Selection of non-financial sustainability indicators as key elements for multi-criteria analysis of hotel chains

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ABSTRACT

Nowadays, online information provided by corporate websites has a great impact on the hotel industry performance. According to existing studies, it is very likely that customers' and investors' decisions may change after consulting these portals. The environmental commitment of hotel companies is usually demonstrated to stakeholders by obtaining environmental quality certifications and eco-labels issued by specialised entities in compliance with certain requirements. However, the question of how to use the sustainable indicators that are usually scattered on the web or in company reports is a problem that requires further research. The main objective of this study is to develop a robust and reliable model to assess the sustainability of hotel chains based on the information gathered from their websites and corporate reports. A literature review is carried out and specialists are consulted to determine the critical factors that affect hotel sustainability. Once the criteria based on non-financial indicators have been chosen, they are organised in a hierarchy according to their orientation. To achieve the objective of the study, a hybrid model is proposed that includes two multi-criteria decision-making approaches, namely the Analytic Hierarchy Process (AHP) and the Technique for Order Preference by Similarity to Ideal Solution (TOPSIS) method. AHP is used to weight the criteria, and the ranking of the alternatives is provided through TOPSIS. Subsequently, a sensitivity analysis is performed to determine the critical indicators. Finally, a numerical example is carried out with a case study of the largest Spanish hotel chains to illustrate the function and applicability of the proposed method. With the results obtained, it has been possible to establish a ranking or selection of hotel chains for the case study, since the hybrid AHP-TOPSIS method provides reliable and robust results for any qualitative or quantitative evaluation criterion, which is of great interest for the different actors involved.

1. Introduction

Tourism is a particularly complex industry as it encompasses all mobility, construction, investment, distribution, and consumption activities, which in turn are interlinked with the processes involving users/customers. It is widely accepted that tourism contributes significantly to economic growth (Balsalobre-Lorente et al., 2020; Cao et al., 2021; Castro-Nuño et al., 2013; Ehigiamusoe, 2020; Pablo-Romero and Molina, 2013). The relevance of this sector in the global economy shows that the GDP of the tourism industry represents 6.1 % (2021) compared to 10.4 % (2019) of global GDP. Although there has been a significant drop due to the pandemic, the sector is still an important employment generator, providing 1 in 11 jobs in 2021 (WTTC, 2022). However, the tourism industry is responsible for using large amounts of natural resources, water, energy, and non-durable goods in its entire life cycle (Mohamad et al., 2014; Bohdanowicz, 2005; Bohdanowicz and Martinac, 2003). Gössling and Peeters (Gössling and Peeters, 2015) called it "resource use intensities (RUIs)". At the same time, they

generate waste that leads to air, water, and soil pollution, especially in the operation phase, becoming a clear emitter of carbon dioxide, which contributes to global climate change. It is estimated that the hotel industry generates around 45.0 % of all municipal solid waste among municipal facilities in the commercial sector (Han et al., 2018). Although tourism has evolved towards a more sustainable model, especially motivated by the COVID-19 pandemic, there is still much room for improvement in the direction of optimizing the balance between economic, environmental, and social dimensions (Seabra and Bhatt, 2022). According to the World Tourism Organisation's (UNWTO), international arrivals have been reduced by 70 % between 2020 and 2021 (UNWTO, 2022) and several studies, such as Palazzo et al. and references therein (Palazzo et al., 2022), mentioned that customers are preferring local destinations and to be more in touch with nature rather than travelling abroad.

International tourism is on track to reach 65 % of pre-pandemic levels by the end of 2022, as the sector continues to recover from the pandemic. The latest UNWTO World Tourism Barometer (UNWTO, 2022) reveals that monthly arrivals were 64 % below 2019 levels in January 2022 and had reached −27 % in September. An estimated 340 million international arrivals were recorded in the third quarter of 2022 alone, almost 50 % of the nine-month total. The robust recovery in tourism is also reflected in various sector indicators, such as air capacity and hotel occupancy rates.

However, it is estimated that by 2030 the hotel industry will account for 5.3 % of all CO_2 emissions (UNWTO, 2019). According to Lenzen et al. (Lenzen et al., 2018), the global carbon footprint of tourism accounts for around 8 % of global greenhouse gas emissions. In addition, the difficult economic environment, including persistently high inflation and soaring energy prices, exacerbated by the Russian offensive in Ukraine, could weigh on the pace of recovery in the fourth quarter and in 2023.

All these circumstances, together with the financial costs, mean that more and more hotel chains are committed to implementing and incorporating sustainability actions in their management. Sustainability reports play a key role in enhancing the trust that forms the basis of (moral) legitimacy in society (Du et al., 2010; Merkelsen, 2011) and should not be seen as "greenwashing" that ends up undermining business (Baviera-Puig et al., 2014; Laine et al., 2021).

Companies are therefore increasingly interested in reporting on their CSR commitments and actions (Font et al., 2012; Schmiedeknecht, 2013; Schönborn et al., 2019; López-Vázquez and Villagra-García, 2013) in the sense that it can help to enhance their reputation and brand (López-Vázquez and Villagra-García, 2013; Islam et al., 2021; de Grosbois, 2012). Indeed, there is evidence of growing stakeholder interest in where companies stand on this issue (de Grosbois, 2012; Waligo et al., 2013). In parallel, an increasing number of companies are publishing self-assessments and sustainability reports based on the guidelines of the Global Reporting Initiative (GRI) or the United Nations Global Compact for Progress (UNGC) (Wang et al., 2018; Grushina, 2012; Mattera and Melgarejo, 2012). In the hotel sector, different empirical studies examined the different positive and negative impacts of CSR, including the financial performance of the hotel industry itself (Claver-Cortés et al., 2007; Kang et al., 2010; Lee and Park, 2009; Fernández-Gámez et al., 2020; Garay and Font, 2012; Kang et al., 2015; Bell and Ruhanen, 2016). Within the Spanish hotel sector, the analysis has been carried out from different spheres and with different approaches, from large hotels to family hotels as a strategic path towards sustainability (Rubio-Mozos et al., 2020; Rodríguez-Antón et al., 2013; Ruiz-Lozano et al., 2018; Tovar-Sánchez et al., 2019).

On the other hand, several researchers argue that sustainability reports do not give a clear picture of the company and are used more as an advertising tool, including criticism not only of the quality of the information disclosed but also of the assurance or certification process (Boiral, 2013; Deegan et al., 2006; Manetti and Becatti, 2009). The work of Boiral (Boiral, 2013) aims to examine the extent to which

sustainability reporting can be seen as a pretence used to camouflage the real problems of sustainable development and to project an idealised view of companies. Manetti & Becatti (Manetti and Becatti, 2009) analyse the reports prepared according to the GRI guidelines by examining the effectiveness of the application of these standards and by analysing the different types of assurance statements. Bilbao-Terol et al. (Bilbao-Terol et al., 2018) suggest that a key factor in providing investors with valuable information about the companies in which they invest, would be the global acceptance of the GRI guidelines as a way of approaching CSR reporting. Machado et al. (Machado et al., 2021) call for further standardisation and methodological development of materiality analysis in sustainability reporting. Diouf and Boiral (Diouf and Boiral, 2017) analyse the perceptions of socially responsible investment practitioners on the quality of sustainability reporting using the GRI framework. Ibáñez-Forés et al. (Ibáñez-Forés et al., 2023) proposes a novel set of indicators to evaluate the social performance level of an organisation according to the information included in its sustainable reports.

It is currently considered that the competitiveness of the tourism sector is closely linked to its sustainability, sometimes not as quickly as it should be. In fact, obtaining recognition of a hotel's sustainability brings tangible and immediate benefits such as short-term cost reductions in water and energy savings, waste management, etc., but also fiscal and financial benefits, as well as other intangible medium and long-term benefits such as customer confidence and official or public recognition. This would explain the relative success that environmental certifications have achieved among hotels, despite the economic and personnel costs involved, and the difficulties encountered in the practical application of these certifications (Ayuso, 2007).

Sustainability is a broad concept that combines a wide variety of concepts of different nature and type that are hard to assess simultaneously. However, ranking sustainability among peers seems a necessary tool, thus multi-criteria decision methods (MCDM) as one possible instrument for that purpose. Although there is a wide and continuous growth in research on sustainable tourism and MCDM have been used to solve location or energy planning problems, there is still very little research on what kind of global information on sustainability is openly provided by companies or corporate hotel groups and its study with these MCDM (Machado et al., 2021; Bellantuono et al., 2016; Calabrese et al., 2017; Calabrese et al., 2016; Cinelli et al., 2014a).

As seen, from a corporate image point of view, hotel companies are increasingly interested not only in enhancing their involvement in terms of sustainability, but also in making public all the actions carried out in this field. This has been found to arouse the interest of both stakeholders and customers. Moreover, it is more common for hotel companies to include this type of information on their websites, as this is the most accessible communication channel. However, the way in which this data is reported is very heterogeneous, as guidelines that set out the type of information on sustainability that hotel chains should make public are not very widespread. Aiming to establish standards in this field, it is necessary to first analyse how hotel chains express their position in terms of sustainability, with the purpose of identifying what kind of public information is most frequently available online. This will be useful to develop general guidelines that apply to all possible cases.

Taking all this into account, the main objective of this study is to design a new methodology that allows, by means of a set of non-financial indicators, to analyse the behaviour of hotel chains in terms of shared information on sustainability. In particular, a set of variables extracted from sustainability reports based on GRI, non-financial reports, SDGs, or the different ethical codes from international organisations are proposed. They are then classified by means of a hybrid MCDM system using two well-known methods such as the hierarchical AHP system and TOPSIS. This combination has been selected since its scientific rigour in providing assessments has long been recognised, but it has rarely been applied to non-financial indicators obtained from hotel chain

websites or reports. Finally, the proposed method will be transposed to a case study of Spanish hotel chains to test its suitability to address issues related to the selection process of best practices in sustainability.

The paper begins by reviewing the relevant literature on how sustainability has become a concern in the tourism industry (Section 2.1), followed by the literature on the state of environmental sustainability in the hotel industry analysed from a multi-criteria decision analysis point of view (Section 2.2). The methodology is explained in Section 3, where the research context and design are detailed. The results are presented and discussed in Section 4.1 and in Section 4.2 the sensitivity analysis and the comparison between the two methods applied are carried out. The paper concludes by presenting the conclusions of the study and the theoretical and managerial implications (Section 5), as well as the limitations and future research directions (Section 6). In general, this research would contribute to a better understanding of the concept of sustainability and how it is displayed within the hotel industry website, in this case in Spain.

2. Literature review

This section presents a brief literature review on the use of MCDM and criteria in sustainability evaluation in the tourism sector, mainly in hotel studies. The evaluation and selection of hotels can be considered a complex MCDM problem involving many factors, ranging from customer needs, hotel location, logistics, energy resource use or company constraints. Therefore, multi-criteria analysis is successfully used in the tourism and hospitality sector for management decision-making.

2.1. Sustainability analysis in the context of tourism management

The environmental aspects of the hotel business must be considered as a specific process that requires a multidisciplinary analysis. Commitment to these issues also requires an analysis of how to successfully implement environmental sustainability in hotels (Segarra-Oña et al., 2012; Álvarez Gil et al., 2001; Gössling and Lund-Durlacher, 2021; Salehi et al., 2021a).

According to these studies, performance management requires the application of certain elements, instruments, indicators, techniques, and methods, from which managers can identify, achieve, and increase the efficiency of the use of the company's resources and capacities. In other words, numerous studies have shown that there is a positive impact of environmental management on the performance of hotel companies (Álvarez Gil et al., 2001; Carmona-Moreno et al., 2004; Chan et al., 2003; de Burgos-Jiménez et al., 2002; Tarí et al., 2010).

The work of Segarra-Oña et al. (Segarra-Oña et al., 2012) argues that the ability to generate value-added services to attract and retain customers is one of the challenges facing the hospitality sector. For this reason, and due to economic realities and government policies, an increasing number of hotels are adopting certified environmental practices such as ISO 14001.

Alvarez Gil et al. (Álvarez Gil et al., 2001) support the view that the age of the facility, size, the hotel chain to which it belongs or environmental pressures from stakeholders have a lasting influence on the degree of implementation of environmental management practices by hotel companies. At the same time, they identify a positive relationship between environmental management practices and the financial performance of companies. While Tari et al. (Tarí et al., 2010) analysed commitment to quality and environmental management and their overall and individual effects on hotel performance. Empirical data were collected on a sample of 301 Spanish 3–5-star hotels. Carmona-Moreno et al. (Carmona-Moreno et al., 2004) studied the environmental strategies adopted in the service sector and their impact on company performance. Empirical data were collected on a sample of 268 Spanish hotels.

Chan et al. (Chan et al., 2003) identify an energy performance index and daily load profiles of different types of energy use in relation to outdoor temperature and hotel occupancy rates. Yoon et al. (Yoon et al., 2022) analyse the water-energy nexus (WEN) in hotels and recreational activities on the Spanish Mediterranean coast. Paramati et al. (Paramati et al., 2017) empirically examine the dynamic relationships between tourism, economic growth, and CO_2 emissions.

The main question raised in the work of Duric et al. (Duric and Potočnik Topler, 2021) is which are the most important environmental indicators in the hotel business. Warren and Becken (Warren and Becken, 2017) highlight that climate change calls for more sustainable tourism goals, including saving resources such as water and energy. According to Lenzen (Lenzen et al., 2018), the global carbon footprint of tourism between 2009 and 2013 increased four times more than previously estimated, accounting for about 8 % of global greenhouse gas emissions where luxury hotels in Iran generate a significant carbon footprint. Salehi et al. (Salehi et al., 2021a) analyse luxury hotels in Iran and finds that they consume 3–4 times more energy and 7 times more carbon than similar hotels from previous studies. Koiwanit and Filimonau (Koiwanit and Filimonau, 2021) compares the results of the carbon footprint of home stays with that of budget hotels in Southeast Asia.

The study by Rasoolimanes et al. (Rasoolimanesh et al., 2020) reviews Sustainable tourism indicators (STIs) based on four criteria: i) the relevance of STIs to the Sustainable Development Goals (SDGs); ii) governance; iii) stakeholders involved; and iv) the distinction between subjective and objective indicators. The review was conducted on 97 articles. The results show a lack of direct attention to the SDGs in those articles published after their launch in 2016. However, most of the SDGs have been covered indirectly in the articles reviewed. The results revealed that, among the themes of sustainability of economic growth, social inclusion, environmental protection and governance, ITS studies tended to overlook the governance dimension.

There is another line of research in the study of sustainability in hotels, based on life cycle analysis that presents strategies on the carbon footprint of hotels (Salehi et al., 2021a; Rico et al., 2019; Filimonau et al., 2011; Hu et al., 2015), on CO_2 emissions or energy consumption (Rosselló-Batle et al., 2010; Puig et al., 2017), or on water consumption (Michailidou et al., 2016a; Michopoulos et al., 2017). Torres-Moraga (Torres-Moraga et al., 2021) have considered how biospheric values contribute to the achievement of green hotel patronage intention. Salehi (Salehi et al., 2021b) presents different strategies to improve energy and carbon efficiency of luxury hotels in Iran Regression models can also be found to estimate CO_2 emissions (Xuchao et al., 2010; Huang et al., 2015), water and energy consumption (Díaz Pérez et al., 2019; Wang, 2012; Deyà Tortella and Tirado, 2011; Mak et al., 2013; Kim and Oldham, 2017; Pablo-Romero et al., 2019; Mclennan et al., 2017), or carbon footprint (Lai, 2015; Oluseyi et al., 2016).

2.2. Analysis of MCDM in the context of energy use in the tourism sector

Academic research has attempted to establish the magnitude of the environmental impacts of hotels and reveal the main drivers of these impacts. Table 1 reviews academic studies focusing on the issue of environmental sustainability of hotels using different multi-criteria methods. Recent research has become more specialised, complex, and interdisciplinary. Academic interest in the environmental sustainability of hotels has grown in recent years, covering more geographical areas, and addressing a wider range of environmental issues.

When using MCDM, it should be kept in mind that there are no single solutions, as the results are obtained from the personal judgement of different criteria. There are several MCDM approaches that are used independently or in combination with other methods to select the best option, as well as to prioritise the options. Among the MCDM approaches, the Analytic Hierarchy Process (AHP) and Technique of Order Preference by Similarity to Ideal Solution (TOPSIS) methods are widespread, as they have a clear logic that signifies the basis of choice. There are many applications of these methods in the literature, including in the fields of travel and hospitality (see Table 1).

Table 1
Review of papers on sustainable tourism and MCDM.

Authorship	Method	Purpose	Comment
Kajanus et al., 2004	A'WOT (hybrid SWOT and AHP)	Strengthening local culture with a focus on local tourism as a possibility for sustainable development	Highly cited work. Over-touristic locations worldwide suffer from depopulation. Points to the fact that MCDS weighting techniques should be applied.
Newell and Seabrook, 2006	AHP	Hotel investment decisions (Australia)	This paper assesses the hotel investment process and assists investors in prioritising the significance of 30 key factors their decision.
Schianetz et al., 2007	Multi-criteria analysis (MCA)	To examine a range of tools for comprehensive sustainability assessments in tourism destinations, covering socio-cultural, economic, and environmental aspects.	Robust, reliable, sustainability indicators with qualitative and quantitative data.
Tsaur and Wang, 2007	Delphi, AHP, fuzzy set theory	Assessment procedure for sustainable tourism development and how it can be empirically applied to a specific destination (Taiwan).	Quite novel approach to the topic of tourism sustainability assessment.
de Montis et al., 2007	Regime method, AHP	To measure the level of integration of tourism into the whole economic system (southern coast of Sardinia, Italy).	Focus on the territorial quality of a set of seven particular territories with reference to tourism
Zhang et al., 2011	TOPSIS; information entropy (IEW).	To assess the competitiveness of tourism destinations (Yangtze River Delta, China)	Highly cited work. Standardisation methods for the data widely used afterwards.
Chen et al., 2011	Hybrid DANP (Dematel - ANP)	To evaluate the performance of a thermal hotel	Highly cited work. Business management oriented.
Park and Yoon, 2011	Delphi, AHP	To develop indicators to measure the sustainable development of rural tourism in a sustainable framework	Community based rural tourism development indicators. Delphi technique applied to 33 indicators with 4 dimensions.
Assaf et al., 2012	DEA	To explore the importance of environmental, social, and financial reporting (triple bottom line -TBL) as a comprehensive approach to achieving sustainability.	Slovenian hotels. Environmental reporting shows higher impact on hotel performance than social and financial.
Chan, 2012	DEA	Benchmarking of hotel energy based on floor area	Conceptual framework that is potentially applicable in collaboration with governmental institutions.
Siskos et al., 2013	MUSA multi-criteria	To propose a tourist satisfaction model based on five main satisfaction criteria: accommodation, catering, travel/transport, tourist attractions/recreation and infrastructure.	MUSA as an effective tool for measuring the level of customer satisfaction with the products or services offered by a company or organisation. The role of satisfaction surveys in the tourism sector as useful tools for extracting information is highlighted.
Khalili and Duecker, 2013	ELECTRE II	Strategic positioning of pollution prevention and clean production projects by means of a sustainable environmental management system (SEMS).	ELECTRE III as an easily applicable, flexible and versatile model, capable of identifying the best management solutions by ranking multiple alternatives in order of preference.
Botti and Peypoch, 2013	ELECTRE I	To assess the competitiveness of tourist destinations (Hawaii)	First application of ELECTRE I to this area of study, proving effective in ranking a group of destinations after all pairwise comparisons between them.
Göksu and Kaya, 2014	Fuzzy AHP and TOPSIS	To evaluate and classify tourist destinations (Bosnia and Herzegovina)	Several factors considered: accessible transportation, cost, belief and doctrines from history and culture, natural beauty, and entertainment.
Hsu et al., 2014	hybrid Fuzzy Delphi (FDM); DEMATEL; DANP; VIKOR	Model for assessing carbon and energy management at suppliers	Approach based on several MCDM methods to select a transport service provider from the environmental point of view.
Hyman, 2014	MCDA- a linear additive model	To evaluate the relative vulnerability of beach versus non-beach tourism	MCDA applied to Jamaica's case. Jaimaca's main tourism product is centred on 'sun and beach,' making it highly sensitive to climate change and other environmental challenges.
Zhou et al., 2015	AHP	Applied to adventure and nature-based activities (West Virginia)	Highly cited paper.
Michailidou et al., 2016b	ELECTRE III	A generic methodological framework for planning, managing and implementing climate change mitigation and adaptation measures in the tourism context.	AHP to evaluate the tourism destination competitiveness in West Virginia, USA, concerning its neighbouring states
Fernández-Tabales et al., 2017	AHP	Design of a Territorial Governance Indicator System for Tourism Destinations.	Proves that not all research results can provide appropriate sustainable tourism frameworks applicable to other destinations. Hence, local analysis are required.
Pérez et al., 2017	Delphi method, GPSI, based on Multiple Criteria Decision Theory.	To measure the degree of sustainability of tourist destinations considering the preferences of stakeholders	Demonstrates that sustainable tourism development has various definitions according to different experts and focus areas.
Peng et al., 2017	time series SBM-DEA model	To examine the characteristics and evolution of eco-efficiency in an individual tourist destination.	Studies on the ecological efficiency of small-scale tourism and the threat it can mean to protected areas.
Horng et al., 2018	fuzzy Delphi method (FDM). DEMATEL-ANP	To generate a model for assessing the practice of corporate social responsibility in the tourism industry	Study on CSR in tourism adapting the FDM-DEMATEL-ANP method to understand the assessment model of corporate social responsibility practices in the tourism industry. Case of Taiwan.
Lu et al., 2018	triangular fuzzy preference relations (TFPRs).	Selection of energy-saving and low-carbon technology schemes in different hotels	Mainly focused on the selection of the energy-saving technology in hotels with the help of triangular fuzzy preference relations (TFPRs)
Kularatne et al., 2019	DEA	To research the performance of hotels with the application of environmentally sustainable practices	Highly cited. Thorough analysis of the technical efficiency of hotels in Sri Lanka and the impact of other external variables on

Table 1 (*continued*)

Authorship	Method	Purpose	Comment
			it.
Andria et al., 2021	DEA, fuzzy AHP	A method for ranking tourism destinations and assessing their performance from a sustainability perspective	Suggests that the advantage of the entropy method is that its availability allows the inclusion of ambiguous or vague statements, which can reduce the subjectivity in the evaluation process. The process is less exposed to the impact of different data leading to a unified metric.
Nilashi et al., 2019	TOPSIS and Machine Learning Techniques	Analysis of online reviews affecting travellers' decision making in the selection of green hotels with spa services (Malaysia)	In contrast to survey-based research using statistical techniques, machine learning techniques may automatically discover consumer preferences from large social datasets such as Trip Advisor.
Tseng et al., 2019	DEMATEL	A decision-making model for understanding the causal relationships between ecotourism attributes to promote ecotourism performance in Thailand.	Highlights the importance of quantifying ecotourism potential, facility management, value of attraction, environmental concern, and local people's attitudes before making some decisions regarding ecotourism initiatives.
Tian et al., 2019	AHP, PROMETHEE II	To develop an integrated decision-making method for the EIA (environmental impact assessment) of tourist attractions	Pythagorean fuzzy numbers incorporated with the individual decision-making preferences to represent experts' evaluation. Hence capturing the fuzzy information in the decision-making process.
Lin, 2020	DEMATEL, VIKOR	Evaluation system of urban and rural tourism according to: cultural preservation, environment sustentation, economic development, and social consciousness	MCDM to assist the creation of urban and rural tourism's environment sustentation strategies.
Zha et al., 2020	Data envelopment analysis (DEA)	To analyse the drivers of tourism growth for the formulation of policies to promote sustainable tourism growth	Data envelopment analysis to determine the drivers of tourism growth and sustainable tourism development. Essential components are found in the process: technological efficiency, technology gap effect, technological progress, etc.
Lin and Chang, 2020	VIKOR, DEMATEL	To analyse how to influence the image of music festival events for music festival participants. To explore how factors that affect the tourist experience and enhance the event image related to this type of activity	Comprehensive methodology based on the application of four techniques to assess the competitive advantages linked to music festivals.
Kumar et al., 2020	Best Worst Method BWM, VIKOR	Green policies and regulations as criteria for assessing the environmental performance of airports	Consistent and time-saving methodology structured in three well-defined phases.
Ren, 2020	DEMATEL	To study the cause-effect relationships between the obstacles to sustainable tourism development in China and to identify the critical issues.	2-tuple fuzzy linguistic representation model effectively complements DEMATEL to avoid information loss associated to the results expression requirements.
Zabihi et al., 2020	GIS, F-AHP	Novel application for ecotourism planning through appropriate land-use zoning	Design of a simple and versatile hybrid method which provided robust results, overcoming limitations of using single MCDM methods, making it extensible to other geographical areas.
Ozturkoglu et al., 2021	fuzzy decision-making trial, DEMATEL	Determining sustainability-oriented innovation in hospitality services in the context of the food and beverage (F&B) industry	Assessment on the triple bottom line (TBL) dimensions of sustainability
Garabinović et al., 2021	review	Ecotourism - sustainable tourism	DEA, AHP, ANP, DEEMATEL, VIKOR and ELECTRE as the most used MCDM methos in the field of sustainable tourism.
Mehdiabadi et al., 2021	fuzzy Delphi fuzzy SWARA fuzzy EDAS	Practical approach to the question of the level of satisfaction of residents in tourist destinations using three methods together	Conceptual cross-checking of numerical results from traditional MCDM models and qualitative descriptor of each evaluated alternative.
Absalon et al., 2022	fuzzy Delphi, fuzzy best-worst method (BWM), and fuzzy (SAW)	To propose a methodological framework to generate a composite assessment of the sustainability index of rural tourism sites.	An assesssment of the level of sustainability is provided on the basis of a single score.
Wang and Nguyen, 2022	Integrated Fuzzy Best-Worst-TOPSIS	A set of criteria for so-called green hotels (Vietnam)	Hybrid MCDM method extensible to other knowledge areas.
Ocampo, 2022	FUCOM, fuzzy WSM	Development of a comprehensive framework for sustainability assessment in rural tourism	Low time-consuming methodology that returns robust results comparable to other more complex MCDMs.

3. Methodology

3.1. Preliminaries

This section briefly introduces some fundamental concepts related to multi-criteria decision methods (MCDM), which have been used to apply the proposed working methodology. In a group decision making process, there will be differences between the different opinions of the experts as their experience, level of knowledge or training is likely to be different.

3.1.1. Analytical hierarchy process (AHP)

To address problems with multiple criteria and a given number of alternatives, Saaty (Saaty, 1980) introduced the AHP, a multi-criteria decision-making process that decomposes and arranges a problem schematically into a hierarchy of priorities. The objective was to evaluate tangible and intangible criteria in relative terms using an absolute scale (Saaty, 1988; Saaty, 1990). In this way, the correspondence, in

Table 2
Fundamental Comparison Scale (Saaty, 1990).

Numerical rating	Verbal preference scale	Definition
1	Same	Both elements are of equal importance
3	Moderate	Moderate importance of one element over the other
5	Strong	Relevant importance of one element over the other
7	Very strong	Demonstrated importance of one element over another
9	Extreme	Absolute importance of one element over another
2, 4, 6, 8	Intermediate terms	Intermediate values, which are used to express preferences that lie between two of the above

the form of a table, between the expert's qualitative assessment and the assignment of the value is a preliminary step to the determination of the weights (see Table 2). The first step is to determine the importance given to each criterion as a percentage.

The standard process first requires the identification of a set of alternatives and a hierarchy of evaluation criteria (value tree), and through paired comparisons hierarchies are established (Belton and Stewart, 2002; Cinelli et al., 2014b). All weights/alternatives are compared with respect to the criteria by asking experts their preference of criterion A relative to criterion B on a scale of 1 to 9, where 1 indicates equal preference and 9 indicates absolute preference. These questions are called pairwise comparisons (Gómez Romero et al., 2020). In group decision-making, there will be differences between the different opinions of the experts as their experience, level of knowledge or training is likely to be different.

To determine the eigenvector, the matrix A is squared, then the row sums are normalised, and the eigenvector value is obtained. From Eq. (1), λ_{max} is cleared to calculate the eigenvalue (Saaty, 2005):

$$A \cdot x = \lambda_{max} \cdot x \tag{1}$$

where A is the reciprocal matrix, x is the eigen vector and λ_{max} is the maximum eigenvalue.

The result of this procedure is a matrix of comparisons expressed as ratios, and the next step is the reduction of the pairwise comparison matrix to a set of scores representing the relative importance of each weight and the performance of the alternatives (priority vectors) (Saaty, 1980; Belton and Stewart, 2002). Once the criteria weights and alternative scores have been obtained with the described process, the overall alternative performance can be calculated using a linear additive model (Saaty, 2005). There are different developments of this method implemented on the web, e.g. (Goepel, 2013; Goepel, 2018).

The method calculates the total inconsistency of judgements by the proportion of >10 %. This may be influenced by the size of the A matrix. The consistency index is determined with Eq. (2)

$$CI = (\lambda_{max} - n)/(n - 1) \tag{2}$$

where CI is the consistency index and n is the matrix size.

To calculate the consistency ratio CR, the consistency and random consistency indices are used, the consistency ratio is determined by means of Eq. (3)

$$CR = CI/IA \tag{3}$$

where CR is the consistency ratio and IA is the random consistency index.

If the result of CR is >10 %, it means that the judgements of the matrix are inconsistent and are not acceptable for decision making. It is likely that in these cases the expert will have to reconsider and modify the original values of the paired comparison matrix until consistency is achieved (the information is elaborated based on Table 3). For CR values equal to or <0.10 the consistencies are acceptable, valid, and justified for decision making.

3.1.2. The TOPSIS method

TOPSIS (Technique for Order Preference by Similarity to an Ideal Solution) method is presented in Chen and Hwang (1992) and Hwang and Yoon (1981). It is one of the most widely used techniques to solve a problem by multi-criteria decision making. The basic principle is that the chosen alternative should have the smallest geometric distance to

the ideal solution and the largest distance to the negative ideal solution. The calculation sequence is as follows:

- Step 1. Calculate Normalised Matrix

$$\overline{X_{ij}} = \frac{X_{ij}}{\sqrt{\sum_{i=1}^{n} X_{ij}^2}} \tag{4}$$

- Step 2. Calculate weighted Normalised Matrix

$$V_{ij} = \overline{X_{ij}} \; x \; W_j \tag{5}$$

- Step 3. Calculate the ideal best and ideal worst value
- Step 4. Calculate the Euclidean distance from the ideal best

$$S_i^+ = \left[\sum_{j=1}^{m} \left(V_{ij} - V_j^+ \right)^2 \right]^{0.5} \tag{6}$$

- Step 5. Calculate the Euclidean distance from the ideal worst

$$S_i^- = \left[\sum_{j=1}^{m} \left(V_{ij} - V_j^- \right)^2 \right]^{0.5} \tag{7}$$

- Step 6. Calculate Performance Score

$$P_i = \frac{S_i^-}{S_i^+ + S_i^-} \tag{8}$$

- Step 7. The assessment values are sorted in descending order and the alternatives are ranked. Therefore, the alternative with the maximum value of the evaluation score is the best alternative.

3.2. The evaluation framework

To achieve the research objectives, a six-step framework has been developed in which three distinct themes have been integrated: i) the choice of criteria; ii) the hybrid MCDM AHP-TOPSIS method being objective and easy to use; iii) the relationship between rational decision-making and subsequent evaluations.

The framework starts with the review of different sustainability documents and reports as a first step and continues with the determination of the set of sustainability criteria that the hotel chains should comply with, including expert opinions. In the third and fourth step, a limited number of hotels are selected, and the criteria weights are calculated according to AHP (see Section 3.1.1). In the fifth step, the selected hotels are ranked using the TOPSIS method, which uses objective metrics for each hotel. Finally, the sensitivity of the chosen criteria is tested against the obtained hotel ranking. To address the presented problem, the research framework is shown in Fig. 1, which summarises the phases to be developed.

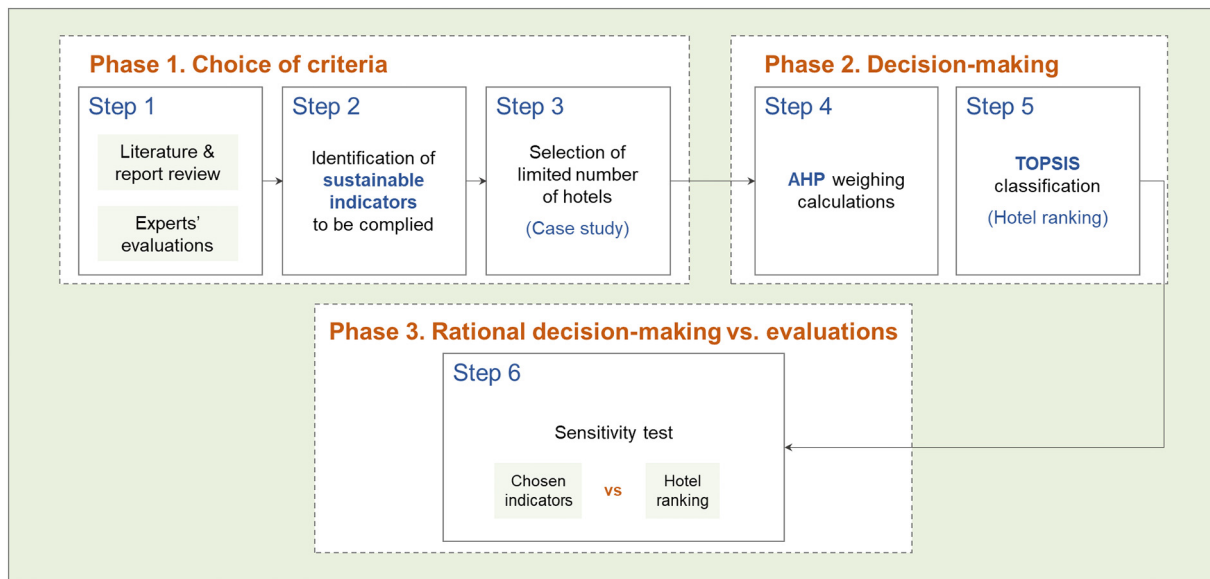**Table 3**
Random consistency index (Saaty, 1997).

Matrix size (n)	1	2	3	4	5	6	7	8	9	10	11
IA	0.00	0.00	0.52	0.89	1.11	1.25	1.35	1.40	1.45	1.49	1.51

Fig. 1. Flowchart for the proposed methodology.

3.3. Experts' opinions/evaluations

In this phase, the decision criteria are identified. The typology of assessment by experts and analysis of the information published by companies and organisations was chosen. The suitability of the criteria obtained from the bibliographical review of the information presented on sustainability by hotel chains was evaluated and completed by five professors from the Faculty of Tourism and another five from the School of Industrial Engineering of the University of Vigo (Spain). By combining the information from the bibliography and the comments from the academic experts, the 7 specific criteria were obtained, which will be developed in a later section.

3.4. Data analysis

This classification process allows the data to be structured around similar themes to facilitate analysis. Given the volume and diversity of information collected, the classification process was carried out in three main steps. In the first step, the information in the sustainability reports was analysed using an analysis grid based on the GRI indicators (Table 4), according to the work proposed by Boiral et al. (Boiral, 2013). In the second, the information provided in the sustainability reports was compiled in spreadsheets. It is important to highlight that during the data collection it was found that the websites of some hotel chains did not contain all the information necessary to guarantee the total exhaustiveness of the study. Each hotel chain may have a different vision of the concept and implementation of social responsibility and/or how to approach and disseminate it. This divergence means that the variables

Table 4
GRI sustainable development indicators (Boiral, 2013; GRI (Global Reporting Initiative), 2006).

Aspects of sustainable development	GRI indicators	Count
Economy	EC1 to EC9	9
Environment	EN1 to EN30	30
Work	LA1 to LA14	14
Human rights	9HR1 to HR9	9
Society	8SO1 to SO8	8
Product responsibility	PR1 to PR9	9
Total		79

we have chosen for the study may be the right choice for some and not the most appropriate strategy for their company for others. There is no single model in Spain or worldwide to measure and compare the information provided by each hotel chain, the most similar is the GRI model. The GRI has developed a guide that includes principles and performance criteria that organisations can use, including the measurement of economic, environmental, and social performance to promote greater standardisation of sustainability reports (GRI (Global Reporting Initiative), 2006).

Finally, the third step consists of the identification of the following 7 indicators which are assumed to be of a general nature and at the same time specific to the evaluated hotel chains.

- Indicator #1. Report of non-financial information. The publication of this type of information by the hotel is considered relevant and a clear indicator of concern for sustainability. This report, moreover, as it is for public consultation, is an essential means of transmitting to third parties (such as investors or customers) an image of the organisation's commitment to issues of particular importance, such as the environment, social issues or the fight against bribery and corruption. In the case of Spain, the presentation of Non-Financial Information Statements is a legal obligation imposed since December 2018 by Law 11/2018 (Spain) for certain companies with >250 employees that either have the consideration of public interest entities or, for two consecutive years meet, at the closing date of each of them, at least one of the following conditions: (a) that the total of the asset items exceeds 20,000,000 euros, or, (b) that the net annual turnover exceeds 40,000,000 euros. For this study, each event was classified as (0) not reported and (1) reported.
- Indicator #2. Sustainability report on corporate website: the existence of the sustainability report being accessible from the website. Each event was classified as (0) not reported, (1) reported.
- Indicator #3. The Sustainable Development Goals (SDGs): a set of 17 interrelated goals seen as the blueprint for achieving a sustainable future for all. Each event was classified as (0) not reported, (x) number of events reported according to information provided by the hotel chain.
- Indicator #4. Integrated report (includes financial and non-financial reporting): this would be an indication that the sustainability strategy is fully integrated and internalised in the company's overall strategy. Each event was classified as (0) not reported, (1) reported.

Table 5
Ranking of the main Spanish hotel chains according to Hosteltur (HOSTELTUR list of hotel chains with more than 1,000 rooms, n.d.).

Alternative	Hotel chain (Hosteltur 2019)	Turnover ranking	Establishments and rooms' ranking	Report links
A1	Meliá Hotels International	1	1	Meliá Hotels International, n.d.
A2	Iberostar Hotels & Resorts	2	5	Iberostars Hotels & and Resorts, n.d.
A3	Barceló Hotel Group	3	3	Barceló Hotel Group, n.d.
A4	Riu Hotels & Resorts	4	4	Riu Hotels & and Resorts, n.d.
A5	NH Hotel Group	5	2	NH Hotel Group, n.d.
A6	Bahía Príncipe Hotels & Resorts	6	10	Bahía Príncipe Hotels & and Resorts, n.d.
A7	Palladium Hotel Group	7	11	Palladium Hotel Group, n.d.
A8	H10 Hotels	8	9	H10 Hotels, n.d.
A9	Eurostars Hotel Company	9	7	Eurostars Hotel Company, n.d.
A10	Princess Hotels	10	>15	Princess Hotels, n.d.

• Indicator #5. Signing various agreements at a global level, including signing the World Tourism Organisation's (UNWTO) Global Code of Ethics for Tourism, being signatories to ECPAT (End Child Prostitution in Asian Tourism), which commits companies to fight against the use of children in sex tourism at a global level. Adherence to the United Nations Global Compact, which includes respect for human and labour rights, commitment to the environment and the fight against corruption (20,118 companies and organisations had signed it by 2022). However, for the hotel sector, it is not essential to adhere to the Global Compact given its broad generality and lack of specificity, as well as the fact that it is not very demanding as it does not require external verification. Each event was classified as (0) not reported, (1) reported to comply with one of the codes, (2) reported to comply with two of the codes or (3) all reported.
• Indicator #6. Submit the CSR report. Each event was classified as (0) not reported, (1) reported.
• Indicator #7. Specific GRIs: those included in the sub-sections (GRI 200, Economic management, thematic GRI; GRI 300, Environmental management, thematic GRI; GRI 400, Social and personnel management). The number of GRI sub-sections in the reports is counted to allow a clear differentiation between the companies, in this case the hotel chains. Each event was classified as (0) not reported, (x) the number of sub-criteria that appear regardless of the section in which they are found, according to Table 4.

4. Results. Case study

4.1. Case study

As an application of the presented evaluation framework, an empirical study is carried out to apply the proposed decision support tool. The research consists in finding the best hotel chain with respect to the holistic view of sustainability. In this case study, a list of ten alternatives was compiled at and a comprehensive sustainability assessment was sought to select the best option. For this purpose, the reports corresponding to 2019 published (on their websites, in official downloadable format) by the Spanish hotel chains, which were classified in the *HOSTELTUR list of hotel chains with >1000 rooms* (HOSTELTUR list of

hotel chains with more than 1,000 rooms, n.d.), are used. In this case, the number of Spanish hotel chains amounts to 126 with >1000 rooms, with a total of 3521 hotels and 709,356 rooms worldwide. It was found that the top 10 hotel chains with the largest number of establishments account for around 75 % of the turnover and thus were chosen for the study. Specifically, the different sustainability actions carried out by the following hotel chains and shown on their corporate websites will be identified (Table 5). There is an additional problem related to the different forms of sustainability reporting. While some are special reports dealing with the main dimensions of sustainability (economic, environmental, and social), others are annexes to the annual report or partial reports for one of the dimensions mentioned. Links to the consulted reports and sustainable information are included in Table 3.

In the case of Spain, the tourism industry has an important economic and social weight, where tourism is a very relevant activity for its economy. According to the "*Cuenta Satélite del Turismo en España*" (INE-Instituto Nacional de Estadística, 2022) the contribution of Travel & Tourism to employment is 14.4 % (2019) and 13.3 % (2020), and 14.1 % of global GDP (2019) with a fall to 5.9 % of global GDP (2020), having a high capacity to influence the development of other sectors and above all in tertiary companies, which is called "drag effect" or "drag capacity".

Once the companies to be analysed have been found, the stages of Fig. 1 are followed. With this purpose, Table 6 is generated based on the compliance of the 10 hotel chains with the seven sustainable indicators defined in Section 3.4.

Table 6 shows that A1 is the only one of the 10 alternatives that meets all the criteria to a greater or lesser extent. A2, A3 and A6 meet 6 of the 7 criteria. A7 and A8 meet 3, while A9 and A10 only meet 2 criteria. The criterion met by all the chains to a greater or lesser extent is criterion 3 on SDGs. On the other hand, it is also worth mentioning that, like A7, A3 and A9 do not have information on sustainability on their respective corporate websites. Regarding A9, it should be noted that although it does not report on any specific environmental measures (indicators #2, #4 and #6) nor does it show an alignment with the GRI (indicator #7), in 2021 it has signed a strategic alliance with a sustainability consultancy applied to the hospitality industry (indicator #5). Furthermore, apart from A7 and A9, A4 and A10 also do not show alignment to the GRI standards. The A5 and A8 alternatives have a report on

Table 6
Sustainability measures of the main Spanish hotel chains.

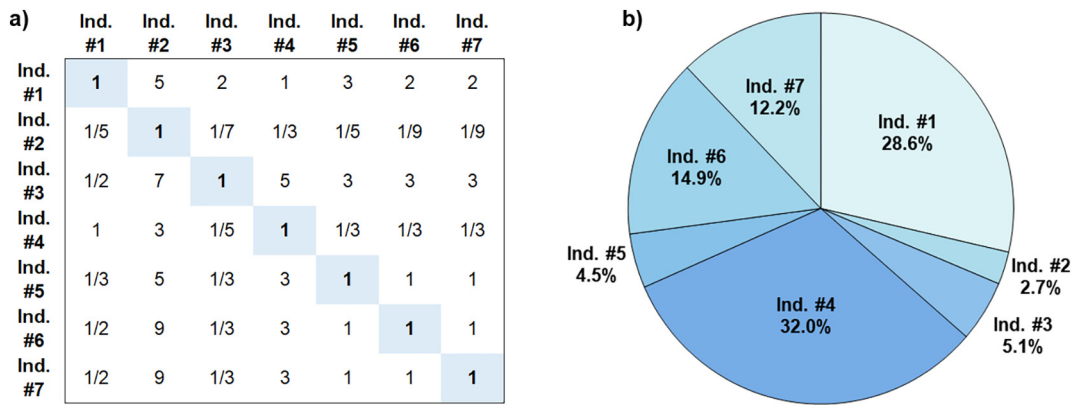| Alternative	Indicator #1	Indicator #2	Indicator #3	Indicator #4	Indicator #5	Indicator #6	Indicator #7
A1	1	1	11	1	3	1	59
A2	1	1	7	0	3	1	43
A3	1	0	6	1	3	1	56
A4	1	1	5	0	2	1	0
A5	1	1	12	0	3	1	24
A6	1	1	10	0	2	1	34
A7	0	0	4	0	2	1	0
A8	1	1	8	0	0	1	0
A9	0	0	1	0	1	0	0
A10	0	0	7	0	0	1	0

Fig. 2. a) Pairwise comparison matrix for the decision criteria b) Weight distribution by criteria.

non-financial information, as well as information on sustainability on their respective corporate websites. A1 and the A3 are the only hotel chains that have incorporated their sustainability report with their financial report (indicators #1 and #2). The existence of an integrated report indicates that the sustainability strategy is fully integrated and internalised in the overall strategy of both companies. In fact, A1 was the first Spanish tourism company to sign the Code against the Sexual Exploitation of Children (ECPAT). Currently, all hotel chains except A8, A9 and A10 have signed the ECPAT code. Except for A9, all hotel chains report and present information on CSR activities. In this sense, as we said earlier with this new strategic alliance on sustainability, it seems that A9 is starting to take a positive turn. In summary, the indicator of compliance with the SDGs is observed to be met in all the chains studied, together with 90 % of them complying with the different codes of ethics and the CSR report. The lowest compliance indicator is the integrated report, which is only met by A1 and A2 alternatives.

Once the data for each of the criteria for each chain has been found, the AHP method has been applied (see Section 3.1.1). A key part of this phase is to determine the weight of each criterion, as each one has a different influence on the efficiency and accuracy of the final ranking process. For the start of the alternatives assessment, the Saaty scale (Table 2) is applied, and their results have been included in Fig. 2-a. Then, the AHP methodology requires first a pairwise comparison of the criteria. The result of the priority weights and their ranking, after applying the AHP methodology, are shown in Fig. 2-b. These weight values signify the priority of the sustainability criteria for a specific chain, which we will call the choice alternatives.

The consistency ratio is also calculated, the result of which returns 8 %, so the data can be considered consistent as it is lower than 10 %. Then, the consistencies are acceptable, valid, and justified for decision-making. According to the judgement made by the group of experts, it was determined that the criterion that obtained the best assessment for the selection is the integrated report (indicator #4) with a score of

0.3203, in second place the criterion of reporting non-financial information (indicator #1) with 0.286, in third place, the CSR report (indicator #6) with a value of 0.149.

Then, applying the equations of the TOPSIS method shown in Section 3.1.2. and marking the sense of the criteria (whether they are beneficial or unfavourable), the sustainability ranking of Spanish hotel companies is obtained (Table 7). In this case, the criteria are all considered to be favourable, given that their existence would improve their sustainability position. Table 7 presents the data for the Euclidean distance from the ideal best (S_i^+), the Euclidean distance from the ideal worst (S_i^-) and the Performance Score (P_i). The evaluation values are sorted in descending order and the alternatives are ranked. The alternative with the maximum value of the evaluation score is considered the best alternative.

Table 7 shows that from the point of view of sustainability reporting, there are significant variations in the information provided by the chains compared to the top three chains in terms of turnover and sustainability reporting. This means that, in addition to being the leading chains, they also have a high level of environmental concern.

Fig. 3 shows that the A1 is the one with the best positions in indicators #4 (integrated report) and #7 (specific GRI). Other alternatives such as A5 also comply very well in SDGs (ind. #3) but not so well in terms of GRI data (ind. #7). The opposite is the case with A3, which ranks first together with A1 in indicator #4, second in #7, but shows a lower performance in terms of the SDGs (ind. #3).

4.2. Sensitivity analysis

In this section a sensitivity analysis is performed to explore the influence of the indicator weights on the ranking of the hotel alternatives
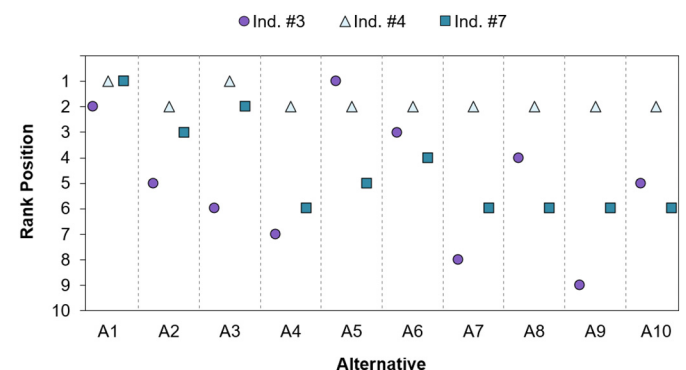
Table 7
Ranking of hotel chains according to TOPSIS method.

Alternative	S_i^+	S_i^-	P_i	Ranking TOPSIS
A1	0.0021	0.2671	0.9923	1
A2	0.2273	0.1323	0.3678	3
A3	0.0170	0.2653	0.9398	2
A4	0.2378	0.1204	0.3362	6
A5	0.2302	0.1265	0.3547	5
A6	0.2285	0.1283	0.3598	4
A7	0.2615	0.0517	0.1650	8
A8	0.2382	0.1203	0.3357	7
A9	0.2670	0.00647	0.0235	10
A10	0.2619	0.05127	0.1636	9

Fig. 3. Classification according to the fulfilment of indicators #3, #4 and #7 without counting their weights.

Rank	Experts	Ind. #1 (80%)	Ind. #2 (80%)	Ind. #3 (80%)	Ind. #4 (80%)	Ind. #5 (80%)	Ind. #6 (80%)	Ind. #7 (80%)
1	A1	A1	A1	A3	A1	A1	A1	A1
2	A3	A2	A3	A5	A6	A2	A2	A2
3	A2	A3	A8	A8	A3	A3	A3	A3
4	A6	A4	A5	A7	A4	A4	A4	A4
5	A5	A5	A6	A1	A2	A6	A5	A5
6	A4	A6	A2	A2	A5	A5	A6	A6
7	A8	A7	A7	A10	A7	A8	A7	A7
8	A7	A8	A4	A6	A8	A10	A8	A8
9	A10	A9	A9	A9	A9	A7	A9	A9
10	A9	A10	A10	A4	A10	A9	A10	A10

Fig. 4. Ranking according to weights of each indicator and order of alternatives.

according to sustainability. The analysis consists in making variations in the weightings of each indicator and observing, numerically and graphically, how these changes affect the alternatives' ranking. It is important to note that there are many more possibilities, as above, to make permutations and/or alterations to the criteria values.

The purpose of this sensitivity analysis is to check the consistency of the priority ranking of the MCDM method. It is done by assigning 80 % of the total weight to one criterion/indicator so the remaining percentage is distributed proportionally among the others. Afterwards, a comparison is made against the selection obtained with the initial AHP-TOPSIS hybrid method. The methodology is adapted from Jain et al. (2018). In the sensitivity analysis, eight cases with different sets of indicator weights are considered. The results once the AHP-TOPSIS method is applied are shown in Fig. 4.

Scenarios 2 and 3 are the most sensitive to the ranking, since in the case of indicator 3, A1, which occupied the first position in all the scenarios, would move to position 5. As for positions 9 and 10, they are practically not sensitive to the modification of the scenarios since the hotel chains remain the same.

The phenomenon presented in the sensitivity analysis can be better interpreted by considering that if the weight of the criterion/indicator is high, then the alternative containing a higher score according to this indicator will have a higher position in the hierarchical order. Consequently, if the weight of the criterion decreases, then the alternative with the highest score will be subject to the grade obtained on the other scenarios. In the case at hand, during the sensitivity analysis, it was observed that when the weights of each indicator were increased, very small perturbations in the ranking of the alternatives have been detected.

5. Discussion and conclusions

According to Bilbao-Terol (Bilbao-Terol et al., 2018), one of the most important challenges of sustainable development is the responsible management by companies of their economic, environmental, and social impacts. Therefore, transparent CSR reporting should become a standard practice for companies. In this paper, CSR performance is studied following the criteria and indicators obtained from the literature adjusted with expert opinion and using CSR reports as a source of information. For this purpose, a special methodology has been developed that allows us to score the performance of companies against internationally agreed sustainability principles.

The hotel chains analysed dedicate at least one section on their website to social responsibility through which most of them offer abundant information, accompanied by data and illustrations and, in addition, most of them offer users the possibility of downloading documents with relevant information on CSR. There is a certain disparity between the amount of information provided on CSR and the way it is presented, which makes it difficult for the user to identify and access it. Then, the user is forced to navigate through several sections of the website to get a complete idea of the CSR-related issues of the hotel company in question. The establishment and fulfilment of certain environmental objectives allows for the continuous improvement of the sustainability of hotel chains. There are several ways of dissemination, but the Internet is currently the most valued by companies to communicate their social, ethical, and environmental commitment, given the multiple advantages it offers. In this sense, it would be of great interest to improve the visibility of the information on CSR provided by the website, i.e., by collecting all this scattered data in a single section, which would be accessed from the main menu, and which also include the links to the different sustainability reports. This would not only promote the accessibility of the data, but also the transparency of the company, which gives it added value.

However, the involvement of hotel companies is still very uneven, both in terms of their size and type of business and in terms of the sustainability instruments to which are subject in relation to aspects such as: CSR, the UNWTO code of ethics, the commitment to protect children from sexual exploitation in travel and tourism (ECPAT), the UN Global Compact on human rights, labour, the environment and anti-corruption or the GRI. According to the information gathered, the dissemination of environmental concerns in the hotel sector seems evident, but it is difficult to discern whether it is limited to a pure question of image and improvement of competitiveness or to deep environmental convictions adjacent to all business decisions. Given the complexity that accompanies the process of assessing the real engagement of hotels with sustainability, this study has been able to provide at least some sufficiently proven criteria to allow a sustainability ranking.

Among the different aspects that can be analysed in terms of sustainability, it has been possible to conclude that the SDGs are the aspect of sustainability in which Spanish hotel groups have the greatest impact, as they are implemented in all the chains analysed, which is a very positive aspect as they are one of the main sustainability standards worldwide. On the other hand, it has been observed that not all the groups analysed carry out environmental and social measures, although, in general, the commitment of the Spanish hotel sector to these areas of sustainability can also be highlighted. From the information analysed in the CSR reports, it is concluded that in general the companies studied

do not fully follow the recommendations of the GRI guidelines. Half of the chains analysed do not show alignment with the GRI sustainability standards, which are one of the main sustainability standards to follow along with the SDGs. This is a negative aspect, as the main Spanish hotel groups should have taken these standards into consideration due to their great importance and relevance at a global level. Nevertheless, it has been verified that the hotel chains are implementing or have already implemented different measures within the CSR framework. Those that are more focused on environmental performance through policies to reduce carbon footprint, water consumption, waste, etc. stand out.

As contributions, the research helped to enhance the understanding of the concept of sustainability and how it is displayed within the hotel industry website, in this case in Spain. The Multi-Criteria Decision Making (MCDM) approach based on TOPSIS resulted as applicable to address issues related to the selection process of best practices in sustainability in Spanish hotel chains and can be extended to all types of hotel chains in other countries or geographical areas.

Throughout this research, it has been possible to identify that sustainability is incorporated in the management of the main Spanish hotel groups, even though there are great differences from one group to another, as we have mentioned in the previous section. It can be observed that many companies, despite the legal obligation, do not report financial information. Others report to comply with the legal requirement, while others demonstrate through their report the incorporation of sustainability in their strategy, as well as their interest in improving their current situation. In general, the Spanish hotel sector shows a great commitment to sustainability. Nevertheless, there are still certain aspects that need to be improved and on which companies should place special emphasis, such as including as much information as possible on their sustainability policies, making it visible and easily interpretable, and making these sections more accessible on their corporate websites. Sustainable development is being implemented in business management, providing a competitive advantage to those companies that carry it out. It is therefore important that the methodology and information used is transparent and easy to interpret.

The results of this research will help managers of hotel companies to identify the key elements and factors that need to be considered and thoroughly managed to achieve success in their environmental policies using the MCDM model. It should be borne in mind that multi-criteria evaluation is strongly influenced by the weighting of criteria and that the final selection is largely subjective, especially when several stakeholders with different interests or objectives are involved.

6. Limitations and future studies

When interpreting the results obtained, certain limitations encountered during the development of this project must be considered. Future research should carry out the same study at an international level. This work carries out an analysis of the information on sustainability collected on company websites with the problem that websites are dynamic by nature, and their content can change. Future research could carry out an analysis by groups of indicators: governance, environmental, social, and observe in each of them where the sector can improve by identifying best practices in companies.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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