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# Implications of BREEAM Sustainability Assessment on the Design of Hotels

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**Abstract:** This original research paper analyses the actual and important topic of the implications of BREEAM sustainability assessment on the design of hotels and it is a personal response to “The Agenda 2030 for Sustainable Development” and its influence on the Tourism and Hospitality Industry. The paper aims to examine the influence of the sustainable assessment method BREEAM on the design of hotels by using seven case studies and studying the changes that were implemented in order to achieve their targets. Qualitative data were obtained by conducting in-depth interviews and analyzing the supplied documentation. The authors notice that the results revealed that a BREEAM approach might limit the design of the hotels but, including the right measures at the early design stage of the project, the target can be easily achieved.

**Keywords:** hospitality; hotels; sustainable assessment; BREEAM methodology; green hotel

## 1. Introduction

Over the past decades, sustainable development has become very important in every economic sector but especially in the Construction and Tourism sectors [1]. Tourism is one of the most powerful drivers of development for the world economy and in particular, international tourism has been considered as a tool for development in emerging economies. Developing countries are leaders in including sustainability procedures for building and hotels are becoming more eco-friendly by including environmental standards in their design, architecture and management [2,3].

Hotels are key in this process of sustainability; in places where tourism is the main contributor to GDP (Gross Domestic Product), the addition of a sustainable design and sustainable certifications for new buildings and renovations is crucial [3]. For a decade, the Hospitality sector has been pressured to include environmental strategies and reduce the carbon footprint by government legislation, in order to minimize its impact on the environment [4,5].

Despite its involvement in sustainability, there is not much research on what is the best way to approach a “green hotel” and how the design can be affected by including sustainable measures [6]. This article is organized into three main sections. The first offers a brief overview of the impact of the Agenda 2030 on Tourism. The second exposes the existing literature about the importance of sustainable certificates on the Hospitality Industry and the background of one of the first sustainable European building assessment methods applicable to residential and commercial buildings, the Building Research Establishment Environmental Method (BREEAM) [7]. The last part aims to analyse by a qualitative method the impact of BREEAM on the design of hotels.

### *Impact of 2030 Agenda on the Tourism*

In 2015, the Heads of State and Government of 193 countries met at the 70th General Assembly of United Nations and approved the resolution of “The 2030 Agenda for Sustainable Development”. This plan is call to action to protect our planet, end poverty and improve the lives and prospects of everyone. The 2030 Agenda sets out 17 Sustainable Development Goals (SDGs) and 169 targets to be achieved by 2030 that are considered at the moment a global emergency to mitigate and balance the three dimensions of sustainable development, the economic, social and environmental [8,9]. This plan must be implemented entirely and as a whole, as all the different goals and targets are related to each other. The United Nations Resolution states that in order to achieve the completion of the SDGs, all the nations must take responsibility. The European Union has played an active role and will implement the 2030 Agenda internally and globally in cooperation with partner countries [10].

The UNWTO (World Tourism Organization) establishes that tourism contributes directly or indirectly to the achievement of all SDGs and in particular, it is included as a target in the Goals 8, 12 and 14 [8,11].

- SDG 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. According to a study from WTTC (World Travel and Tourism Council), Travel and Tourism was the sector with the fastest growth in 2018 (3.1%), ahead of the Construction (2.8%) and Banking (2.6%) sectors. In addition, Travel and Tourism sustained a total of 319 million jobs across the world and induced 10% of all jobs, exceeding the impacts of the Financial, Health and Banking sectors, among others [2,3]. The contribution of the Tourism sector is specified in Target 8.9 “By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products” [8].
- SDG 12. Ensure sustainable consumption and production patterns. Tourism can play an important role in the evolution of a green economy and inclusive growth [2]. If the tourism sector adopts sustainable consumption and production practices (SCP), it can significantly accelerate the shift to a more sustainable planet [11]. The One Planet Sustainable Tourism Programme has the objective to improve the sustainable development impacts of tourism by promoting SCP that use natural resources and produce less waste [12]. The inclusion of “green hotels” is key for this goal. Clients are experiencing an awareness of environmental damage and the addition of sustainable measures in hotels is becoming a very important factor for their design [13].
- SDG 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development.

Coastal and maritime tourism are tourism’s biggest segments. It is specified in target 14.7 that “by 2030, increase the economic benefits to small island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism” [8]. Small Island Developing States (SIDS) rely on healthy marine ecosystems. Integrated Coastal Zone Management must include tourism development to preserve fragile marine ecosystems and promote a blue economy [11].

## **2. Literature Review**

### *2.1. The Importance of Sustainability Certifications for the Hospitality Industry*

In 1993, the World Tourism Organisation (UNWTO) put forward the concept of Sustainable Tourism Development. In 1995, United Nations Educational, Scientific and Cultural Organization (UNESCO), United Nations Environment Programme (UNEP) and UNWTO held in Spain the first World Conference on Sustainable Tourism and the Charter for Sustainable Tourism was adopted in this meeting. Since then, Sustainable Tourism has occupied a dominant position in the Tourism industry [14,15]. Although the UNWTO has established that tourism contributes to the completion of

the SDGs [10], the Hospitality industry faces the challenge of determining which of the 17 SDGs and associated targets are its priority [16].

Widely, the building sector accounts for one third of energy-related carbon emissions [17,18]. In the UK, buildings are responsible for half of the carbon emissions, half of the water consumption, one third of the landfill waste and one quarter of all raw materials used in the economy [19]. Hotels' users consume a great amount of water and energy at the same time that generates an important amount of solid waste and effluents on a daily basis [20], but hotels may have a significant and positive impact on the environment by changing some of their management and design aspects. Customers have radically changed their attitude towards adopting environment-friendly practices and as a result, hotels cannot ignore their environmental and social responsibilities [13,21]. For this, many hotels are now in the process of becoming "green hotels", but it has been demonstrated that most of them only focus on small changes such as reusing linen and towels [22,23]. A green hotel must operate according to the principles of green hospitality; this does not mean planting some trees in front of it, but being environmentally friendly, implementing waste management systems, recycling, and saving in water and energy, among other procedures [24].

The guests expect the implementation of more sustainable and eco-friendly practices such as water conservation, energy efficiency and proper waste division [25,26] and this approach should be incorporated from the planning stage to the demolition phase of the building. A green building must be designed as a whole and covers all the phases such as design, construction and operation [27].

As it has been studied before, the term smart tourism is closely related to the application of new technologies [28,29]. They propose to rethink the traditional approach to tourism and include the latest technology such as smartphones and tablets in its planning and programming. New technologies can enhance tourism in different ways; several studies demonstrate that hotels display, on the internet, their certificates and environmental practices to show their customers their awareness of the environment [30,31]. Studies indicate that the application of environmental procedures and their consequent certifications can improve the image of the company and its operating performance [32]. As a consequence, environmental assessments of buildings have become one of the most important steps in the sustainable built environment [5,7,33]. The European Union Energy Performance of Buildings Directive (EPBD) [34] and the UK Climate Change Act of 2008 set sustainable buildings on the UK policy agenda; since then, a wide variety of tools have been developed to assess and help construction projects, and BREEAM is one of the most successful of these tools [35].

## 2.2. Background of BREEAM Assessment

At first in the UK and now worldwide, BREEAM is leading the list of sustainability assessments; between 2013 and 2017, over 10,800 certified assessments were issued at both the Design and Post-construction stage [36]. The method was launched in the UK in 1990 by the Building Research Establishment (BRE); it was initially designed to focus predominantly on environmental aspects [33,37], but in the past decade it has also highlighted economic and social aspects. It has been applied in 77 countries [7,38].

BREEAM considers ten categories to measure sustainable value, including management, health and wellbeing, energy, transport, water, materials, waste, land use and ecology, pollution and innovation [38]. Each of these categories is divided into a range of assessment issues with its own target, aim and benchmarks.

A BREEAM assessor will determine when a target or benchmark is reached and will award with score points or credits as per Table 1, then these are weighted and aggregated on a scale of outstanding, excellent, very good, good, pass and unclassified [38], as shown in Table 2.

**Table 1.** BREEAM Environmental section weightings.

Environmental Section	Weighting (%)			
	Fully Fitted Out	Simple Building	Shell and Core Only	Shell Only
Management	11	7.5	11	12
Health and Wellbeing	14	16.5	8	7
Energy	16	11.5	14	9.5
Transport	10	11.5	11.5	14.5
Water	7	7.5	7	2
Materials	15	17.5	17.5	22
Waste	6	7	7	8
Land Use and Ecology	13	15	15	19
Pollution	8	6	9	6
Total	100	100	100	100
Innovation (additional)	10	10	10	10

This weighting system is defined in more detail within the BRE Global Core Process Standard (BES5301).

**Table 2.** BREEAM rating benchmarks.

BREEAM Rating	% Score
Outstanding	≥85
Excellent	≥70
Very Good	≥55
Good	≥45
Pass	≥30
Unclassified	<30

BREEAM is regularly updated to ensure it meets the requirements for building sustainability and it is used for public and private projects, applicable to residential and commercial buildings [7]. In some cases, it is a mandatory requirement to satisfy certain planning conditions or regulations, particularly for the public sector projects. In other cases, it is used voluntarily to earn recognition due to its international prestige [33], and it is highly valued when it comes to indicate the carbon emissions of commercial buildings.

It has been demonstrated that hotels and tourism benefit from the application of sustainable assessments such as BREEAM [32]. In addition, the method has shown its support to the SDGs and the Agenda 2030 and has demonstrated how and where the BREEAM family of standards and tools support the SDGs [39]. It has highlighted its significant contribution to meeting the following goals [8]:

- SDG 3. Ensure healthy lives and promote well-being for all at all ages.
- SDG 6. Ensure availability and sustainable management of water and sanitation for all.
- SDG 7. Ensure access to affordable, reliable, sustainable and modern energy for all.
- SDG 9. Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation.
- SDG 11. Make cities and human settlements inclusive, safe, resilient and sustainable.
- SDG 12. Ensure sustainable consumption and production patterns.
- SDG 13. Take urgent action to combat climate change and its impacts.
- SDG 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

Despite its importance, little research has been conducted about the effects the application of this sustainability assessment method might have on the hotel's design and management process. Holmes and Hudson [40] examined how BREEAM affects the design of an office building but the method has been through many changes since this study was taken and they focused more on the perceived value of the method than its design effects. Lowe and Watts [41] analysed the benefits of implementing BREEAM on a two storey medical centre development but this research was focussed

on the financial implications of the method. Fenner and Ryce [42] compared BREEAM with the LEED method, analysing their limitations in current practice, but this research did not focus on the design aspect. Several studies taken from Haroglu and Schweber [33,35,43] analysed the implication that BREEAM might have on the design process although these studies used different types of buildings as case studies such as educational, commercial, residential and healthcare. Mengxue Lu [7] compared four rating tools: BREEAM, Leadership in Energy and Environmental Assessment (LEED), Green Star and Building Environmental Assessment method (BEAM Plus), and concluded that all of them were similar, covering the same environmental aspects, in terms of energy audit. The carbon audit, however, was not a common investigation focus in any of them.

This paper examines how the implementation of BREEAM impacts on the design of hotels and their management processes and demonstrates the changes that have occurred to the projects in a specific context as a result of the assessment. The intention of the study is not to generalize across specific design features of the hotels but rather to provide a general understanding of the influences and impact that the BREEAM method might have on the hotels' design stage. Due to the lack of research on this field and its importance in Tourism and Hospitality, this study examines the impact of the BREEAM assessment method on the design process of seven hotels in the UK.

### 3. Methodology

This study uses a qualitative method of analysis. The qualitative approach to research seeks to analyze the effect of BREEAM on hotels' design decisions; this is not confined to a specific phase of the projects but it comprehends the entire process from conception to completion and beyond. Although some researchers have investigated before about sustainable assessments and specifically BREEAM, little research has been focused on the implications that the method might have on the design of buildings [30,32,40] and no prior research has been found where the case study was a hotel. Hence, the study presents this limitation and the need for further development in this area of research. In addition, the qualitative method used in the research is based on human experience and is dependent on the individual skills of the researcher and the people interviewed.

In the present study, a number of specialized Hospitality professionals, both architects and architect technicians, were selected based on their level of expertise in the field and quality of hotels produced during their careers. All of them are Hospitality focused and the main people responsible for the selected projects of this study. They offered a variety of hotel projects assessed under BREEAM. In total, 7 case study hotels were selected, each of them with different characteristics, stages and BREEAM targets. As a context, all of the hotels are based in the UK due to the importance of this method there.

Architects and architectural technicians responsible for the design of the buildings were interviewed. The interviews were undertaken during April and May of 2020 and, due to the worldwide pandemic of COVID 19 and the mandatory lockdown in the UK during these months, it was not possible to do the interviews face to face. Hence, they were done via Yealink Meeting Server with each technician and architect. Each interview lasted an average of 30 min per project and they were recorded with Windows 10 Screen Recorder. The collection of data was also supplemented with documentation provided by the designers including plans and elevations, BREEAM assessments, planning decision notices and relevant information from several professionals that influenced in the design process of the hotels, with all of the information in pdf format. In Table 3, the details of the selected cases are shown such as the stage of the project, number of rooms, number of storeys and BREEAM target and final score. For confidentiality, the projects are named under the headings A, B, C, D, E, F and G.

**Table 3.** Case study hotel projects.

Case Studies	Stage	N° Rooms	N° Storeys	BREEAM Target	BREEAM Final Score
A	Completed	216	5	Excellent	Excellent
B	Completed	302	7	Very Good	Very Good
C	Under construction	82	9	Very Good	On going
D	Completed	339	42	Excellent	Outstanding
E	Under construction	456	13	Excellent	On going
F	Under construction	153	9	Very Good	On going
G	Under construction	329	19	Very Good	On going

## 4. Results

An extensive amount of data was collected from the interviews about the influence that the BREEAM assessment method has on various aspects of the hotel design. This section includes two parts, the first is a description and a brief of the information obtained from the architects and technicians about the required changes during the design process of each case study. The second part exposes the key design changes extracted from the interviews that were crucial in all the cases.

### 4.1. General Description of Case Studies

In case study A, the client was very interested in getting a BREEAM Excellent score and it finally achieved the highest ever BREEAM score for a hotel in the UK. The building is now utilising a range of low energy technologies to reduce its energy demand and generates its own energy supply, delivering an 87% reduction in CO<sub>2</sub>. The negotiation process with the assessor involved many changes in the project, mainly in the Mechanical and Electrical designing phase, where the assessor asked for bigger plant rooms and more plant areas in addition to several systems that were needed to achieve the credits. It was required to incorporate a number of sustainable construction techniques including enhanced isolative building elements and a sustainable surface water drainage system. In addition, the hotel harvests rainwater, which is used to serve the toilets in the building and to water the external landscaping areas. Increasing the size of cycle store was also needed; the technician explained that this is very common practice when working on a BREEAM project since it is an easy way to get the number of credits required and usually it does not impact excessively the design of it. Finally, the designers had to increase the size of the refuse store as a result of accommodating more numbers of bins and also provide an external bin store. The materials used for this building were assessed in order to meet the Building Regulations and BREEAM criteria, resulting in a combination of brick, metal and stone cladding.

Case study B was a regeneration and further extension of an existing historical building; as a result, the design process required special attention in this case. The hotel is located in the city centre and had a planning requirement to achieve a BREEAM Very Good score. A pre-assessment was submitted as part of the planning application, which is the standard process for most of the buildings in the UK. The planners reviewed it and conditioned it to make sure that the score was achieved; as a consequence, certain changes were needed in order to get BREEAM Very Good as the final score. The designers had to increase the number of cycle storage spaces in the building in order to get the credits related. Under the ecology requirements, even though it was a regeneration of an existing site, the architects and technicians had to provide an enhancement. They had to include certain numbers of bat boxes housed on the roof levels designated for nesting bats. This requirement was needed under the premises that the demolition of an adjacent building was needed in order to extend the hotel and it was deemed that bats could have nested there if they wanted to, so in order to replace this, bat boxes were included. The number and size of bins were increased and, as a consequence, the refuse store was also slightly expanded to accommodate them. In regard to the building envelope, some of the windows had to be upgraded due to the fact that the acoustic requirements of BREEAM were higher than the hotel operator's requirements. The specification of the glass was changed but the size and position of the windows remained the same, so the design of the facade was not altered. Finally, the material

of the new hotel was proposed as rendered to match the existing building which, from a BREEAM perspective, is not ideal due to its characteristics but planning required it to keep the same material in order to minimise the impact of the extension.

Case study C is an existing building refurbishment and extension, it has planning approval and is currently under construction. The hotel is on the boundary on three sides and they are extending it out on the fourth side. There is no space for landscaping and the existing building has a pitched roof, so there were no opportunities for proposing green roofs, bat or bird boxes and planters at ground floor; as a consequence, the ecology credits were difficult to achieve. In order to compensate this, the BREEAM assessor advised that during the design stage, the architects should carry out an assessment to demonstrate that they were not able to provide ecological enhancements. The Mechanical and Electrical engineer presence was crucial in this hotel; although they always have an important role on the completion of BREEAM projects, in this specific case and due to the lack of ecological enhancements, the engineers had to bring new solutions to compensate this lack. The installation of flow restrictors helps to save water by limiting the flow of particularly wasteful taps and showers. The architect explained that the water consumption is always a common factor to take into account for Hospitality projects and its right management can drastically change the running cost of the hotel. Finally, to meet BREEAM acoustic requirements, the technicians had to enhance the existing glazing by adding a secondary glazing. At the moment, they are on target for achieving BREEAM Very Good.

Case study D is a highly sustainable skyscraper building with a small footprint and 42 floors. It had a planning requirement for a BREEAM Excellent but it finally achieved an Outstanding, the highest BREEAM rating available at the time of completion. Ecology had a major impact on the project. Solar panels and a green roof were included in addition to beehives on the 39th floor to produce honey for guests. On the lower levels, bat and bird boxes for nesting were also incorporated. In addition, due to the small footprint of the building, it was impossible to include a cycle store within it, so a separated external cycle store was designed with a green roof and green walls under the recommendations of the ecologists. Finally, it is important to mention that the mechanical system of the hotel has a vital importance in this project. Several measures were included such as a combined heat power system that contributes to a 30 per cent reduction in CO<sub>2</sub> emissions and light regulation system that adjusts the level of light according to the time of day and season. In addition, waste management is crucial in this case; the hotel recycles cooking oil, general waste, soap and bottled bathroom products. Moreover, it uses eco-friendly products from local suppliers.

Case study E has planning approval and is currently under construction. In this project, there were no planning requirements for BREEAM but the client founders had a BREEAM target of Excellent; they requested the BREEAM assessment method to help to reduce the running cost of the hotel. The architect explained that the energy and water consumption in hotels is massive so by including some procedures that will reduce the impact of that, the benefits will be higher for the owners. As well as that, one of the hotel operators also had, as an employee requirement, the achievement of BREEAM Very Good for their projects, so although in this case it is a lower target than the founder's, it is still important to take into consideration. The pre-assessment of the project is done and the building has a potential target of 79% score for BREEAM Excellent, higher than the 70% minimum score needed so it is highly possible that the project will achieve the targeted score. In this case study, they also had to increase the cycle and bin stores' sizes in order to achieve the credits needed. For the ecology requirements, the designers had to include a total of 65 square metres of planting distributed on three separate roof levels as a consequence of filling the site completely by the building at ground level. The ecologists made a report with their requirements and due to the lack of space for planting, the landscape architect had to include all these planters on different levels of the building to achieve the needed credits. Internally, the architects had to increase the thickness and specifications of the partitions to meet BREEAM acoustic requirements. The technicians had to enhance the glazing specifications for some of the external windows due to the fact that the operators had some requirements for the windows and, in some instances, BREEAM was above them so they had to upgrade the windows in

order to achieve the acoustic requirements. The architect explained that one of the hotel operators had very strict thermal requirements, which were well above Building Regulations and BREEAM requirements so the insulation of the building did not need any adjustment to meet the credits. Finally, an adaptability study was needed, which is a document that studies the spatial, structural, and service strategies of the building and analyzes the malleability of it in response to changing operational parameters over time [44]. The study proved that the hotel will be able to change its use if needed, mainly because it is built in lightweight partitions and blade columns.

Case study F is under construction at the moment. This project comprehends two buildings in the same site, a refurbished existing office building and a newly built hotel with some affordable accommodations included. Due to there being three different uses sharing the site, planning required three separated permanent cycle stores and temporary short-term cycle storage. The temporary cycle store had to be increased as the BREEAM assessor recommended. In this case, it was a planning requirement to increase the number of bird and bat boxes that the ecologists advised, so BREEAM did not influence this decision. Since the hotel is a new building, the designers decided to go for blade columns and lightweight partitions to facilitate the adaptability of the building if it changes its use, so BREEAM rated this positively.

Case study G has planning approval and it is under construction; it has planning and operator's requirements for BREEAM Very Good. There is a planning condition that it must get this targeted score, so a pre-assessment was done in the first place to study the best way to meet this requirement. As in the previous case studies, the main changes were the bin and cycle stores and the inclusion of planters at ground floor level around the building. After a few discussions with the ecologists, some of the planters were omitted as they contained trees that are no longer proposed; the architect explained that this aspect is being revised at the moment. Currently, the design and illuminance of external lighting, including the hotel signage, has been highlighted by the assessor to take into consideration in order to reduce future risks of non-conformance. A lighting assessor will revise these and recommend the best solution; as a consequence, it will have a minor impact on the external design.

#### *4.2. Key Design Changes*

Several changes were needed during the design process of the described projects. The key changes applied to the buildings explicitly to obtain the required BREEAM credits and under the instructions of the BREEAM assessor have been identified below. In addition to these changes, the presence of the Mechanical and Electrical engineer is crucial for the design of the hotels. As it has been demonstrated, hotels are linked to produce high levels of water consumption; people tend to consume more water when they stay in hotels than in their homes [45,46]. Implementing the right strategies, technologies and innovation measures help the hotels to reduce their water consumption drastically [47]; case studies C and E included water management systems. The key design changes can be classified under three main groups: upgrade through layout amendments, upgrade through performance and upgrade through additions. On the other hand, Haroglu [33] classified the key design changes under three main areas: building features, materials and water services.

##### *4.2.1. Upgrade through Layout Amendments*

These changes were related to both internal and external amendments of the layout.

The increase in the cyclist facilities in order to house a greater number of cycles is a common factor in all the case studies. This amendment falls under the Transport section and credits are given with the adequate provision of cyclist facilities to promote exercise and help to reduce congestion and CO<sub>2</sub> emissions [48]. It is a relatively easy way to get BREEAM credits and does not have a major impact on the layout.

Another key change that was required in the case studies A, B, E and G was the enlargement of the bins storage areas due to increase in the number of bins; this amendment falls under the Waste section. With the provision of dedicated storage facilities, BREEAM aims to promote sustainable



waste management and divert recyclable waste from landfill or incineration [49]. With an inefficient management programme, hotel owners pay twice for their waste, one is in the form of packaging and the other is for their disposal. It has been demonstrated that around the 30% of a hotel's solid waste can be recycled and reused [50].

#### 4.2.2. Upgrade through Performance

A different category of measures that can be applied to improve the efficiency of the hotels, especially for refurbished and existing buildings, are those related to the performance of their components.

In case studies B, C and E, the architects had to change the type of windows by upgrading the glazing specifications and also, in case study E, they had to increase the thickness of the partitions to meet BREEAM acoustic requirements. These are associated with the Acoustic performance subcategory of the Health and Wellbeing section of BREEAM [51]. In this same section, the team involved in case study G are working on the enhancement of lighting impact to ensure artificial lighting is considered at the design stage to minimize its impact [52].

#### 4.2.3. Upgrade through Additions

Finally, there are specific elements that help to obtain the BREEAM target score and will help with the completion of a sustainable or green hotel. Mostly two main categories can be classified in this group, Energy and Land Use and Ecology.

Under the first category, solar panels are an immediate response when working on a sustainable hotel as happened in our case study D. BREEAM promotes the reduction in atmospheric pollution and carbon emissions and encourages local energy generation taken from renewable sources [53].

Certain actions are adopted to enhance the ecology of the site. These fall under the Land Use and Ecology BREEAM category, specifically under the subcategory Enhancing site ecology [54]. The installation of bird and bat boxes at strategic locations on the site was a measure used in case studies B, D and E. Planters with native species or that are beneficial to local wildlife were distributed on different levels of the hotels in case studies D, E and G. Lastly, case study D has a green roof that improves air and water quality and creates a wildlife habitat.

### 5. Discussion

The results obtained in this work have important implications on what is the best way to approach the design of a sustainable hotel. The details obtained from the interviews suggest that the application of the sustainability assessment method of BREEAM on the project, should be planned and done since the first stage of its design in order to facilitate the inclusion of the actions or elements recommended by the BREEAM assessor. In addition, it has been found that the inclusion of a BREEAM assessor at the very early stages of the project and the right technicians will accelerate and facilitate the execution of a green hotel. This aligns with the comments by Haroglu [33] about the significance of how the assessment process is handled and how the early involvement of BREEAM assessors can play an important role in the design. Fenner and Ryce [42] also state that the assessor's approach might have a significant effect on the clarity of the BREEAM assessment. It has been noticed that, in addition of the architects, two other professionals are key for the execution of the project under the BREEAM premises; they are the mechanical and electrical engineer (M&E), and the ecologist. These two technicians will help to adequately address the requirements that the assessor imposes on the hotel. This relates to the results of Lowe and Watts [41], which stated that the introduction of BREEAM on a construction development will cause an increment of the M&E workload, with most of the work being in the design of the systems.

The data collected from the interviews shows that the impact that BREEAM might have on the design depends on whether the hotel is existing or newly built. It has been explained by the architects that if the building is existing, both Planning and BREEAM are more flexible in qualifying the project

under the BREEAM requirements due to the difficulty of adapting an existing hotel into a green hotel. In addition, it has been extracted that specifically for hotels, the measures to be taken are common in almost all the cases. In the case of existing buildings that require a refurbishment for their new use, the most important categories to consider are Health and Wellbeing and Land Use and Ecology. In this instance, an update of the existing windows will improve the thermal and acoustic insulation conditions. In addition, the introduction of bat and bird boxes and planters will immediately add an enhancement of the ecology of the hotel. In the case of newly built hotels, the Waste and Transport categories have been a common factor in all of them. An adequate design of the project that includes enough area designated to cycle and bins stores, will help in acquiring the necessary credits to classify the project as a sustainable hotel. Again, Health and Wellbeing and Land Use and Ecology categories are very important for newly built hotels; additionally to the elements mentioned above for refurbished hotels, the incorporation of green roofs will contribute positively to acquiring the BREEAM target score. As it has been already highlighted, the inclusion of new technological and sustainable measures, such as solar panels, is also key in new buildings.

## 6. Conclusions

The present study has shown the results of the investigation of seven case study hotels in order to examine the impact that BREEAM has on their design. It was found that the sustainability assessment has a major impact on the design of these buildings and the approach for designing a BREEAM hotel might seem challenging. The main implications of the sustainability assessment were found to be in the Health and Wellbeing and Land Use and Ecology categories for both refurbished and newly built hotels but some categories, such as Waste and Transport, have a major importance for newly built hotels.

The study utilises BREEAM as the tool for measuring the sustainability of different hotels because it is the most common sustainable method used in the UK, but the results can be extrapolated and used for reference for any other hotel that aims to become more sustainable or for those newly built hotels that need to include sustainable elements in their design to be green hotels. For instance, the key changes shown in this research can be applied for newly built or refurbished hotels.

BREEAM is expected to become even more popular and international in the following years ahead. This will implicate new restrictions and measures taken to incorporate BREEAM requirements and the need for further research on this field.

While this paper makes a contribution to understanding the impact that BREEAM has on the design elements of hotels, the importance of water and waste management in hotels has been noticed. Hence, future research could seek to identify how BREEAM impacts on the water and waste management in hotels and how the right actions can enhance their performance.

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