A Comparative Study of the Barriers to Implementing Environmentally Sustainable Practices in the UAE Construction Industry

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Abstract

This paper reports the results of an empirical study examining the barriers to implementing environmentally sustainable practices in the construction industry and whether each of the identified barriers in ISO 14001 certified firms differ significantly compared to those in non-ISO 14001 certified firms. The study used interviews and a structured questionnaire to collect data from 40 construction firms in the United Arab Emirates (UAE). The analysis of results showed that the top three of the 15 identified barriers are economic development placed above meeting environmental sustainability requirements, insufficient support from policymakers, and challenges to decreasing the amount of energy consumed during construction processes. The results also showed no significant difference between firms adopting ISO 14001 and firms not adopting ISO 14001 in terms of the importance of each identified barrier. These findings could guide managers and policymakers in construction firms interested in the implementation of environmentally sustainable practices in the UAE and firms operating in the same environment worldwide.

Keywords
Construction Projects, Sustainable Practices, ISO 14001 Standard, Barriers, UAE.

1. Introduction
The construction industry in many countries is among the leading industries contributing to the economic growth of many countries and providing necessary infrastructures. Despite these contributions, the environmental damage caused due to construction practices is undeniable. For example, 25% to 50% of CO2 emissions released into the atmosphere worldwide is the sole result of construction practices (Gharzeldeen and Beheiry, 2015; Arocho et al., 2017; Afable, 2019; Liu et al., 2020). These activities also consume between 20% and 50% of the world's natural resources and are responsible for almost half of the solid waste generated (BIMhow, 2019; Benachio et al., 2020; Sáez and Osmani, 2019). This situation has prodded policymakers and governments at various levels to launch programs and create regulations and rules protecting the environment by boosting environmental-friendly practices during project execution. Per these regulatory programs, firms must implement environmentally sustainable practices conforming to governmental initiatives and regulations (Touqan et al., 2020; Iranmanesh, 2017). Such practices include utilizing recyclable and reusable materials, decreasing energy consumed during the construction process, and utilizing renewable energy sources (Bamgbade et al., 2019; Yates, 2014; Chen et al., 2019). To achieve self-imposed sustainability objectives and government-specified requirements, thousands of firms worldwide began to implement environmental management system standards established to control the adverse impacts of their practices on the environment. Examples of these standards include the Carbon Trust Standard, the Eco-Management and Audit Scheme, and the International Organization for Standardization's ISO 14001. Begun in early 1996, ISO 14001, concentrating on delivering the necessary guidelines, practices, and principles essential for organizations to develop and implement the environmental management system, is perhaps the most commonly issued environmental certification (Kabirifar et al., 2020). By 2020, 417,479 certificates were issued in 195 countries, according to ISO (Liu et al., 2020). This represented an increase of 74% from 2010 when the total number of certificates stood at 239,880 issued in 156 countries (ISO, 2020). The construction sector has the largest number of certified firms (58,751 certifications).

1.1 Problem Statement
According to Waxin et al. (2019) recent study, ISO 14001 certification has assisted 14 organizations in nine different industries in the United Arab Emirates (UAE), improving environmental consciousness, environmental management practices, environmental performance, relationships with stakeholders and reputation, organizational proficiency. However, in another study, Bashir et al. (2021) found that only a partial improvement in using environmentally sustainable practices accompanied the adoption of the standard. This finding was based on data

collected from more than 250 construction firms in the UAE. The inconsistent finding of the studies mentioned above makes it clear that a need exists for more studies to examine whether construction firms can overcome barriers to implementing environmentally sustainable practices in the UAE construction industry via ISO 14001 standard certification.

1.2 Research Aim & Questions

This research aimed to address the need mentioned above and, by doing so, also contribute to further understanding of ISO 14001 certification in the framework of the United Arab Emirates construction industry. Accordingly, the following research questions were formulated:

RQ1: What are the barriers to implementing environmentally sustainable practices in the UAE construction industry?

RQ2: Are the barriers differ significantly across ISO 14001 certified versus non-ISO certified firms?

To address this second question, the following null and alternative hypotheses were formulated:

H_0: The importance of barrier *I* certified firms do not differ significantly from that in non-ISO 14001 certified firms, $i = 1, 2, \ldots n$, where n represents the number of the identified barriers

H_1: The importance of barrier *I* in non-certified firms do not differ significantly from that in ISO 14001 certified firms, $i = 1$.

2. Literature Review

2.1 Sustainability in Construction

Economic development, especially in developing countries, led to a massive demand for construction projects, where environmental management is overshadowed (Banihashemi et al., 2017). This has aroused the attention of officials, administrative authorities, policymakers, professionals, and researchers worldwide (Sfakianaki, 2019). This attention has led to the emergence of the concept of sustainability in project management that Silvius and Schipper (2014) defined as "The planning, monitoring and controlling of project delivery and support processes, with consideration of the environmental, economic and social aspects of the life-cycle of the project's resources, processes, deliverables, and effects, aimed at realizing benefits for stakeholders, and performed in a transparent, fair and ethical way that includes proactive stakeholder participation." From the environmental aspect, sustainable project management involves applying sustainability practices from the extraction of raw materials all through the project design, planning, and execution of buildings and infrastructures and their deconstruction and waste management (Sfakianaki, 2019). According to Sánchez (2015), there is a need to introduce sustainability into project management by assessing projects in terms of their profits, environmental, and social impacts. It should be noted, however, the focus of this study is on the environmental aspect of sustainability.

2.2 Environmental Sustainability in the UAE Construction Industry

Before the 2008 financial crisis, the UAE construction industry had undergone a boom, beginning about 1996 and peaking in 2007. During this boom, the UAE became a significant producer of waste, 75% of which was generated from construction activities (Hajj and Hamani, 2011). Because of this alarming figure, coupled with the motivation on part of the UAE government regarding their commitment to the various levels of sustainability, several regulations and initiatives were established to protect the environment. One example is "Estidama," which the Abu Dhabi Urban Planning Council implemented (El-Sayegh et al., 2021). This initiative introduced the "Pearl Rating System" tool to evaluate construction projects using principles that the Council had outlined. They established a minimum score that all construction projects needed to fulfill, providing the necessary impetus for Abu Dhabi in establishing a sustainable construction policy for environmental protection (Estidama, 2010) Similarly, Dubai introduced the "Green Building Regulations and Specifications" in 2011, which have been enforced for all construction projects in Dubai since 2014 (Dubai Municipality, 2014). However, despite the regulations and initiatives that the UAE government has enacted at various levels, the UAE's construction industry has not yet wholly embraced environmentally sustainable practices (Bashir et al., 2021).

2.3 The Implementation of ISO 14001 in the Construction Industry

The primary elements of an ISO 14001-complied management system are the development of organizational capacity for formulating new environmental guidelines, implementing developed guidelines, planning, operations control through deep monitoring, and working on corrective actions (Treacy et al., 2019; Johnstone, 2020). ISO 14001 standard does not require organizations to accomplish a specific level of environmental performance. Still, it provides information about a system to help firms achieve their environmental goals. The literature shows that the ISO 14001 standard offers guidance for organizations to reach sustainability goals while also providing requirements for both stakeholders and legal authorities (Phan and Baird, 2015; Carvalho and Rabechini, 2017). Several studies have shown that it is relatively challenging to implement the ISO 14001 standard in construction firms mainly oriented around specific projects because environmentally sustainable practices are often not rooted

in project culture (Banihashemi et al., 2017; Carvalho and Rabechini, 2017). In a study examining construction firms in Turkey, respondents were asked if the firms had implemented environmental practices. The results indicated that 100% of ISO 14001 certified firms and 77.5% of non-certified firms had done so (Turk, 2019). However, the implementation of ISO 14001 does not always guarantee an improvement in an organization's environmental performance, even if a firm shows improved environmental performance after implementing ISO 14001, it does not necessarily prove that the improvements would not have been the same without the system (Barla, 2007; Campos, 2012; Nawrocka and Parker, 2009).

2.4 Barriers to Implementing Sustainability in Construction Projects

Although the great emphasis in the literature on the importance of adopting sustainable project management within academic discourse, environmentally sustainable practices have not occurred to be generally implemented across the construction industry, mostly due to many barriers (Bashir et al., 2021). Several worldwide studies have investigated barriers to implementing environmentally sustainable practices in the construction industry to address this issue. These have identified barriers like the implications of perceived costs, ignorance of its economic benefits, inappropriate building regulations, stakeholders who do not consider sustainability, insufficient knowledge of sustainable designs, client reluctance, lack of the correct data, unavailability of sustainable building materials, and the absence of the capacity to enforce and execute policies for sustainable construction projects (Whang and Kim, 2015; Plessis, 2005; Fathalizadeh et al., 2019; Trierweiller et al., 2012; Davies and Davies, 2017; Abolore, 2012; AlSanad, 2015; Masrom et al., 2017; Aghimien et al., 2018; Babatunde e al., 2020; Oke and Aigbavboa, 2017; Opoku et al., 2019; Hosseini et al., 2018).

3. Methodological Approach

Figure 1 displays the flow chart of the adopted methodological approach employed in this study. This study conducted interviews to identify the barriers to implementing environmentally sustainable practices in the UAE construction industry, then a structured questionnaire to gather data on ISO 14001 certified firms and non-certified firms. The interviews were conducted individually and face-to-face with three project managers employed by different firms (two were ISO 14001 certified, and one was non-certified). In each interview, a project manager was briefed about our research objectives and then asked to provide a list of barriers to implementing environmentally sustainable practices in his/her firm by validating a list of 40 barriers reported in the literature. The validation included modifying and removing unnecessary barriers on the list. The expert interview was focused on reviewing all the barriers and their effect in the construction industry in order to come out with a reasonable number of barriers. The three interviewees concluded a list of a total of 20 barriers, and the duplicate barriers were eliminated, resulting in a total count of 12 barriers which were compiled into the following Table 1.

Table 1. Considered barriers to implementing environmentally sustainable practices

1.	Economic development placed above meeting sustainability requirements
2.	Insufficient support from policymakers
3.	Lack of high-quality workmanship
4.	Insufficient consultation with stakeholders
5.	Weak management decision-making
6.	No guarantee to follow standards for construction materials specifications
7.	Lack of comprehensive definition of material quality in standards
8.	Challenges of decreasing high waste generation in the construction industry
9.	Low workforce commitment
10.	Low education level awareness of new technologies among the construction industry’s workforce
11.	Lack of environmentally sustainable design
12.	Challenges to reducing the rate of energy being consumed during construction processes

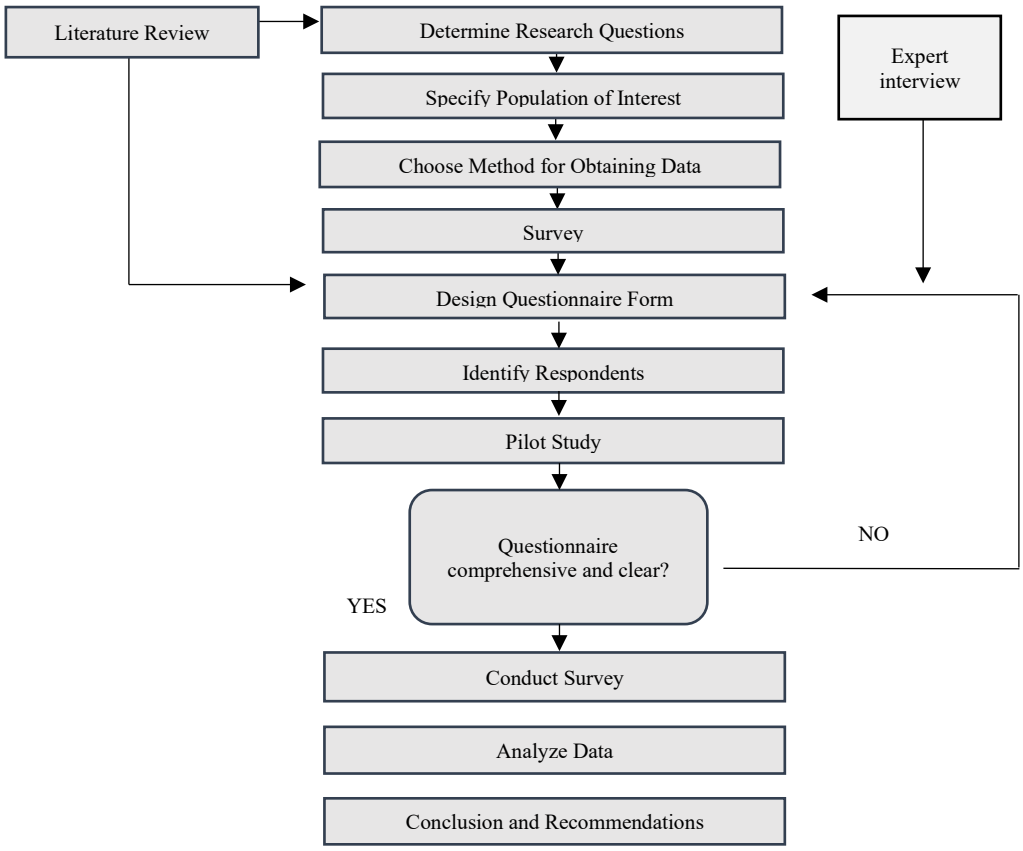

Figure 1. Research methodology flow chart

3.1 Questionnaire Design

A questionnaire consisting of three sections was designed to collect the required data.

Section A: This section contains inquiries related to each respondent, containing designation, organization name (optional), respondent name (optional), respondent email (optional).

Section B: This section contains a mixture of fill-in-the-blank and multiple-choice questions, requesting information about the average employee count, as a measure of the size of the organization, the average number of executed projects per annual, the type of firm ownership, and whether the firm is ISO 14001 certified.

Section C: In this section, respondents were asked to give a rating to the importance of each of the related 12 barriers using the following scale: "1 = not important, 2 = slightly important, 3 = moderately important, 4 = important, and 5 = very important". A pilot study was conducted in which five respondents were given an opportunity to add missing barriers and provide any comments regarding the clarity of questionnaire items. Based on their responses, we revised the wording of a few barriers, though no new barriers were added to the list.

3.2 Data Collection

After conducting the pilot study, the final questionnaire design was ready for distribution. The questionnaire form was distributed through online surveys sent by mails, and face-to-face interviews. The final version of the designed questionnaire was targeting construction project managers, as well as construction professionals specialized in sustainability in 86 various construction firms in the UAE; 40 responded to the questionnaire, indicating a response rate of 46.5%. Of these respondents, 28 (70%) were certified firms, whereas the remaining 12 firms (30%) were ISO 14001 non-certified.

4. Results & Discussion

The responses to the questionnaire on barriers to implementing environmentally sustainable practices are summarized in Figure 2. As shown in this figure, the top three barriers are economic development placed above meeting environmental sustainability requirements (Barrier no. 1), insufficient support from policymakers (Barrier no. 2), and challenges to decreasing the amount of energy consumed during construction processes (Barrier no. 12). They were rated 82%, 59%, and 53%, respectively, of the surveyed firms as either important or very important. On the other hand, insufficient consultation with stakeholders (Barrier no. 4) was rated as the lowest since it was rated either an important or very important barrier in only 39% of the surveyed firms.

Moreover, the Mann- Whitney U test was performed to test the null hypothesis (H_0) of RQ2 (Are the barriers differ significantly across non-ISO 14001 certified versus ISO certified firms?). As Table I shows, the result of this test at the 0.05 significance level suggests no significant difference between non-ISO 14001 certified firms and ISO certified firms in terms of any of the identified 12 barriers. This result leads to the conclusion the adoption of the ISO 14001 standard has not facilitated the degree of implementation of environmental sustainability. This finding is very close to that reported by (Bashir et al., 2022). The outcomes of these two studies could mean that the implementation of the standard might be ineffective. To enhance the standard's effectiveness**,** firms must implement a comprehensive framework that includes policies and practices, engagement of all stakeholders, and enhanced eco-awareness at all firm levels so that implementing environmentally sustainable practices becomes embedded in project culture. This could be promoted through launching by decision-makers at the governmental level, a combination of three separate types of strategies mandatory, supporting, and encouraging (Albastaki, et al., 2021).

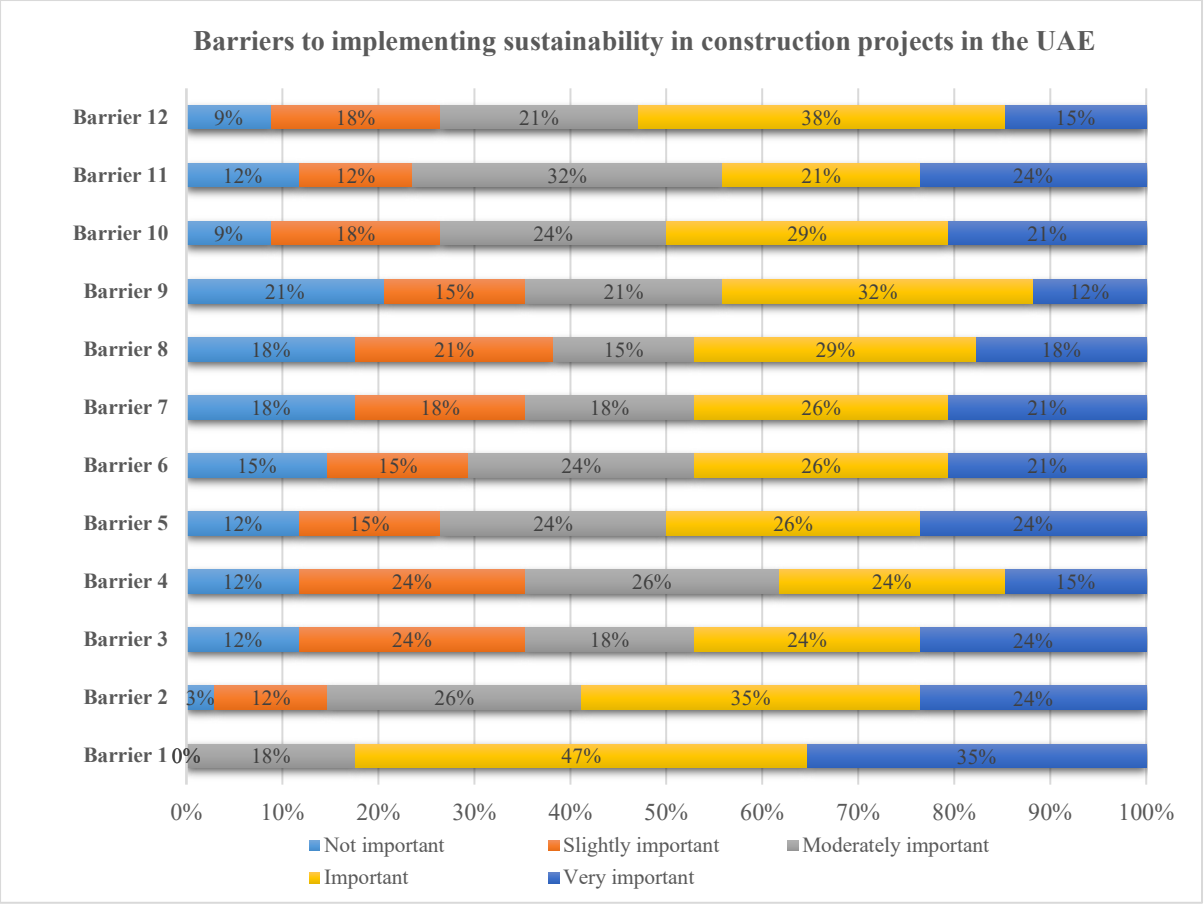

Figure 2. Barriers to implementing environmentally sustainable practices .

5. Summary, Conclusion, and Future Research

This study explored the barriers to implementing environmentally sustainable practices in construction projects in the context of the UAE. It also aimed to compare non-ISO 14001 and ISO certified construction firms in terms of the barriers to environmentally sustainable practices. Based on interviews and the literature review, 12 barriers were identified, then data were collected from a questionnaire of 40 non-ISO certified and ISO-certified firms. The results showed that the top barriers are economic development placed above meeting environmental sustainability requirements, insufficient support from policymakers, and challenges to decreasing energy consumption during construction processes. The results in Table 2 showed no significant difference among ISO and non-ISO-certified firms regarding the barriers to implementing environmentally sustainable practices. This may lead to the conclusion that ISO certification does not lead to any significant difference in facilitating the implementation of sustainability practices in construction projects in the context of the UAE. However, more studies are required to confirm these findings because the current research was based on data collected from a relatively small sample of construction firms. If this finding has been confirmed, there is a need to investigate the causes for such findings. A future study could also be conducted to examine the association between the barriers to implementing environmentally sustainable practices and other firm characteristics such as ownership type and

firm age (Bashir et al., 2020). Comparing non-ISO certified with ISO-certified firms in terms of documentation and performance would be another interesting area for future study (Ashrafi and Bashir, 2011).

The outcomes of this study contribute to reducing the gap in knowledge concerning barriers to implementing environmental sustainability in construction projects and provide a valuable reference for aiding policymakers and project managers to take appropriate measures to mitigate the barriers to sustainability in construction projects.

Table 2. Mann Whitney U-test results

Barriers to implementing environmentally sustainable practices	P-value of Mann-Whitney U-test	Hypothesis result
Economic development placed above meeting sustainability requirements	0.066	Retain Ho
Insufficient support from policymakers	0.196	Retain Ho
Lack of high-quality workmanship	0.127	Retain Ho
Insufficient consultation with stakeholders	0.871	Retain Ho
Weak management decision-making	0.517	Retain Ho
No guarantee to follow standards for construction materials specifications	0.517	Retain Ho
Lack of comprehensive definition of material quality in standards	0.166	Retain Ho
Challenges of decreasing high waste generation in the construction industry	0.355	Retain Ho
Low workforce commitment	0.944	Retain Ho
Low education level awareness of new technologies among the construction industry's workforce	0.763	Retain Ho
Lack of environmentally sustainable design	0.185	Retain Ho
Challenges to reducing the rate of energy being consumed during construction processes	0.231	Retain Ho

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