



Prioritization of the Eco-hotels Performance Criteria in Yemen using Fuzzy Delphi Method

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ABSTRACT

The foremost step in planning and implementing sustainability practices in any sector is to select appropriate factors for application according to the conditions of that sector and the priorities for applying those factors in it. Keeping inappropriate and insignificant factors and removing the most important ones leads to unreliable and inaccurate results. This study aimed to obtain a consensus of experts on the most critical criteria for planning and implementing sustainability practices in the Yemeni hotel sector. To achieve this goal, a panel of 13 experts was formed to evaluate a set of 42 eco-hotel performance criteria using the Fuzzy Delphi method. The remarkable majority finding in this paper is the classification of these criteria according to their importance into three categories, the first category of which included the ten most essential measures and were as follows: "Sustainability management system," "Legal compliance," "Local employment," "Decent work," "Cultural interactions," "Protecting cultural heritage," "Efficient purchasing," "Energy conservation," "Water conservation," "Wastewater" and "Solid waste." The results of this study will assist decision-makers in this sector in planning, implementing, and evaluating sustainability practices.

General Terms

Eco-hotels, Sustainability, Fuzzy method, Prioritization of criteria

Keywords

Green hotels, eco-hotel, sustainability, performance criteria, fuzzy Delphi, GSTC standards

1. INTRODUCTION

The quality of the natural or human-made environment is essential for the sustainability of the entire tourism development. Nevertheless, the relationship of tourism development with the environment is a complex one, and it includes many activities that can have adverse environmental impacts. Many of these influences are associated with building public infrastructures such as roads, airports, and tourism facilities, including resorts, hotels, restaurants, and parks. The contradictory impacts of tourism development can gradually destroy the environmental resources on which it depends. On the other level, tourism can serve the environment by contributing to environmental protection and conservation. It is a means of increasing awareness of ecological values and can finance natural areas' stability and improve their economic importance. Despite the economic, ecological, and sociocultural significance of tourism, it is still partly responsible. It contributes to many problems and negative impacts that disturb the ecological balance and the

environmental framework. The paradoxical effects of tourism occur when the usage level of ecological resources is greater than their size within the acceptable limits of change, with which the environment can deal.

Uncontrolled traditional tourism poses potential threats to many natural areas around the world. They can exert tremendous pressure on a location and lead to impacts such as soil erosion, increased pollution, gas emissions, and water drainage into the sea, reduced quality of beaches and water, loss of natural resources, increased pressure on endangered species, and increased exposure to forest fires, as well as they cause noise discomfort and lifestyle changes, often imposing pressure on water resources, energy and other significant assets of local people and can force them to compete for the use of critical resources.

In the recent period, the challenges and problems of this kind have grown in severity and increased severity for several reasons. Perhaps the most important of them is represented in the mismanagement and treatment of environmental pollution sources produced by various tourist destinations, resorts, and hotels, such as solid waste treatment, sanitation, and noise. In addition to the lack or misapplication of practices and programs needed to use, rationalize, and advance the effectiveness of energy, water, and other significant resources. The absence of competencies, local references and standards for quality and sustainability, the absence of controls/deficiencies of legislation, the absence of adequate governmental support, support, and management, and the lack of economic resources may be part of these reasons as well.

As a result of the increase in these challenges and their implications for the safety, health, and environment of societies, countries and their private hotel sectors have tended to shift towards adopting environmental sustainability concepts in the hotel sector.

Green hotel is one of the modern forms of sustainability in the tourism sector. The achievement of green hotel practices, or the so-called eco-hotels, has become a method and approach adopted and relied upon by many hotel institutions in many countries as one of the hotel sector's sustainability solutions [1]. Green hotels are used to overcome traditional hotel problems that are harmful to the environment. Besides, green hotels can use their environmentally friendly image and reputation as a marketing tool that can attract many tourists and bring community sympathy with them. The international standards of the Global Sustainable Tourism Council (GSTC) are used to measure and demonstrate these practices in a reliable way [2]. Also, these standards enhance business growth in the tourism sector, improve the confidence of the



beneficiaries of the services of this efficient sector, and help achieve economic, social, cultural, and environmental benefits for local communities within a common and unified framework that is recognized and agreed on its concepts. It also works on forming a common understanding of tourism destinations by providing many of the requirements that any institution concerned with tourism management must adhere to and has a desire and orientation towards achieving sustainability principles. Its design can be used in different ranges and types of tourist destinations; it is indicated by its inclusiveness of the four main issues of poverty alleviation, gender equality, environmental sustainability, and climate change, which constitute a global challenge and significant goals of the United Nations Millennium Development Goals.

Studies [3,4,5] have shown that the application of these standards and guidelines in hotel institutions is increasing globally to preserve natural resources, reduce the adverse effects of the hotel industry on the environment, reducing expenses, providing a healthy environment for guests, rationalizing, recycling materials, waste treatment, reduction of impact, noise mitigation and explaining the use of natural resources such as energy and water.

The GSTC standards are one of the most important international standards that contain many fields, factors, and indicators needed to implement and measure sustainable practices in tourism environments according to a hierarchical structure. However, organizations should choose the relevant areas according to their considerations and in proportion to their objectives. Their needs must be done taking into account the condition and type of the tourist destination [6], as well as another emphasizes that the selection of that criterion must be made taking into account the internal regulatory framework or the environmental, social, economic, or cultural conditions prevailing in the country in which the planning processes are applied [7,8,9].

Moreover, selecting factors and indicators is imprecise and requires experts' participation to determine what is more appropriate for a specific tourism sector. Problems that have such characteristics are called multi-criteria collective decision support problems of a fuzzy nature. They require special techniques to deal with uncertainties and ambiguities in them, compare their alternatives, arrange them, and choose the most appropriate ones. Several methodologies and models for Multi-Criteria Decision-Analysis-MCDA are available [10,11,12,13]. The fuzzy Delphi technique represents a powerful tool to solve practical problems in making multi-criteria decisions to find a consensual solution and assist in decision-making in uncertain environments [14, 15].

Taking into consideration the great importance of sustainability in the hotel field, the role that international standards can provide for tourism, the differences that the hotel sector enjoys from other tourism sectors, the analytical capabilities of Delphi technology in dealing with the ambiguous conditions related to the selection of factors and indicators of hotel sustainability, this study seeks to use the Fuzzy Delphi technique to build a general model for hotel sustainability factors that are compatible with the conditions and environment of the Republic of Yemen (specifically in the capital, Sana'a), based on the requirements of the international standard (global standards for sustainable tourism). Therefore, the study aims to develop a multi-level hierarchical structure for the factors and indicators of hotel sustainability in the Yemeni capital - Sana'a.

2. RELATED WORK

2.1 Performance Criteria for green Hotels

Many studies dealt with the concept of tourism development, and many researchers have defined it in different ways. The authors [16] believe that tourism development is a partial system and has an integral role within the comprehensive development system framework. It is further defined as a complex process that includes several interconnected and intertwined elements. It is based on a scientific and practical attempt to reach the optimum utilization of tourism production's primary components. Its types can be classified into comprehensive, sustainable, local, regional, and international tourism development. Sustainable tourism development could be defined as the development that meets and satisfies the current needs of tourists and host communities and ensures future generations' benefit. In this way, it means working on using environmental resources, preserving them, and preserving their innate nature because these resources are not the property of the present generation but rather the future successive generations [17].

Therefore, it requires, on the one hand, meeting the current needs of tourists and the host regions, and on the other hand, it requires protection and improvement of future opportunities. It is also defined as a set of guiding rules in the field of resource management in a way that allows meeting economic, social and aesthetic needs while preserving all cultural characteristics, and with a mechanism that ensures the achievement of cultural integration, environmental factors, biological diversity, and support for life systems.

To achieve an excellent sustainable tourism development, decision-makers must consider several principles, the most important: (1) Tourism planning, development, and management must be part of the sustainability strategies of the region or the state [18], (2) Tourism should be planned and managed in an integrated and intertwined manner, including various government agencies, private institutions, and citizens, whether they are groups or individuals, to provide the most significant benefits [19], (3) These agencies, institutions, groups, and individuals must follow the principles that respect the culture, environment, and economy of the host region and the traditional way of life and behavior of the community, including political patterns, (4) Tourism must be planned and managed sustainably for the protection and optimal economic utilization of the natural and human environment in the host area, and (5) A program of evaluation, monitoring, auditing, and correction should be implemented during all stages of tourism development management [20] in a manner that enables stakeholders to develop solutions to achieve benefits and diminish negative impacts on the social, economic, and environmental levels. From this standpoint, the tourism sustainability strategy must accomplish the following: Optimal utilization of ecological resources, preserving the ecological balance and biological diversity, respecting and preserving the customs, traditions, and cultural values of local communities, and contributing to understanding rapprochement between different cultures. For the hotel sector, these requirements are generally classified into four major groups, according to GSTC [21]. The first group aims to provide a management environment for sustainable tourism issues in the tourism destination, capable of playing their role effectively. The second focused on socially and economically beneficial practices and topics for the host community and procedures that limit the negative impact of tourism on achieving the economic and social objectives of that society—



protecting the rights, property, culture, and heritage of the host community where the main building blocks of the third group's interlocutor. The fourth group highlights the environmental aspect includes the topics that protect and preserve the environment or limits the adverse effects of the intent. The figure below shows the decision tree with its four-level hierarchical structure, which summarizes the key and sub-criteria used to measure hotel sustainability practices.

There is also available another set of international standards such as ASEAN GREEN HOTEL STANDARD, The Green Globe Standard, GreenStep Sustainable Tourism Standard, Green Tourism Active, Hostelling International's Quality and Sustainability Standard, Asian Ecotourism Standard for Accommodations (AESA), and Travelife Standard for Hotels & Accommodations.

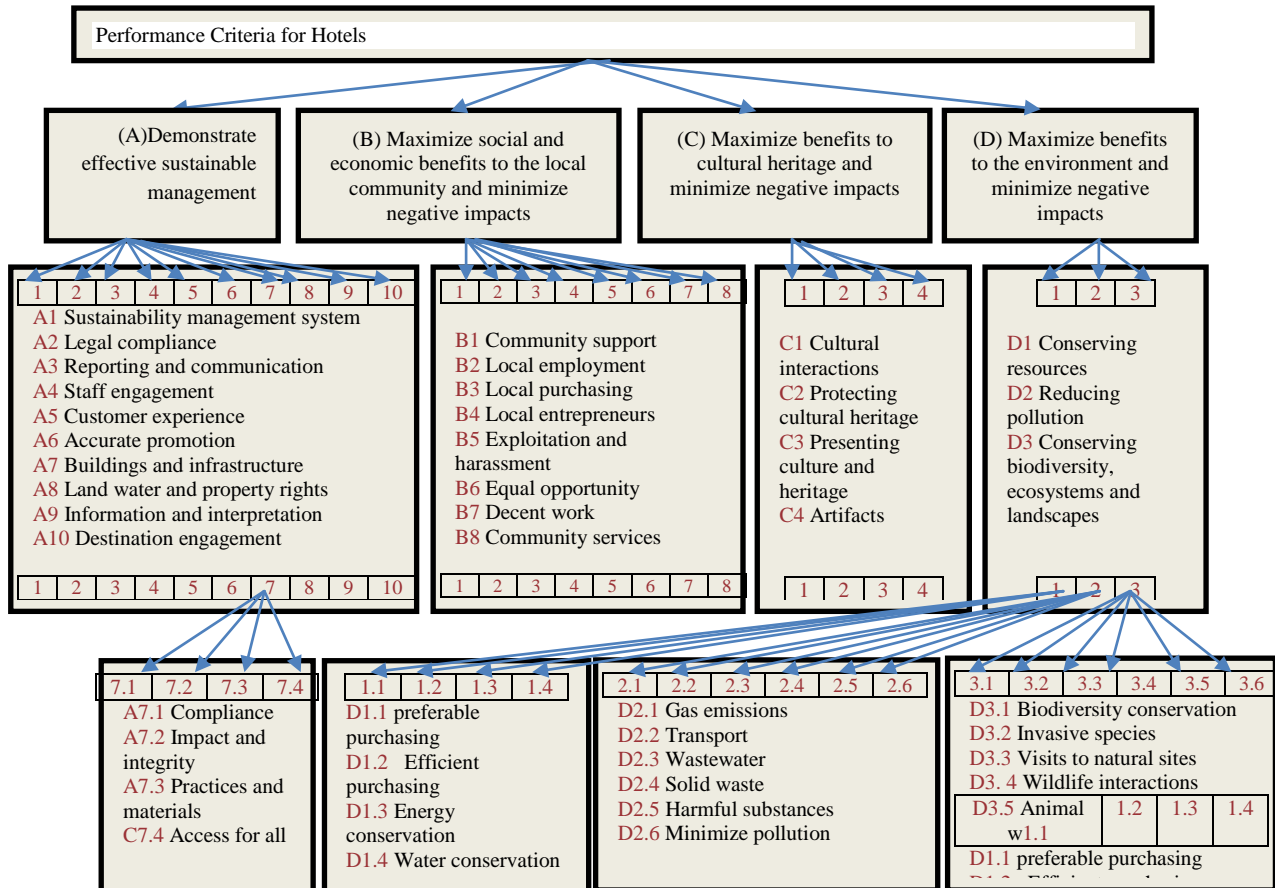


Fig 1 : Performance Criteria for Hotels and Accommodations based on [21]

Many factors affect the possibility of applying sustainability standards in the hotel sectors, including the environmental and economic conditions of the country, the local trend towards an interest in tourism destinations, the difference in governmental ecological legislation, the size and nature of tourism from one place to another, the costs and the possibility of applying various standards, and capital requirements. The high investment and the chance of recovery, and the different level of availability of the natural resources used (such as water wealth, oil derivative resources, for example). As it was explained earlier, this study seeks to identify sustainable factors that are most appropriate and suitable for application in the Yemeni hotel sector from the point of view of experts, taking into account the modest tourism situation in Yemen and external environmental factors affecting the practices of this sector. Locally, there is an extensive research gap, and there are no previous local studies to deal with this problem. Internationally, many studies have dealt with this problem, such as the study of [22, 23, 24]. This study differs from these studies in that it sheds light on the Yemeni reality and is based on international standards due to the lack of appropriate local measures. The

global standards for sustainable tourism have been chosen as a means of measuring sustainable development in hotels in this study. The main reasons for choosing them are the advantages and characteristics that these standards have, making the results of this study applicable in reality. These standards are characterized by being able to build a shared understanding of tourism destinations, by providing the minimum requirements that any institution concerned with tourism management must adhere to, and that has a desire and orientation towards participation in achieving the principles of sustainability, as well as reaching several other benefits: provide basic guidelines for destinations wishing to become more sustainable; help consumers identify sustainable and sound tourism destinations; provide essential information for the media to define the destinations and guide citizens about their sustainability, help entities within the destinations to ensure that their standards meet generally accepted grounds, represent a starting point for government programs, non-governmental programs, and private sector programs to develop the conditions and requirements of sustainable tourism. It reflects the criteria, and indicators adopted by certification programs, which reflect best practices followed



in different cultural and geopolitical contexts worldwide, at the level of the tourism sector and other sectors where this is suitable. Most of all, its criteria and indicators have undergone various tests to gauge their degree of relevance and applicability to a wide range of purposes. This study agreed with some of those previous studies [22] as it, relying on the fuzzy Delphi technique as an evaluation tool.

2.2 Fuzzy Delphi method for ranking of green hotels factors

The study's problem requires the participation and consultation of experts in the evaluation of the criteria [22]. The fuzzy Delphi technique is considered one of the most important and modern methods to achieve this goal [14,15, 25]. This technique is the modified version of the classic Delphi method, one of the primary and systematic approaches widely used to collect and analyze expert opinions. Despite the importance of this traditional technique, it has a set of disadvantages [25]: for instance, misunderstanding of experts' judgments due to ignoring the vagueness, absence of the specified set of rules to obtain the cherished result; missing the respondents' (or decision experts') interest and their assessment records as a result of the time-exhaustion procedure, which shall cause returned screening, and lead to an increase in the cost of studying, and does not deal with the problem of ambiguity of experts; The FDM of the method has been selected for this study to avoid these imperfections. This method uses a set of fuzzy numbers to represent the valuation options, each of which takes a value in the range [0,1]. This method was chosen in this research for its capability to decrease the cost, time, and rounds of evaluating criteria, enable the specialists to reveal their judgments with a higher level of objectivity, and free from any vagueness biases, which improves the completeness of experts' decisions. It helps obtain the experts' agreement without compromising their original decisions towards the evaluation statement [25].

3. METHODOLOGY AND MATERIALS

This study depends on the descriptive and analytical approaches. The following sequence problem-solving phase's structure is applied:

- 1) *Determine the research problem, aspirations, and questions;*
- 2) *Literature review and related work;*
- 3) *Data collection tool design;*
 - 3-1) *Green hotel questionnaire design*
 - 3-2) *Panel of experts (Research Subjects)*
- 4) *Data collection, analysis, and testing:*
 - 4-1) *Assessment Data collection;*
 - 4-2) *Classification of criteria significance*
 - 4-3) *FDM analysis;*
 - 4-4) *Consistency and criteria acceptability determinations*
- 5) *Analysis and discussion of the ranking and classification results;*
 - 5-1) *Ranking results analysis*
 - 5-2) *Classification of criteria significance*
 - 5-3) *Analysis of criteria classification results*
- 6) *Conclusion, recommendations and future work*

At the first stage, the research problem was identified through the reality in which one of the researchers lives in one of the largest hotel companies in Yemen. By relying on a group of

local and international literature, the problem was formulated, the study objectives and its theoretical determinants, and the advantages and advantages of the study, as shown in sec. 1.

At the second stage, the literature related to the research topic was studied. The appropriate criteria for evaluation were determined, and the methods and tools used to solve the study problem were studied. The research gap, similarities, and differences between this study and previous studies were identified as well. Details are shown in sec. 2.

At the third stage, based on the decision tree outlined in the second sec., the questionnaire tool was built consisting of four main domains in the second level, twenty-five sub-criteria in the third level, and eighteen sub-criteria in the fourth level. To facilitate experts' understanding, these criteria were translated into Arabic; a simplified description was presented on each measure. Secondly, this study developed a draft on the development of green hotels criteria. Thirdly, this study set an expert questionnaire to verify the goodness of fit of the prototype structure and revised it as a scale on the assessment of the importance as perceived by them. Then, the questionnaire has been sent by email in its Arabic verified version to the experts.

In the second sub-stage, the panel of experts (Research Subjects) was identified; the number of invited experts to assess the importance of criteria was reflected best and complied with earlier recommendations, which required 10 to 50 subjects; if these experts are homogenous, the minimum necessary number is in the range of [10-15] [25,26]. This study invited 13 experts; the invitees were experts in hotel management who are incredibly familiar with sustainability in tourism, have participated in pertinent and closely connected concerns and activities for more than ten years, and have paid great attention to the study topic. A response rate of 100% was achieved in this study from all experts' panel members (thirteen experts).

At the fourth stage, firstly, to summarize the concept of the FDM implemented and to obtain the kind approval of the selected 13 experts, they were communicated via mobile calls. Then, questionnaires containing 42 sub-criteria were distributed to them between Sep. and Dec. 2020. Experts were asked to determine their importance level for each criterion using a five-point Likert scale (for further FDM analysis, the equivalent fuzzy-based scaling system was defined as shown in table 1). All questionnaires were delivered to the primary researcher by hand.

Table 1. Scaling levels

Five point Likert scale	Fuzzy Delphi Scale
5. Very strongly important	(0.6,0.8,1)
4. strongly important	(0.4,0.6,0.8)
3. Important	(0.2,0.4,0.6)
2. Weakly important	(0,0.2,0.4)
1- Not important	(0,0,0.2)

Secondly, to classify the investigated criteria (at the fifth stage), a procedure has been used to define the classification classes and scopes. Table (2) shows the Likert scale-based classification scores and their fuzzy equivalents agreed by the experts to categorize these investigated criteria by their



importance scores into the four classes of significance.

Table 2. Classification criteria

Sign. class, Sign	Likert Score	FDM Score
Absolutely Significant (VH)	$W \geq (4.5)$	$W \geq (0.7)$
Very strongly Significant (H)	$(4.3) \leq W < (4.5)$	$(0.66) \leq W < (0.7)$
Strongly Significant (MH)	$(4) < W < (4.3)$	$0.60 < W < (0.66)$
Significant (LH)	$W < (4)$	$W < (0.60)$

Thirdly, to determine the importance of criteria, the Fuzzy Delphi Method (FDM) was applied; it integrates the classic Delphi method with fuzzy set theory to solve the limitation of humankind's vagueness. This study used the concept of membership function (MF) to translate the experts' Likert scale recorded responses and integrate their judgment. The values ranged between zero and one. The lower the preference level of an expert was, the closer to zero the MF value was. And the higher this level was, the closer to one the MF value was.

Each recorded response had three values to consider, namely the average minimum value (n1), most reasonable value (n2), and the maximum value (n3). Then, The fuzzy scores were averaged as indicated by m1, m2, and m3 values for the next defuzzification process. The defuzzification process is used in this study to compute the aggregate MF value of really examined criteria and to decide whether to Keep or reject specific criteria according to their overall aggregated

importance score. These scores are calculated by dividing the sum of values (m1,m2,m3) by 3.[25].

This study used three prerequisites to be fulfilled to determine the acceptability of the green hotels sub-criteria, if the threshold value of sub-criteria ≤ 0.2 , (2) experts agreement on evaluated sub-criteria $\geq 75\%$, [27,25], and (3) Ranking and classification of criteria. By applying the presented above procedures, All the sub-criteria within the four green hotels categories (A, B, C, and D) had scored Likert scoring (LS) of three to five, which was in the scale of middle important to highly important. The detected average values of LS (ALS) were between [3.33 and 5]. The Likert scores were converted into fuzzy numbers. FDM analysis was made; the first requirement was satisfied whereby all 42 sub-criteria had threshold value (Th v) ≤ 0.2 . Values between [0.03 and 0.1] were perceived. For the second requirement (expert consensus (EC) on the evaluated sub-criteria), five criteria (12%) - Three criteria (23%) from the first category "A" and two criteria (22%) from the second category "B"- had expert consensus equal 92%. All other measures (88%) have expert consonance of 100%. So, all sub-criteria fulfilled the first two requirements. Tables 3-1 to 3-4 illustrate these results in detail.

And finally, The third requirement was used to rank the sub-criteria within the four main performance criteria by calculating the average fuzzy numbers (FS) and classifying them into four significant categories by the previously defined classification criteria (Table 2). The ranking and classification results shown in Fig. 2, and the brief description of the last two methodological stages, will be provided in the following sections.

Table 3.1. FDM analysis results for the first category of criteria (A)

SC	A1	A2	A3	A4	A5	A6	A7.1	A7.2	A7.3	A7.4	A8	A9	A10
ALS	4.8	4.85	4.23	4.46	4.46	4.08	4.00	4.08	4.08	4.08	4.23	4.31	4.23
Th. V	0.05	0.05	0.07	0.10	0.10	0.06	0.06	0.06	0.06	0.03	0.07	0.09	0.07
EC(%)	100	100	100	100	100	92	100	92	92	100	100	100	100
FS	0.77	0.77	0.65	0.69	0.69	0.61	0.6	0.62	0.62	0.62	0.65	0.66	0.65

Table 3.2. FDM analysis results for the second category of criteria (B)

SC	B1	B2	B3	B4	B5	B6	B7	B8	B9
ALS	4.08	4.77	4.15	4.08	4.46	4.23	4.77	4.38	4.31
Th. V	0.06	0.07	0.05	0.06	0.10	0.07	0.07	0.09	0.09
EC()	92	100	100	92	100	100	100	100	100
FS	0.615	0.753	0.630	0.615	0.692	0.646	0.753	0.676	0.661

Table 3.3. FDM analysis results for the third category of criteria (C)

SC	C1	C2	C3	C4
ALS	4.69	4.69	4.00	4.00
Th. V	0.09	0.09	0.03	0.03
EC(%)	100	100	100	100
FS	0.738	0.738	0.6	0.6

Table 3.4. FDM analysis results for the fourth category of criteria (D)



SC	D1.1	D1.2	D1.3	D1.4	D2.1	D2.2	D2.3	D2.4	D2.5	D2.6	D3.1	D3.2	D3.3	D3.4	D3.5	D3.6
ALS	4.46	4.77	5.00	5.00	4.00	4.00	4.77	4.38	4.38	4.31	3.46	3.38	4.23	3.31	3.31	3.23
Th. V	0.10	0.07	0.00	0.00	0.03	0.03	0.07	0.09	0.09	0.09	0.10	0.09	0.07	0.09	0.09	0.07
EC(%)	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
FS	0.69	0.75	0.80	0.80	0.60	0.60	0.75	0.67	0.67	0.66	0.49	0.48	0.65	0.46	0.46	0.45

C	FS	FS (%)	Rank	Sign.Class	C	FS	FS (%)	Rank	Sign.Class
A1	0.76923	2.82%	2	VH	C1	0.73846	2.70%	5	VH
A2	0.76920	2.82%	3	VH	C2	0.73846	2.70%	5	VH
A3	0.64615	2.37%	11	MH	C3	0.60000	2.20%	15	LH
A4	0.69231	2.54%	6	H	C4	0.60000	2.20%	15	LH
A5	0.69231	2.54%	7	H	D1.1	0.69231	2.54%	7	H
A6	0.61538	2.25%	13	MH	D1.2	0.75385	2.76%	4	VH
A7.1	0.60000	2.20%	15	LH	D1.3	0.80000	2.93%	1	VH
A7.2	0.61538	2.25%	13	MH	D1.4	0.80000	2.93%	1	VH
A7.3	0.61538	2.25%	14	MH	D2.1	0.60000	2.20%	15	LH
A7.4	0.61538	2.25%	13	MH	D2.2	0.60000	2.20%	15	LH
A8	0.64615	2.37%	11	MH	D2.3	0.75385	2.76%	4	VH
A9	0.66154	2.42%	10	H	D2.4	0.67692	2.48%	8	H
A10	0.64615	2.37%	11	MH	D2.5	0.67692	2.48%	8	H
B1	0.61538	2.25%	14	MH	D2.6	0.66154	2.42%	10	H
B2	0.75385	2.76%	4	VH	D3.1	0.49231	1.80%	16	LH
B3	0.63077	2.31%	12	MH	D3.2	0.47692	1.75%	17	LH
B4	0.61538	2.25%	14	MH	D3.3	0.64615	2.37%	11	MH
B5	0.69231	2.54%	7	H	D3.4	0.46154	1.69%	18	LH
B6	0.64615	2.37%	11	MH	D3.5	0.46154	1.69%	18	LH
B7	0.75385	2.76%	4	VH	D3.6	0.44615	1.63%	18	LH
B8	0.67692	2.48%	8	H					
B9	0.66154	2.42%	9	H					

Fig 2: The ranking and classification results of Performance Criteria for Hotels and Accommodations using FDM

4. ANALYSIS AND DISCUSSION OF THE RANKING AND CLASSIFICATION RESULTS

The results show that, from the experts' point of view, the ten most important criteria, which represent (24)% of the total criteria [fig 3], do not belong to a specific class of

sustainability fields but instead included two criteria from each of the four areas (except the fourth environmental field, where four of the criteria for this field were classified within this category), as they were distributed by (20, 20, 20, and 40) present over the four areas (D) respectively, representing (15, 22, 50, and 25) percent of the number of criteria for those fields, respectively (fig. 4).

	Total number of criteria	N/ total number of criteria(%)
Absolutely Significant (VH)	10	24%
Very strongly Significant (H)	10	24%
Strongly Significant (MH)	12	29%
Significant (LH)	10	24%
Total	42	100%

Fig 3: Criteria and their importance classification



	Total number of criteria	Selected criteria (N)	Selected criteria (%)	N/ total number of selected criteria (%)
A	13	2	15%	20%
B	9	2	22%	20%
C	4	2	50%	20%
D	16	4	25%	40%
Total	42	10		100%

Fig 4: Criteria and their distribution within an absolutely significant category of criteria

	Total number of criteria	Selected criteria (N)	Selected criteria (%)	N/ total number of selected criteria (%)
A	13	3	23%	30%
B	9	3	33%	30%
C	4	0	0%	0%
D	16	4	25%	40%
Total	42	12		100%

Fig 5: Criteria and their distribution within very strongly significant category of criteria

	Total number of criteria	Selected criteria (N)	Selected criteria (%)	N/ total number of selected criteria (%)
A	13	7	54%	70%
B	9	4	44%	40%
C	4	0	0%	0%
D	16	1	6%	10%
Total	42	12		100%

Fig 6: Criteria and their distribution within a strongly significant category of criteria

	Total number of criteria	Selected criteria (N)	Selected criteria (%)	N/ total number of selected criteria (%)
A	13	1	8%	10%
B	9	0	0%	0%
C	4	2	50%	20%
D	16	7	44%	70%
Total	42	10		100%

Fig 7: Criteria and their distribution within a significant category of criteria

These results have many indications, as they confirm the two implicit hypotheses of the study, which are that there are differences between the level of importance of the study criteria and that all areas of sustainability and its objectives (the four categories) are combined, regardless of whether they serve the institutional, social, cultural, or environmental aspect. On the other hand, these results indicate the importance and role of the selected criteria in achieving sustainability and their relevance to the reality and the applied environment in Yemen, the objectivity of the evaluation committee and its broad perception, and its familiarity with the importance of the four aspects of sustainability in this area.

The results also indicate that taking measures that enable reducing energy consumption, making efforts to shift towards the use of renewable energy (D1-3), as well as working on assessing water risks, consumption, and following appropriate measures to reduce its consumption, and searching for sustainable sources that do not affect the sustainability of this vital resource (D1-4), which received the highest level of importance (0.8), are considered two critical factors for sustainable planning in hotels, and this is in line with the recommendations of local studies[28,29], whereas, Yemen

suffers significantly from a lack of these resources and ineffective management methods, and need to follow appropriate procedures for the sustainability of these two suppliers in all institutions. The results also indicate the importance of implementing a sustainability management system applicable to the size and scope of hotels in the long term (0.77), taking into consideration environmental, social, cultural, economic, quality, human rights issues, health and safety issues, risks and crisis management in a manner that helps achieve continuous improvement (A1). It also stresses the importance of its acquiescence with all viable local, national and international regulations and legislation (0.77); This includes the aspects of health, safety, work and the environment (A2) and this is in line with the findings of previous studies and does not contradict with logic either, as it is not possible to implement sustainable practices in any sector without implementing these two basic requirements of sustainability requirements [30,31].

The results also indicated that the factors (B2, B7, D2-3, D1-2.), which aim to give the local population equal opportunities for employment and advancement, including in managerial positions (B2); And to ensure respectful work rights, provide a safe and healthy work environment, remunerative salaries



for employees, and training, development and promotion opportunities for employees. (B7); to carefully manage the purchasing process of consumer goods by selecting disposable goods, including food, to reduce waste (D1-2); and to effectively treat and recycle wastewater and discharge it without harming the local community and the environment (D2-3), are also critical factors (0.75). This importance can be explained by the sustainable and effective role these factors can play if Yemeni organizations commit to implementing them. Equal employment opportunities have a significant impact on employees' rights [32] and their ability to access adequate social protection. It is also a way out of poverty, especially in an imperfect society such as Yemen [33]. A decent work environment provides adequate job opportunities, fair wages, and social protection for families, better possibilities for individual development and social inclusion, and space for individuals to express their concerns, contribute and take part in making decisions that impact their lives, and achieve equal opportunities and equal treatment for men and women [34]; Through effective purchasing process, the generation of harmful and persistent waste can be reduced or eliminated, and this supports efforts to promote a more sustainable society[35]. Treated wastewater is a strategic choice as a water resource [36], and its proper disposal enhances the healthy life of the community [37]. The study also affirmed that the contribution to the protection, preservation of local properties, historical and archaeological sites and other sites and cultural properties, and not impeding residents' access to them (C2); Follow acceptable local and international practices to manage and enhance visits to these locations (C1); They are also important (0.73) to minimize negative impacts and maximize local benefits to local communities, culture, and visitor satisfaction; this can be explained by the Yemeni society's need to take care of and preserve the heritage, culture and various tourist sites, and the deteriorating economic situation that needs to develop specific strategies to attract the largest number of visitors and gain their satisfaction and leads to many social, economic and environmental benefits, directly or indirectly [38,39]

Within the scope of the fourth group which represents the least appropriate, relevant, and meaningful set of criteria for the reality and sustainable environment of Yemen, ten criteria also defined with a percentage equal to the rate of the first group criteria (24%), the overwhelming majority of the elements of this group (70%) were from the fourth group elements (Environmental orientation). In contrast, the rest of the ingredients were distributed to the third and first groups in a ratio of (2:1), and the elements of this group formed (8, 50, 44) percent of the criteria in the first, third, and fourth fields (fig 5, 6, and 7). It is also noticed that the social sphere issues were excluded from the classification within this group.

This result has several implications, the most prominent of which is that the elements included in it, despite their sustainable importance, are not commensurate with the hotel sector's practices. Therefore the beginning requires that the focus in the upcoming planning processes be focused on the highest returns' elements or achieve maximum benefit. Perhaps the social aspect (B) and organizational (A) constitute the approach of the highest priority; it must be noted here also that classifying these elements within this category does not mean neglecting them but looking at them in future stages.

5. CONCLUSION AND FUTURE WORK SCOPING

Green hotel is one of the modern forms of sustainability in the tourism sector. Selection and adapting the accurate and appropriate performance criteria in this sector's organizations contribute to achieving many social, economic, and environmental benefits for all local communities, host organizations, and visitors. This study aimed at determining the most important green performance criteria. This study classified a number of 42 performance criteria according to their sustainability importance for Yemen's hotel sector. Three importance categories were defined. The high important category included 10 criteria: " Sustainability management system", " Legal compliance", " Local employment", "Decent work", "Cultural interactions", "Protecting cultural heritage" , "Efficient purchasing" , "Energy conservation", " Water conservation", "Wastewater" and "Solid waste". The second, third, and fourth categories included by 10,12 and 10 criteria. The performance criteria for green hotels developed in this study were the results of experts' consensus. They can be provided as a reference for decision-makers and managers of the Yemeni hotels to promote sustainability planning and design in the hotel sector, as well as used as the criteria for developing detailed indicators for assessing sustainability practices effectiveness in hotels. The positive in this regard is that researchers presented the results of this study to the decision-makers in the Al-Alamiah Group of Companies, which is the leading company in the field of hotels in Yemen. It was met with great approval. Accordingly, in future research trends, authors firstly plan to study and compare the impact of this method and other MCDM methods such as AHP and Fuzzy AHP on a ranking and classification decision of this MCDM model and select the best alternative for application. Secondly, complete the implementation project and evaluate the sustainability practices in the hotels of this group by studying the detailed indicators of the most important factors, determining their relative importance from the reality of the priorities of this company, studying the reality of application, and proposing improvements, through the implementation of a series of applied research work on the institutions of this company.

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