sharing our survey with a range of local sustainability conferences in order to increase participation from individuals with relevant backgrounds. We requested participant information, phone numbers, and email addresses from the organizers of many of these conferences; some cooperated; while others did not provide us with such lists, owing to the confidentiality of their information and their organization's policies. That is something we are mindful of. The responders were carefully selected based on their qualifications, as they may be a project engineer, manager, adviser, quality engineer, sustainability head, or green growth supervisor in one of the firms' associated roles. Since the sustainability problem necessitates communication with many stakeholders, we've attempted to include as many as possible in the population of respondents to whom we sent a survey, including consultants, vendors, manufacturers, government officials, private companies, and researchers, and others. Questionnaires were distributed among construction professionals in Qatar. Some interviews took place by e-mail or text message, while others took place in person. A total of 200 construction experts with prior experience of working on Qatar's development projects were polled. Questionnaires were delivered to 200 Qatari professionals with 134 replies; 5 were invalid due to very inadequate replies and possibly several submissions from the same person. Since the weight of the share of responsibility of each existing party will influence the outcomes of this study. The right overall survey response rate, 129 of 200, suggests a legitimate response rate of 64%, which is valid for 64%, according to Moser and Kelton’s claims [114]. Table (2) contains additional information about the profiles of respondents.

DATA ANALYSIS METHOD:

As shown in the table (03), management and stakeholders have the highest relative weight (27%), followed by regulations and standards, and then at the same weight were supply and materials issues (19 percent), and technical issues. (17 percent), financial and external issues (10 percent), and design issues (8 percent). According, the technical category has the highest impact, with an average of 3.75, followed by regulations, which an average of 3.72. Risk factors related to stakeholders and management rank third with a mean of 3.70, While design and financial issues rank nearly the same with meanings of 3.58 and 3.57, respectively, P-

value zero (Sig. = 0.000 < 0.05) is seen in all parties. unless the perceptions of design and technical issues are no longer significantly different. And relating to the ranking of risk categories based on (RII-index) value, technical issues (RF-T) were the highest group for green adoption in construction projects, followed by regulations (RF-R), then stakeholders and management (RF-S), financial issues (RF-F), design (RF-D) and ended with materials and supply risk s (RF-M).

Category	Type	Respondents Number	Percent %
Years of work experience	More than 10 years	101	78%
	Between 10 and 5 years	19	15%
	Less than 5 years	9	7%
Role of professionals surveyed	**Construction Manger**	**50**	**39%**
	Engineer	42	32%
	Experts	19	15%
	Architect	7	6%
	Sales, Procurement manger	8	6%
	Lecturer, Professor, Researcher	3	2%
Types of Company	**Government**	**15**	**12%**
	Consultants	18	14%
	Contractors	40	31%
	Products suppliers/Manufacturers	45	35%
	Others	11	8%

Table (2) Profiles of the respondents.

Relative Importance Index (RII).

The Relative Importance Index (RII), for every risk, was calculated using Equation (1). The RII is used to categorize risks. Risk factors will have either a very medium, low, moderate, intermediate or very high degree of significance [75]. The RII also rates, calculates, and measures risks. This was done for every one of the

$$RII = \frac{\sum_{i=1}^{5} WiXi}{\sum_{i=1}^{5} Xi} \quad \text{…. Eq. (1)}$$

Where Wi is the weight assigned to the response, and i is the weight assigned to the response; Wi = 1, 2, 2, 3, 4, and 5, and i = 1, 3, 1, 3, 1, 4, and 5, respectively. And Xi = frequency of response. i = response class index = 1, 2, 3, 4 and 5 for very low, low, moderate, high and very high respectively. As a result, the RII for (RF-T) was the highest (74 percent), followed by (RF-S) and (RF-R) with values of (73 percent), then (RF-R) and (RF-D) with 71 percent and 70 percent, respectively, and lastly (RF-M) with RII value of (68 percent).

Differences Between Parties and categories mean Scores

A post hoc Least Significant Difference (LSD) test was performed to assess the significance of the mean differences between the respondent's parties and the RF categories. Governments differ significantly from contractors (sig. = 0.00), consultants (sig. = 0.00), and suppliers (sig.

= 0.00), as shown in table (3). Furthermore, there is a perception gap between government contractors and others (sig. = 0.00 and 0.02). Suppliers, on the other hand, differ significantly from all stakeholders unless they have a solid agreement with them. Furthermore, the others strongly oppose the contractors and suppliers, but they agree with the consultants and the government. It should be noted that the variations are statistically significant (sig. 0.05). As shown in the below figure (01) and as can be seen, (X) on the lines implies that the two parties do not have an agreement between the parties.

Risk categories	**RF-S**	**RF-R**	**RF-T**	**RF-F**	**RF-D**	**RF-M**	**Sig.**	**Gov. Sig.**	**Consultants Sig.**	**Contractors Sig.**	**Suppliers Sig.**	**Others Sig.**
Gov	3.96	4.08	4.13	3.91	3.97	3.79	0	…	0.28	0	0	0.65
Consultants	3.72	3.55	3.73	3.63	3.58	3.51	0	0.28	..	0.09	0	0.1
Contractors	3.67	3.72	3.74	3.58	3.51	3.42	0	0	0.09	..	0.67	0.02
Suppliers	3.41	3.51	3.43	3.33	3.27	3.15	0	0	0	0.67	…	0.03
Others	3.73	3.75	3.74	3.44	3.57	3.42	0	0.65	0.1	0.02	0.03	…
Mean	**3.7**	**3.72**	**3.75**	**3.57**	**3.58**	**3.45**	C. alpha value	**0.92**	**0.96**	**0.93**	**0.95**	**0.96**
Sig.	0	0	0.32	0	0.58	0	Weight %		(RII) %		Rank	
RF-S	1	0.866	0.981	0.894	0.98	0.982	27		73%		3	
RF-R	0.866	1	0.924	0.794	0.903	0.849	19		73%		2	
RF-T	0.981	0.924	1	0.938	0.991	0.985	17		74%		1	
RF-F	0.894	0.794	0.938	1	0.937	0.96	10		71%		4	
RF-D	0.98	0.903	0.991	0.937	1	0.99	8		70%		5	
RF-M	0.982	0.849	0.985	0.96	0.99	1.00	19		68%		6	

Table (3) Differences Between Parties and categories mean Scores

There is no agreement between the government and contractors, for example, but consultants and the government have a strong agreement because there is no (X) on the line. Furthermore, an examination of the relationship between risk categories is essential. As stated (Pallant, 2005), as mentioned in [118], , the data collected is usually distributed, obtained randomly and independently. These criteria were used to evaluate whether there was or was not any association between two or more variables by using the Pearson correlation test (r). The test results normally vary from zero where there is no relationship between two variables to one that is the ideal relationship [52].

In order to carry out a comprehensive analysis of the correlation between risk categories in the construction sector in Qatar, the Pearson correlation coefficient (r) test was applied to carry out an in-depth investigation into the correlations between risk categories in the Qatar construction market. The association between categories is shown in Table (03). As stated, the strength of the relationship is high when ($0.5 < r < 1.0$) between two categories. The analysis shows that the greatest correlation between the categories is between technical issues (RF-T), design issues (RF-D), materials and supply (RF-M) and design issues and Design-related

risks (RF-D) as well, with values of 0.991 and 0.990 respectively. On the other hand, the weakest is the correlation of financials (RF-F) with the regulations (RF-R), but it is still found to be solid (r = 0.794).

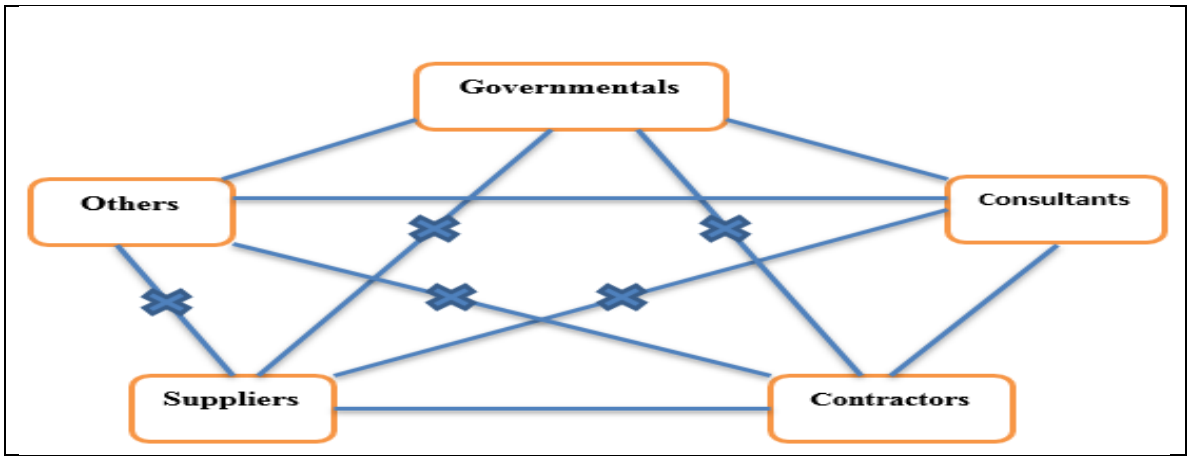

Figure (1) Agreement relationship difference (LSD) between construction parties.

Reliability Test (Cranach's Coefficient Alpha).

Validity and reliability are often considered as principles fundamental to the integrity of a study (Miles and Huberman, 1994), although, as per Saunders et al. (2009), they minimize the probability of getting inaccurate information as cited by [69] and [119]. Therefore, validity is associated with whether the test can genuinely test the principles that are meant to be tested (Hardy and Bryman, 2004), (Silverman, 2001). Additionally, consistency relates to accuracy in which the attributes involve those of the tool as well as the circumstances under which it is performed (Cooper and Schindler, 2001). (Cooper and Schindler, 2001). Reliability depends on whether the methodology of the analysis is reliable and relatively constant over time and through investigators and approaches (Miles and Huberman, 1994). (Miles and Huberman, 1994) cited in [69] et al. and [119] et al. However, McNeil (1990) defines reliability as the likelihood that if someone uses the same approach or methods to gather knowledge in identical situations at a different time, the same result will be obtained, as cited in [52] and [120]. In this study, the reliability evaluation, the standard of Cronbach alpha, can be found using the formula in the equation (1). Cronbach alpha value;

$$\alpha = \frac{K}{K-1}\left(1 - \frac{\sum_{i=1}^{K} \sigma_{Y_i}^2}{\sigma_X^2}\right) \quad \text{…. Eq. (1)}$$

Where K reflects that number of risk factors, σx2 corresponds to the variation in the observed risk factor, but Yi is the variance of risk factor (i). As a result, the overall Cronbach alpha value is equal to 0.95... Eq. (1). Qatar's construction industry produces consistent and dependable results. Based on exploratory techniques of study, the Cronbach alpha value is normally acceptable, at least 0.60, to assure acceptable reliability and to suggest that the components are internally consistent [24].

RESULTS AND DISCUSSION:

To determine the negative impact of each category related to risk factors based on the Relative Importance Index (RII). And to comprehend the construction parties' respective shares of responsibility. Understanding who the dominant presence is, or who has the risk, is critical for understanding and managing risks [5]. Such a perspective can minimize or eliminate the risk, or it can lead us in the proper direction [17]. The main risk factors for each category identified and the responsibility for these risks are described, as stated in the given table, based on the viewpoint of the practitioners on the impact of these factors. This section is intended to summarize the risk factors. The overall findings of the survey and the rankings with values (RII) displayed the total ranks of each 48 of the risk factors (RF) based on RII.

This will allow us to be aware of the significant implications and the challenges of shifting from traditional to green. It might also help us comprehend and validate our findings in the following stage by comparing them to other research in different nations.

According to the analysis, and in the given table, the five main risks in the building sector of Qatar include:

Building codes and special regulations need to keep pace with the shift towards green building and sustainability (R-08).

lack of awareness and training (S-12).

Absence or lack of educational curricula that help to understand sustainability and green for graduates (R-01).

Difficulty in locating experienced or expert green workers. (S-10).

Low green investment is due to a lack of demand in the local construction market(F-05).

Based on the respondent's perception, these observations indicated that the responsibility for the important risk factors (RFs) in Qatar was shared by the government (29 percent) and consultants (29percent), followed by contractors (21percent). However, suppliers have the least (14 percent) as well as the other parts of the responsibility (7 per cent).

Overall Respondents							Gov.		Consultants		Contractors		Suppliers		Others	
Categories	RFs'	RII (%)	rankings	MEAN	Frequency	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
RF-S	S01	51.63	48	2.58	333	1.43	2.80	1.61	2.50	1.25	2.625	1.46	2.38	1.53	3.091	1.30
	S02	73.95	16	3.70	477	1.02	4.07	0.96	3.50	1.20	3.575	1.06	3.67	1.04	4.091	0.83
	S03	73.8	19	3.69	476	1.08	3.80	0.86	3.56	1.10	3.75	1.26	3.56	1.34	4.091	0.83
	S04	72.71	25	3.64	469	1.07	4.00	0.93	3.44	1.10	3.7	1.11	3.42	1.18	4.091	1.04
	S05	72.4	26	3.62	467	1.05	4.47	0.64	3.50	1.25	3.775	1.07	3.33	1.09	3.273	1.19
	S06	73.64	21	3.68	475	1.06	4.13	0.83	3.61	1.24	3.775	1.19	3.42	1.10	3.909	0.94
	S07	70.54	31	3.53	455	1.07	3.60	1.12	4.06	1.11	3.55	1.26	3.24	1.17	3.636	0.67
	S08	75.66	9	3.78	488	1.10	3.93	0.96	3.94	1.35	4.025	1.1	3.47	1.20	3.727	0.90
	S09	72.87	24	3.64	470	1.08	3.87	1.30	3.78	1.06	3.8	1.04	3.38	1.05	3.636	0.92
	S10	**77.1**	**4**	**3.85**	**497**	1.07	4.13	0.99	4.00	1.24	3.95	1.06	3.60	1.12	3.909	0.94
	S11	74.26	15	3.71	479	1.07	4.13	1.06	4.06	0.87	3.575	1.24	3.56	1.16	3.727	1.01
	S12	**78.76**	**2**	**3.94**	**508**	1.09	4.33	0.90	4.28	0.96	3.8	1.16	3.82	1.19	3.818	1.25
	S13	75.81	8	3.79	489	0.98	4.27	0.88	4.11	0.68	3.825	1.17	3.53	1.14	3.545	1.04
RF-R	**R01**	**77.67**	**3**	**3.88**	**501**	1.04	4.47	0.92	3.56	1.04	3.8	1.36	3.84	1.17	4.091	0.70
	R02	75.97	7	3.80	490	1.10	4.13	0.92	3.50	0.99	3.8	1.09	3.76	1.15	4.000	1.34
	R03	71.16	28	3.56	459	1.11	4.27	1.10	3.33	1.03	3.575	1.15	3.38	1.15	3.636	1.12
	R04	63.88	46	3.19	412	1.13	3.67	1.18	3.06	1.21	3.475	1.15	2.71	1.34	3.727	0.79
	R05	74.88	12	3.74	483	1.16	4.00	1.07	3.50	1.20	4.025	1.12	3.62	1.13	3.273	1.27
	R06	71.01	29	3.55	458	1.12	3.80	0.77	3.67	1.28	3.6	1.13	3.36	1.30	3.636	1.12
	R07	69.3	35	3.47	447	1.08	3.87	0.74	3.39	1.33	3.7	1.09	3.07	1.23	3.818	0.98
	R08	**79.07**	**1**	**3.95**	**510**	0.97	4.27	0.88	4.06	0.87	3.575	1.15	4.18	0.86	3.818	1.08
	R09	76.9	6	3.84	496	1.09	4.27	0.88	3.89	1.18	3.9	1.03	3.67	1.09	3.727	1.27
RF-D	D01	71.32	27	3.57	460	1.14	4.27	0.80	3.61	1.29	3.55	1.2	3.33	1.21	3.545	1.21
	D02	70.23	33	3.51	453	1.17	4.07	1.03	3.56	1.38	3.45	1.28	3.29	1.18	3.818	0.98
	D03	70.7	30	3.53	456	1.21	3.60	1.50	3.89	1.08	3.5	1.13	3.49	1.24	3.182	1.08
	D04	67.44	40	3.37	435	1.13	3.93	0.88	3.28	1.27	3.55	1.24	2.98	1.25	3.727	1.01
RF-M	M01	68.53	36	3.43	442	1.07	3.40	1.18	3.61	0.92	3.45	1.43	3.27	1.01	3.727	0.79
	M02	73.02	23	3.65	471	0.97	4.00	0.93	3.61	1.14	3.8	1.02	3.33	1.13	4.000	0.63
	M03	60.78	47	3.04	392	1.20	3.53	1.51	2.83	1.20	3.3	1.2	2.73	1.19	3.000	0.89
	M04	73.95	16	3.70	477	0.97	4.33	0.72	3.72	1.07	3.825	0.9	3.36	1.26	3.727	0.90
	M05	67.75	39	3.39	437	1.21	3.67	1.45	3.94	1.06	3.325	1.31	3.18	1.35	3.182	0.87
	M06	64.5	45	3.22	416	1.16	3.67	0.98	3.39	1.33	3.2	1.26	2.98	1.08	3.455	1.13
	M07	65.58	44	3.28	423	1.05	3.73	1.10	3.28	1.13	3.425	1.15	3.02	1.14	3.182	0.75
	M08	66.05	43	3.30	426	1.07	3.80	0.77	3.33	1.28	3.125	1.28	3.24	1.09	3.455	0.93
	M09	68.53	36	3.43	442	1.04	4.00	0.93	3.83	1.10	3.325	1.14	3.24	1.23	3.091	0.83
RF-T	T01	70.39	32	3.52	454	1.11	4.07	0.70	3.67	1.28	3.475	1.15	3.27	1.32	3.727	1.10
	T02	70.08	34	3.50	452	1.09	3.87	0.92	3.61	1.24	3.55	1.3	3.22	1.26	3.818	0.75
	T03	75.5	11	3.78	487	0.99	4.20	0.77	3.94	1.00	3.75	1.01	3.62	1.13	3.636	1.03
	T04	74.42	13	3.72	480	1.10	4.13	0.99	3.72	1.18	3.9	1.15	3.44	1.14	3.636	1.03
	T05	75.66	9	3.78	488	1.02	4.33	0.82	3.83	1.10	3.875	1.07	3.49	1.12	3.818	0.98
	T06	73.8	19	3.69	476	1.05	4.20	0.77	3.39	1.20	3.85	1.12	3.42	1.16	4.000	1.00
	T07	74.42	13	3.72	480	1.05	4.33	0.82	3.50	1.10	3.8	1.18	3.53	1.06	3.727	1.10
	T08	73.95	16	3.70	477	1.02	3.87	0.92	4.17	0.71	3.75	1.08	3.44	1.34	3.545	1.04
RF-F	F01	68.37	38	3.42	441	1.41	3.67	1.40	3.56	1.42	3.475	1.34	3.20	1.46	3.545	1.44
	F02	66.82	41	3.34	431	1.13	3.87	1.06	3.39	1.20	3.325	1.27	3.24	1.21	3.000	0.89
	F03	73.64	21	3.68	475	1.04	3.80	0.94	3.89	0.96	3.7	1.14	3.51	1.31	3.818	0.87
	F03	66.67	42	3.33	430	1.18	3.87	1.13	3.50	1.25	3.35	1.33	3.11	1.30	3.182	0.87
	F05	**77.05**	**5**	**3.85**	**497**	0.93	4.33	0.82	3.83	0.86	4.05	1.04	3.58	1.01	3.636	0.92

Table (4) Overall survey results and overall rankings with (RII) values.

SUMMARY AND CONCLUSION:

The transition to sustainability has become a major challenge, since an interconnected network can only be strengthened or integrated if all construction parties in Qatar have a shared understanding of those priorities that are also presented in [122], [123], [124] and [125]. It can be stated that the role and the management of organizations are vital to sustainability and they are part of changes in their activities from traditional construction to sustainable construction as presented in [126]. In addition to that, unless large construction organizations enter this field and strengthen the ideas and promote small industries, sustained building risk management will continue without any significant improvements that are also mentioned in [5]. These results indicate that the government still has a major role to play in steering the wheel toward sustainable buildings in the State of Qatar, as well as eliminating obstacles, such as those listed in this study, to help organizations engaged in this type of construction. Although the government plays an important role in developing policies that keep up with development in this sector, one of the most significant barriers to approaching or transitioning to green building, as noted in the study results, is a lack of expertise and awareness among construction workers.

Moreover, as a result, the government, particularly in Qatar, must provide certain standards for assessing workers and staff in the construction sector, or include some of the qualifications for getting a license to work, and companies must stick to all of them. and must play a part in addressing the issue of a lack of investment in this type of structure. Since it is still a major barrier, the government must support such types of structures with multiple payment options. They are often expected to create a data base and input log as a guide, focusing on all completed projects, so that other organizations can learn from knowledge. And relating to new regulations, the government should include, or participate in, the parties of the construction industry before making decisions, as part of decision-making. Furthermore, consultants share a significant amount of responsibility for prioritizing sustainability for projects and developers, as well as not exaggerating standards that non-local materials struggle to fulfill. Manufacturers, contractors and suppliers will also play an important role in providing green products that meet standards while also contributing to increased performance and compliance. Contractors would be required to use local products, encouraging in-house manufacturing and assisting local industries.

According to the study's findings, there are a variety of barriers to green adoption in Qatar, particularly those related to knowledge and education, which are compatible with [28] and [41], as well as regulations and standards which are compatible with [51] and [63]. Furthermore, there is a problem relating to the lack of demand from the local market, which has resulted in low investment in this type of sustainable building that is also compatible with [47] and [42] . Finally, there are challenges to recruiting skilled workers or experts to work in the green. This is presented in [5]. Further research can be conducted in another field to determine what the challenges to sustainable growth are. Alternatively, this future research can be extended to include methods to promote Green Building

Strategies and green adoption, as well as solutions or strategies for overcoming these obstacles. The current study adds to the green construction literature by analyzing obstacles in the context of a developing country's green construction uptake, which could help governments and professionals take appropriate steps to address obstacles and promote green construction development. Future studies will study the links between all the crucial obstacles and the effect on the adoption and development of sustainable construction.

LIMITATIONS AND ETHICAL CONSIDERATIONS:

When doing data analysis, every researcher should consider research ethics and truth criteria [5] and [1]. This is closely linked to people or groups which are utilized for research purposes or which are somehow touched by research [52]. Therefore, there are some limitations to the framework, methodology, and methods of data collection. Because the qualitative analysis method used in this study is a multiple-case experiment, this thesis may raise concerns about its generalizability. Because these case study subjects show significant differences between the practitioners, it may be because of experience differences with several of their competitors in the industry. However, future research may involve companies from other countries in which sustainability is more interesting in creating more broad statements about the current situation of sustainable building as well as the industry.

There was no intentional bias in the processes of selecting the subject, developing the questions, and selecting the factors to be examined, as well as distributing the questionnaires and providing a summary of the results. If any bias happens by accident, it is unwanted in the case where it occurs. We have taken every measure to prevent bias. We had not been given any instructions that might have resulted in a change in the outcomes or even recommendations for a specific objective. Finally, we want to thank all the participants and companies whose employees participated in our investigation, as well as everyone who supported us with any research related to our topic of study. And we welcome any constructive feedback intended to improve this research or increase the significance of its findings.

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