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The impact of sustainable practices on competitiveness in the hospitality industry

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Abstract

Purpose – This study investigates the impact of sustainability practices on the competitiveness of hospitality establishments in the Czech Republic, measured through customer ratings. **Methodology** – Data were collected from 429 accommodation facilities using stratified random sampling. The sample included hotels, guesthouses, and apartments. Chi-square tests examined relationships between categorical variables, and one-way ANOVA assessed differences in means across groups. Regression analysis was then employed to evaluate the influence of sustainability on customer ratings, with multiple regression identifying specific sustainability practices affecting customer satisfaction. **Findings** – Overall sustainability levels did not significantly differ between facility types, though certain practices varied by operational characteristics. Underused practices – such as electric car charging stations and the use of 100% renewable electricity – represent potential for improvement. A weak but positive correlation was found between overall sustainability and customer ratings, with waste management practices showing the strongest association. **Implications** – This study shows that sustainability contributes modestly but positively to customer satisfaction, extending previous research by including a broader range of lodging facilities. Hospitality managers should focus on high-impact practices, particularly in waste management, to enhance the guest experience. Sustainability should be seen as a complementary element of service quality, supporting environmental goals and competitiveness.

Keywords: sustainability, competitiveness, hospitality, customer ratings, Booking.com
JEL classification: L83, Q56, D40

Uticaj održivih praksi na konkurentnost u ugostiteljstvu

Sažetak

Svrha – Ova studija istražuje uticaj praksi održivosti na konkurentnost ugostiteljskih objekata u Češkoj Republici, mereno kroz ocene kupaca. **Metodologija** – Podaci su prikupljeni iz 429 smeštajnih objekata korišćenjem stratifikovanog slučajnog uzorkovanja. Uzorak je obuhvatao hotele, pansione i apartmane. Hi-kvadrat testovi su primenjeni za ispitivanje odnosa između kategorijskih varijabli, a jednosmerna ANOVA je korišćena za

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procenu razlika u srednjim vrednostima između grupa. Zatim je korišćena regresiona analiza za procenu uticaja održivosti na ocene kupaca, pri čemu je višestruka regresija identifikovala specifične prakse održivosti koje utiču na zadovoljstvo kupaca. Svi testovi su sprovedeni na nivou značajnosti od $p < 0,05$. **Rezultati** – Ukupni nivoi održivosti nisu se značajno razlikovali između tipova objekata, iako su se određene prakse razlikovale po operativnim karakteristikama. Nedovoljno korišćene prakse – kao što su stanice za punjenje električnih automobila i korišćenje 100% obnovljive električne energije – predstavljaju potencijal za poboljšanje. Pronađena je slaba, ali pozitivna korelacija između ukupne održivosti i ocena kupaca, pri čemu prakse upravljanja otpadom pokazuju najjaču povezanost. **Implikacije** – Ova studija pokazuje da održivost skromno, ali pozitivno doprinosi zadovoljstvu kupaca, proširujući prethodna istraživanja uključivanjem šireg spektra smeštajnih objekata. Menadžeri u ugostiteljstvu trebalo bi da se fokusiraju na prakse sa velikim uticajem, posebno u upravljanju otpadom, kako bi poboljšali iskustvo gostiju. Održivost treba posmatrati kao komplementarni element kvaliteta usluge, koji podržava ekološke ciljeve i konkurentnost.

Ključne reči: održivost, konkurentnost, ugostiteljstvo, ocene kupaca, Booking.com
JEL klasifikacija: L83, Q56, D40

1. Introduction

Sustainability concerns are gaining increasing significance across various industries, including tourism and hospitality, where businesses face growing pressure to adopt practices that not only minimize environmental impact but also support long-term economic viability and social responsibility. For clarity, green practices refer specifically to environmental actions (e.g., waste reduction, energy efficiency), while sustainability practices encompass a broader framework that includes economic and social dimensions. The methods, practices, and communication of entrepreneurial initiatives are crucial. The 1987 report by the World Commission on Environment and Development (WECD), often referred to as Our Common Future, underscores the idea that all of us bear the responsibility for fostering sustainable development. This concept, as defined by the Commission, involves meeting present-day requirements without jeopardizing future generations' capacity to fulfill their own needs (WECD, 1987). In the hospitality industry, implementing sustainable initiatives presents challenges from both competitive and ethical viewpoints, as these practices may not always offer clear economic advantages or align with all customer priorities. These initiatives play a vital role in applying the triple bottom line concept, wherein the enduring prosperity of a company and its stakeholders depends on prioritizing all three facets of sustainability: economic, environmental, and social (Amini & Bienstock, 2014; Zhang et al., 2012). However, the effectiveness of these practices in enhancing a company's competitiveness remains contested, particularly in contexts where cost efficiency and customer experience dominate consumer decision-making processes.

Many studies (e.g., Dimitrova et al., 2022; Nekmahmud et al., 2022; Saari et al., 2021) have presented the premise that consumers are inclined to adopt green or sustainable choices in their own lives to ensure a habitable planet for future generations. Within the hospitality industry, there is a noteworthy phenomenon in which a subset of customers look for accommodations that prioritize eco-friendliness and sustainability. As more customers actively seek out such options, the hospitality industry is motivated to align with these preferences, adapting its practices and offerings to cater to this increasing demand for sustainability (Buffa et al., 2018; Cvelbar et al., 2017).

Zhang et al. (2012) state that to stand out in a competitive hospitality market, it is essential to communicate sustainability practices and initiatives to potential and existing customers. Apart from the traditional marketing communication strategies of lodging facilities, new

opportunities for sustainability practice communication appear on Online Travel Agencies (OTAs) such as Booking.com. Booking.com's Travel Sustainable program recognized over 500,000 accommodations for their sustainability efforts in 2023 (Sustainable Travel Report, 2023). Lodging facilities using Booking.com can join the program to showcase their sustainability practices. However, it remains unclear how effectively this visibility improves competitiveness through customer ratings, warranting further investigation.

The sustainability criteria information in Booking.com facility profiles allowed us to analyze its impact on the competitiveness of hospitality establishments, as seen in customer ratings. While sustainability efforts can enhance customer perceptions, their effectiveness as a key factor in competitiveness needs further examination. Customer ratings are an important factor in a company's competitiveness (Abrudan et al., 2020; Nguyen & Malik, 2021). In the competitive hospitality industry, online reviews and ratings serve as powerful marketing tools, offering objective feedback that attracts new customers. (Nguyen & Malik, 2021). Positive customer reviews can provide a competitive edge by demonstrating quality and satisfaction to potential buyers (Abrudan et al., 2020).

While sustainability in hospitality has been widely studied, most research has concentrated on hotels, with limited attention to guesthouses and apartments. Moreover, little is known about the effectiveness of communicating sustainability practices via online platforms such as Booking.com, and the impact of specific practices on customer ratings remains unclear. This study therefore examines how sustainability practices influence competitiveness in Czech hospitality establishments, with a focus on identifying the most relevant practices and comparing engagement across facility types. The paper contributes by broadening the scope beyond hotels, providing evidence from a Central European context, and offering practical implications for managers seeking to align sustainability with competitiveness.

2. Theoretical background

This study addresses the research question of whether sustainability practices affect customer ratings. Several studies conducted in the hospitality industry have discussed similar issues: sustainability practices affect tourists' satisfaction and loyalty (Gerdt et al., 2019; Olya et al., 2021), form a competitive advantage (Abdelkader, 2022), and influence tourists' hotel choice decisions (Verma & Chandra, 2018). Other studies are concerned only with the environmental pillar of sustainability and green practices. A summary table of the available studies on the topics addressed is presented in Appendix A. The table outlines the context of each study, its methodology, and key findings, and includes only those studies that are most relevant to the research questions and published within the last 15 years.

Sustainability practices facilitate a hotel's performance in several ways. Olya et al. (2021) showed a positive relationship between sustainability practices and tourist satisfaction, with tourists' familiarity with these practices also enhancing their satisfaction. Therefore, familiarity with a hotel's sustainable practices improves tourists' service evaluation and increases purchase intentions. Abdelkader (2022) examined the impact of sustainability practices on a hotel's competitive advantage, finding a moderate influence. The surprising results of a study from India by Verma and Chandra (2018) suggested that tourists prioritize sustainability practices, followed by price, location, value for money, brand awareness, and food and service quality, during the accommodation selection process.

Gerdt et al. (2019) examined customer reviews, finding that while sustainability management positively influences review ratings, its impact is limited. Similarly, Berezan et al. (2014) suggested that sustainable hotel practices attract primarily a niche group of customers, indicating that the relevance of sustainability for guest satisfaction may vary across

segments. Other research shows a more nuanced picture. For instance, Alreahi et al. (2023) highlighted that green hotels tend to garner higher levels of customer loyalty and satisfaction, and this effect becomes stronger in higher-rated hotels and among chain-affiliated establishments. Qubbaj et al. (2023) further confirmed that eco-certifications significantly enhance customers' willingness to book eco-friendly hotels and even pay premium prices, which underlines the growing market value of sustainability.

Several studies have also investigated regional differences. Barakagira and Paapa (2023) in Uganda reported that green practices improved profitability, reduced material costs, and strengthened customer service, though the correlation with hotel performance was weak among luxury hotels. Salem et al. (2022) in Oman found that customers' positive perceptions of eco-hotels were primarily shaped by their environmental values, cognitive image, and low-carbon knowledge, suggesting that cultural and cognitive factors mediate the effect of sustainability on guest satisfaction. Likewise, Berezan et al. (2013) found that nationality plays a role: green practices were particularly influential for Mexican and American tourists, but less so for others.

The evidence also points to the fact that some sustainability practices influence customer ratings more directly than others. Abrudan et al. (2020) revealed that, from the sustainability dimension, only facilities for disabled guests and electric vehicle charging stations significantly improved customer ratings. Preziosi et al. (2022) emphasized that guests view environmentally friendly practices not only as an add-on but as a distinct dimension of service quality and an "excitement factor" that contributes to overall enjoyment. However, contrary evidence was provided by Aznar et al. (2016), who concluded that sustainability does not necessarily translate into financial performance improvements, raising questions about whether the business case for sustainability is always straightforward.

Among the online platforms where customer ratings play a crucial role, Booking.com stands out as a leading digital travel company connecting a wide range of properties, from large hotels to small lodging options, with global audiences. Available in 43 languages, it offers over 28 million listings (Booking.com, 2023). Since 2010, its extensive data has attracted many researchers, leading to increased utilisation of the platform (Mariani et al., 2020).

For all lodging facilities that use Booking.com, it is essential to constantly monitor and improve the customer ratings collected by the platform, because they directly affect the position of the hotel's listings in the search and increase the number of reservations (Vermeulen & Seegers, 2009), hotel room sales (Cezar & Ögüt, 2016) and occupancy rates (Viglia et al., 2016). The rising use of online review platforms has made hotel ratings a key factor shaping travellers' accommodation choices. At the same time, hotel managers rely on these ratings as crucial measures of market performance and competitiveness (Naumzik et al., 2022; Xia et al., 2020). An experimental study (Vermeulen & Seegers, 2008) of 168 participants demonstrates that online hotel reviews significantly influence consumer decision-making by increasing hotel consideration and awareness; both positive and negative reviews raise awareness, while positive reviews further enhance attitudes toward hotels, with these effects being particularly pronounced for lesser-known hotels, whereas reviewer expertise exerts only a minor positive influence.

In addition to online reviews, research (So et al., 2014) highlights the importance of customer engagement as a determinant of brand loyalty. While traditional loyalty drivers such as satisfaction and service quality remain relevant, customer engagement has emerged as a stronger predictor of long-term loyalty. Empirical findings based on hotel and airline customers demonstrate that engagement significantly enhances brand evaluation, trust, and loyalty. Importantly, the study shows that brand loyalty can be strengthened not only through direct service experiences but also through active customer involvement beyond the service

encounter. This suggests that cultivating customer engagement strategies – such as interactive communication, brand communities, or personalised services – may further amplify the positive effects of online ratings and strengthen hotels' competitiveness in the digital marketplace.

Our study aims to examine how sustainability practices influence customer ratings, positing that this impact may be modest. There is a research gap regarding similar issues in the entire lodging facilities industry, including guesthouses. Are these establishments implementing sustainable practices, and how does their level of implementation compare to hotels? These are crucial questions for academic researchers to explore.

3. Materials and methods

Based on the current research gap identified by the literature review and data availability, the research questions were set as follows:

RQ A. Are there statistically significant differences in sustainability practice adoption according to the facility type?

RQ B. Do the sustainability practices adoption influence the customer rating, and if yes, to what extent?

In the context of these research questions, five hypotheses were formulated:

- H1: There are no significant differences in the overall sustainability level according to facility type.
- H2: There are no significant differences in the application of individual sustainability practices according to the facility type.
- H3: The customer rating is not influenced by the sustainability level.
- H4: Individual dimensions of sustainability practices do not influence customer ratings.
- H5: There are no significant differences in customer ratings according to the facility type.

For hypotheses H1, H2, and H3, differences were tested for statistical significance at a 0.05 level of significance, using appropriate tests according to the type of variable. For H3 and H4, the one-way relationship between the two variables (dependent variable customer rating and independent variable level of sustainability) was tested.

An analytical, descriptive, and deductive approach was employed to achieve the research objectives. Booking.com observed and published a list of 28 sustainable practices for each offer, which was categorized into five dimensions: waste, water, energy and greenhouse gases, destinations and communities, and nature. Table 1 summarizes a list of specific practices. Booking.com only indicated whether or not a facility applied a given practice. In the positive case, the practice was coded as 1, and if it was not applied, it was coded as 0. Overall sustainability was measured as the average number of sustainable practices implemented by facilities within their respective types. The customer rating value was taken directly from the Booking.com website for each of the selected facilities. No weights were assigned to the individual practices or dimensions, as doing so would have introduced subjectivity into the evaluation process. All practices and dimensions were therefore considered equally important in order to ensure methodological transparency and comparability. While the current dataset captures the presence or absence of practices, it does not provide information on customer perceptions or the intensity of sustainability communication.

Table 1: Sustainable practices defined by Booking.com

Waste	Single-use plastic miniature shampoo, conditioner, and body wash bottles not used Water cooler/dispenser Recycling bins are available to guests and waste is recycled Single-use plastic stirrers not used Single-use plastic straws are not used Single-use plastic water bottles not used Single-use plastic beverage bottles not used Single-use plastic cups not used Single-use plastic cutlery/plates not used
Water	Water-efficient toilets Water-efficient showers Option to opt out of daily room cleaning Option to reuse towels
Energy and greenhouse gases	Most lighting throughout the property uses energy-efficient LED bulbs All windows are double-glazed Most of the provided food at the property is locally sourced Electric car charging station Key card or motion-controlled electricity 100% renewable electricity is used throughout The property makes efforts to reduce its food wastage
Destination and community	Tours and activities organized by local guides and businesses offered Provides guests with information regarding local ecosystems, heritage, and culture, as well as visitor etiquette Invests a percentage of revenue back into community projects or sustainability projects Local artists are offered a platform to display their talents
Nature	Wild (non-domesticated) animals are not displayed/interacted with while captive on the property or harvested, consumed, or sold Green spaces such as gardens/rooftop gardens on the property Offsets a portion of their carbon footprint Most of the provided food is organic

Source: Booking.com, 2023

Data were collected from tourism destinations in the Czech Republic from August to September 2023. Following the Czech Statistical Office's methodology (ČSÚ, 2022), in line with Eurostat's 2014 guidelines, the study focused on three types of accommodation: hotels, apartments, and guesthouses. A hotel is a commercial establishment with at least ten rooms, offering accommodation and services to tourists. Hotels typically provide various room types with amenities and services like room service, housekeeping, restaurants, bars, and recreational options such as spas. Apartments are separate units typically featuring kitchens, bathrooms, and lounges, offering guests a more homely atmosphere than traditional hotels. A guesthouse is a small private accommodation where guests stay in private rooms. They often provide personal experiences, including homecooked meals and recommendations for local attractions (Ahr, 2022).

Stratified random sampling was chosen as the sampling method. The sample size was set at 10% of collective accommodation establishments located in the ten most visited areas (regional destinations certified by Czech Tourism as the national tourism organization) of the country. Owing to a change in the methodology for destination categorization during the data collection process, 12 regional destinations were finally included in the study to incorporate both previously and newly certified areas. The capital city of Prague was intentionally excluded to avoid biasing the results for the entire country, as it shows a diametrically different character of tourism, both in terms of demand (visitors) and supply (accommodation establishments). The data was collected randomly for selected areas only for establishments on Booking.com, which were marked as "travel sustainable property". Therefore, all absolute and relative frequencies presented refer only to establishments that apply sustainable practices.

Information was collected from 429 collective accommodation facilities in the Czech Republic. The guidelines for multiple regression require a minimum of 10 cases for each independent variable (5). The ratio of valid cases (429) to the number of independent variables (5) was 85.8, which was higher than the proposed minimum level (Milton, 1986).

The extracted data were statistically analyzed using IBM SPSS software. First, the dataset was analyzed using descriptive statistical methods, including frequency table construction, mean calculation, and standard deviation determination. The subsequent data analysis involved testing the hypotheses to better understand the relationships within the dataset. Linear regression was applied to examine the relationship between the overall sustainability level and customer ratings, as both variables are continuous and this method allows estimation of the strength and direction of the association. Multiple regression was used for the individual sustainability dimensions to identify which specific practices have a significant impact on customer ratings, while controlling for the influence of other dimensions simultaneously. Chi-square tests were chosen to assess relationships between categorical variables, and one-way ANOVA was applied to compare mean values of overall sustainability level across different types of accommodation. This rationale ensures that the selected statistical methods are appropriate for the nature of the data and the research questions, enhancing the robustness of the analyses. All tests were performed at a significance level of $p < 0.05$.

4. Results and discussion

The sample consisted of 429 collective accommodation establishments located in the most visited Czech region (see Table 2). Most of them were from the Giant Mountains (22.4%), followed by the Jizera Mountains (11%) and Karlovy Vary (10.7 %). In terms of the type of accommodation, all three types were represented by a relatively similar share (apartments, 32.2%; guesthouses 32.4%; and hotels, 35.4%).

Table 2: Sample characteristics

	Type			Total (N)	Total (%)
	Apartment	**Guesthouse**	**Hotel**		
Beskid Mountains	5	11	9	25	5.8
Brno and Environs	9	5	12	26	6.1
Central Moravia	8	5	9	22	5.1
Giant Mountains	24	43	29	96	22.4
Jeseníky Mountains - West	20	10	10	40	9.3
Jizera Mountains	9	18	20	47	11.0
Karlovy Vary Region	13	4	29	46	10.7
Lipno Region	18	2	2	22	5.1
Moravian Slovakia	4	10	11	25	5.8
Pálava and the Lednice-Valtice Complex	8	21	12	41	9.6
Třeboň Region	9	5	5	19	4.4
Zlín-Luhačovice Region	11	5	4	20	4.7
Total (N)	138	139	152	429	100.00
Total (%)	32.2	32.4	35.4	100.00	

Source: Authors' research

The sustainability level was measured by the facility's application of practices set by Booking.com, which was categorized into five dimensions: waste reduction (nine items), water saving (four items), energy and greenhouse gases (seven items), destination and community (four items), and nature (four items). On average, each facility implemented 16 out of 28 practices. The most frequently adopted practices (i.e., in more than 80% of

facilities) were in the waste reduction dimension (four items), water saving dimension (two items), and energy and greenhouse gas dimensions (two items). The option to reuse towels was adopted by the highest share of facilities (94%). This practice was followed by not using plastic cutlery/plates (90%), not using plastic stirrers (88%), opting out of daily room cleaning (88%), and using energy-efficient LED bulbs (88%). On the contrary, the least number of facilities implemented these sustainability practices: electric car charging stations (11%), 100% renewable electricity used throughout (12%), offsets a portion of their carbon footprint (17%) (see Table 3).

Table 3: Adoption of individual sustainability practices

	N	%
Water [Option to reuse towels]	402	94
Waste [Single-use plastic cutlery/plates not used]	385	90
Waste [Single-use plastic stirrers not used]	378	88
Water [Option to opt-out of daily room cleaning]	378	88
Energy and greenhouse gases [Most lighting throughout the property uses energy-efficient LED bulbs]	378	88
Waste [Single-use plastic cups not used]	373	87
Energy and greenhouse gases [All windows are double-glazed]	373	87
Waste [Single-use plastic straws not used]	357	83
Waste [Recycling bins are available to guests and waste is recycled]	321	75
Water [Water-efficient toilets]	304	71
Nature [Green spaces such as gardens/rooftop gardens on the property]	302	70
Waste [Single-use plastic miniature shampoo, conditioner, and body wash bottles not used]	299	70
Waste [Single-use plastic beverage bottles not used]	292	68
Waste [Single-use plastic water bottles not used]	288	67
Water [Water-efficient showers]	254	59
Destination and community [Provides guests with information regarding local ecosystems, heritage, and culture, as well as visitor etiquette]	235	55
Nature [Wild (non-domesticated) animals are not displayed/interacted with while captive on the property or harvested, consumed, or sold]	231	54
Destination and community [Tours and activities organized by local guides and businesses offered]	208	48
Energy and greenhouse gases [The property makes efforts to reduce their food wastage]	199	46
Destination and community [Local artists are offered a platform to display their talents]	173	40
Energy and greenhouse gases [Most food provided at the property is locally sourced]	157	37
Energy and greenhouse gases [Key card or motion-controlled electricity]	138	32
Nature [Most food provided is organic]	123	29
Destination and community [Invests a percentage of revenue back into community projects or sustainability projects]	117	27
Waste [Water cooler/dispenser]	94	22
Nature [Offsets a portion of their carbon footprint]	74	17
Energy and greenhouse gases [100% renewable electricity used throughout]	51	12
Energy and greenhouse gases [Electric car charging station]	46	11

Source: Authors' research

Tests of hypotheses

H1: There are no significant differences in the overall sustainability level by type of facility.

In Hypothesis H1, we focused on the sustainability level (measured by the average number of sustainable practices implemented by facilities) and whether there were statistically significant differences among apartments, guesthouses, and hotels.

Table 4: Descriptive statistics: Sustainability level by type of accommodation (H1)

	N	Mean	Std. Deviation
Apartment	138	16.101	4.438
Guesthouse	139	15.899	4.505
Hotel	152	16.434	4.514
Total	429	16.154	4.482

Source: Authors' research

Table 5: One-way ANOVA results: Sustainability level by type of accommodation (H1)

	Sum of Squares	df	Mean Square	F	Sig.	η^2
Between Groups	21.334	2	10.667	0.530	0.589	0.003
Within Groups	8576.512	426	20.133			
Total	8597.846	428				

Source: Authors' research

Since the significance level ($p = 0.589$) exceeded the threshold of 0.05, H1 was not supported. Moreover, the effect size was negligible ($\eta^2 = 0.003$, explaining approximately 0.25% of the variance). Thus, differences in the level of sustainability according to the type of accommodation were not statistically significant. Therefore, we explored the results in more detail and focused on individual sustainability practices to determine whether they were significant for the studied accommodation types. This was examined using the following hypotheses:

H2: There are no significant differences in the application of individual sustainability practices by type of facility.

We examined whether the applied sustainable practices varied across accommodation categories. Table 6 summarizes the results for all sustainable practices, providing data on the share of facilities within each category that apply sustainable practices, the value of the test criterion (Pearson Chi-Square), and the significance level. Statistically significant differences (at a significance level of 0.05) were found between apartments, guesthouses, and hotels for bold-marked practices.

Table 6: Distribution of sustainability practices across accommodation types (H2)

Sustainable practices	Share of facilities that apply the sustainable practice (%)			Pearson Chi-Square	df	Significance level
	Apartment	Guesthouse	Hotel			
Waste [Single-use plastic miniature shampoo, conditioner, and body wash bottles not used]	**80**	**66**	**63**	**11.422**	**2**	**0.003**
Waste [Water cooler/dispenser]	23	17	25	2.732	2	0.255
Waste [Recycling bins are available to guests and waste is recycled]	**88**	**86**	**53**	**61.622**	**2**	**< 0.001**
Waste [Single-use plastic stirrers not used]	91	86	87	1.998	2	0.368
Waste [Single-use plastic straws not used]	**92**	**78**	**80**	**11.654**	**2**	**0.003**
Waste [Single-use plastic water bottles not used]	**82**	**63**	**58**	**20.789**	**2**	**< 0.001**
Waste [Single-use plastic beverage bottles not used]	**81**	**65**	**59**	**17.072**	**2**	**< 0.001**
Waste [Single-use plastic cups not used]	89	83	88	2.271	2	0.321
Waste [Single-use plastic cutlery/plates not used]	93	87	89	2.466	2	0.291
Water [Water-efficient toilets]	75	67	70	2.423	2	0.298
Water [Water-efficient showers]	63	58	57	1.326	2	0.515

Water [Option to opt-out of daily room cleaning]	**78**	**89**	**96**	**22.094**	**2**	**< 0.001**
Water [Option to reuse towels]	93	94	95	0.494	2	0.781
Energy and greenhouse gases [Most lighting throughout the property uses energy-efficient LED bulbs]	88	91	86	1.835	2	0.400
Energy and greenhouse gases [All windows are double-glazed]	88	88	85	0.920	2	0.631
Energy and greenhouse gases [Most food provided at the property is locally sourced]	**28**	**38**	**43**	**8.074**	**2**	**0.018**
Energy and greenhouse gases [Electric car charging station]	**9**	**7**	**16**	**6.476**	**2**	**0.039**
Energy and greenhouse gases [Key card or motion-controlled electricity]	**21**	**27**	**47**	**25.925**	**2**	**< 0.001**
Energy and greenhouse gases [100% renewable electricity used throughout]	11	14	11	1.235	2	0.539
Energy and greenhouse gases [The property makes efforts to reduce their food wastage]	**36**	**42**	**60**	**18.545**	**2**	**< 0.001**
Destination and community [Tours and activities organized by local guides and businesses offered]	**36**	**41**	**66**	**31.042**	**2**	**< 0.001**
Destination and community [Provides guests with information regarding local ecosystems, heritage, and culture, as well as visitor etiquette]	**47**	**53**	**64**	**8.582**	**2**	**0.014**
Destination and community [Invests a percentage of revenue back into community projects or sustainability projects]	**35**	**25**	**22**	**6.074**	**2**	**0.048**
Destination and community [Local artists are offered a platform to display their talents]	**28**	**39**	**53**	**20.122**	**2**	**< 0.001**
Nature [Wild (non-domesticated) animals are not displayed/interacted with while captive on the property or harvested, consumed, or sold]	**46**	**53**	**62**	**7.107**	**2**	**0.029**
Nature [Green spaces such as gardens/rooftop gardens on the property]	69	78	65	5.738	2	0.057
Nature [Offsets a portion of their carbon footprint]	20	20	13	3.736	2	0.154
Nature [Most food provided is organic]	**20**	**35**	**30**	**7.872**	**2**	**0.020**

Notes: The bold style is for significant values (significance level less than 0.05).
Source: Authors' research

Statistically significant differences were found in several waste reduction practices, including the non-use of single-use plastic shampoo, conditioner, and body wash bottles, plastic straws, plastic water bottles, and other plastic beverage bottles, as well as the availability of recycling bins for guests. These practices are implemented more frequently in apartments, where over 80% report using them, compared to approximately 60% of hotels and guesthouses. The only exception is the availability of recycling bins, which is similarly high in both apartments (88%) and guesthouses (86%).

Referring to the water-saving practices, the differences in implementation of the "Option to opt-out of daily room cleaning" were verified as statistically significant. This option was

offered to customers of almost all hotels (96%). To a lesser extent, this option is offered by guesthouses (89%) and apartments (78%).

Statistically significant differences were found in energy-saving and greenhouse gas reduction practices, such as offering mostly locally sourced food, providing electric car charging stations, using key card or motion-controlled electricity, and making efforts to reduce food waste. These measures are most commonly implemented by hotels and least frequently by apartments.

Statistically significant differences were observed across all items related to destination and community engagement, including offering tours and activities by local guides and businesses, providing guests with information about local ecosystems, heritage, and etiquette, investing part of revenue in community or sustainability projects, and supporting local artists. All practices – except for investment in community and sustainability projects – were more frequently implemented by hotels (at least 53%) than by apartments and guesthouses. The exception, investing in local projects, was more common in apartments, though still adopted by only 35% of them.

In the dimension of nature, two items were statistically significant. The first, "Wild animals are not displayed or interacted with while captive or sold", is primarily followed by hotels (62%), guesthouses (53%), and apartments (46%). The second, "Most food provided is organic", is mainly implemented by guesthouses (35%), hotels (30%), and apartments (20%).

H3: The customer rating is not positively influenced by the sustainability level.

Hypothesis H3 focuses on analyzing the relationship between customer ratings and the level of sustainability through linear regression. The results are summarized in Tables 7 - 9.

Table 7: Model summary: influence of sustainability level on customer rating (H3)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.205[a]	0.042	0.040	0.626

a. Predictors: (Constant), Sustainability level
Source: Authors' research

Table 8: One-way ANOVA results: Influence of sustainability level on customer rating (H3)

Model		Sum of Squares	df	Mean Square	F-value	Significance
1	Regression	7.375	1	7.375	18.821	0.000[b]
	Residual	167.321	427	0.392		
	Total	174.697	428			

a. Dependent variable: Customer rating
b. Predictors: (Constant), Sustainability level
Source: Authors' research

Table 9: Coefficients[a] (H3)

Model	Standardized Coefficients Beta	t-value	Significance
(Constant)		73.607	0.000
Total score	0.205	4.338	0.000

a. Dependent variable: Customer rating
Source: Authors' research

Linear regression proved that the level of sustainability influenced customer ratings (significance level: 0.000). The standardized beta coefficient was 0.205, indicating a positive correlation. The constant was 8.330. Therefore, in mathematical terms, we can write the equation as

Y (customer rating) = 8.330 + 0.205 (sustainability level).

This implies that if the facility adopts one more sustainability practice, the customer rating increases by 0.205. Nevertheless, the R-squared value of 0.042 indicates that only 4.2% of the variance in the dependent variable can be explained by the independent variables in the model. In other words, the sustainability level in the regression model did not explain much of the variability in customer ratings. This finding highlights the limited influence of sustainability practices on customer evaluations, suggesting that while sustainability efforts may contribute marginally to improved ratings, they are far from being a decisive factor in determining overall customer satisfaction or competitiveness. For hospitality establishments, this underscores the importance of not solely relying on sustainability initiatives but also prioritizing other aspects of the customer experience, such as service quality, price, and convenience, to enhance their competitive position.

H4: Individual dimensions of sustainability practices do not influence customer ratings.

We focused on the different dimensions of sustainability and whether and to what extent customer ratings depend on them. Multiple regression analysis was used as the method of choice. Tables 10–12 summarize the results.

Table 10: Model Summary: Influence of sustainability dimensions on customer ratings (H4)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.275[a]	0.075	0.064	0.618

a. Predictors: (Constant), Waste score
Source: Authors' research

Table 11: One-way ANOVA results: Influence of sustainability dimensions on customer ratings (H4)

Model		Sum of Squares	df	Mean Square	F	Significance
1	Regression	13.175	5	2.635	6.900	<0.001[b]
	Residual	161.522	423	0.382		
	Total	174.697	428			

a. Dependent Variable: Customer Rating
b. Predictors: (constant) waste score, water score, energy score, destination and community score, nature score
Source: Authors' research

Table 12: Coefficients (H4)[a]

Model	Standardized Coefficients Beta	t-value	Significance
(Constant)		62.965	< 0.001
Waste score	0.240	5.001	< 0.001
Water score	0.058	1.153	0.250
Energy score	0.089	1.590	0.113
Destination and community score	-0.046	-0.804	0.422
Nature score	-0.018	-0.314	0.754

a. Dependent Variable: Customer Rating
Source: Authors' research

The results suggested that only the waste dimension had a significant correlation with customer ratings, with a significance value lower than 0.001 (lower than 0.05). The standardized beta coefficient was 0.240, indicating a positive correlation between waste reduction level and customer rating. However, the other dimensions (water, energy, destination and communication, and nature), that is, the number of sustainability practices adopted in these dimensions, did not show significance between the dependent variables. In mathematical terms, the equation can be written (where the constant is 8.144) as

Y (customer rating) = 8.144 + 0.240 × (waste reduction level).

H4 was partially supported, although not all dimensions were found to be related to customer ratings. Dimension "Waste reduction level" has a positive relationship (coefficient beta = 0.240) with the customer rating. In other words, the more sustainable the waste reduction practices of accommodation facilities, the better they are rated by customers.

Nevertheless, it must be noted that R square achieved a low value (7.5%), which means that customer ratings were influenced by other factors that were not included in our research.

H5: There are no significant differences in the customer rating by type of facility.

Although establishing an association between accommodation type and customer ratings is not the focus of this study, we present the results of the statistical test. These results complement the findings of the present study.

A one-way ANOVA (see Table 13 and Table 14) revealed statistically significant differences in customer ratings across accommodation types, $F(2, 426) = 34.12$, $p < 0.001$, with apartments receiving the highest scores (9.132), followed by guesthouses (8.735) and hotels (8.566). The effect size was large ($\eta^2 = 0.138$), indicating that accommodation type explains approximately 13.8% of the variance in customer ratings

Table 13: Descriptive Statistics: customer rating by type of facility (H5)

		N	Mean	Std. Deviation
Customer Rating	apartment	138	9.132	0.531
	guesthouse	139	8.735	0.593
	hotel	152	8.566	0.649
	Total	429	8.803	0.639

Source: Authors' research

Table 14: One-way ANOVA results: customer rating by type of facility (H5)

		Sum of Squares	Df	Mean Square	F	Sig.	η^2
Customer Rating	Between Groups	24.118	2	12.059	34.115	0.000	0.138
	Within Groups	150.579	426	0.353			
	Total	174.697	428				

Source: Authors' research

5. Discussion

No significant differences in overall sustainability were observed between facility types, which suggests that sustainability has become a common concern across the sector. This indicates that sustainability has become a priority across all accommodation types, likely driven by environmentally conscious customers. Facility-specific attributes, such as the absence of food services in apartments, can shape the adoption of certain practices,

underlining the need for nuanced sustainability assessments. Underutilized practices such as EV charging or renewable electricity represent areas with potential competitive advantage if more visibly implemented.

The modest link between sustainability and customer ratings suggests that sustainability is not yet a decisive driver of customer satisfaction. These results align with the findings of studies such as Berezan et al. (2014), which suggest that sustainable hotel practices appeal primarily to a niche segment of customers, and Aznar et al. (2016), who found no clear relationship between sustainability and improved financial performance in the hospitality sector. Similarly, Barakagira and Paapa (2023) reported only a weak correlation between the adoption of green practices and the performance of five-star hotels, reinforcing the notion that sustainability practices may not always be a decisive factor in driving customer satisfaction or loyalty.

However, the results diverge from studies such as Verma and Chandra (2018) and Alreahi et al. (2023), which highlight a stronger connection between sustainability initiatives and customer preferences or loyalty. For example, Verma and Chandra (2018) emphasized that green practices are among the most critical attributes in customers' hotel selection decisions, while Alreahi et al. (2023) reported that green hotels tend to achieve higher levels of customer satisfaction and loyalty, particularly among higher-star-rated establishments.

The findings also partially contrast with Olya et al. (2021) and Salem et al. (2022), who demonstrated that specific dimensions of sustainability, particularly social and environmental aspects, significantly enhance guest satisfaction and loyalty. These studies suggest that the influence of sustainability on customer perceptions may be moderated by cultural, regional, or demographic factors, as well as by the way these practices are communicated to customers.

Interestingly, the minimal impact observed in this study aligns with Abrudan et al. (2020), who noted that only certain sustainability practices, such as electric vehicle charging stations, are significantly associated with improved customer ratings. This indicates that customers may prioritize practical and visible sustainability measures over less tangible initiatives.

Among all dimensions, waste management emerged as the most relevant, reinforcing prior evidence that tangible practices resonate more with guests, aligning with Verma and Chandra's (2018) findings.

5. Conclusion

From a practical perspective, this study has several implications. The main outcome of this study is that sustainability level does not have a significant influence on customer ratings (only 4.2%). Customers rate their overall experience of their stay and do not perceive the level of sustainability of the facility significantly. Therefore, if managers prioritize the improvement of customer ratings, improving sustainability should be a secondary strategy. From a single-dimension perspective, the only statistically significant driver for improving customer ratings was waste reduction. Waste reduction dimension practices influence the customer ratings by 7.5%. Therefore, if facilities want to improve their customer ratings through sustainable practices, they should first adopt the waste reduction dimension. However, from a societal and environmental point of view, improving the sustainability of lodging facilities is in the best interest of all stakeholders; therefore, it should be continuously improved independently of customer ratings.

In terms of facility type, the sustainability level did not seem to differ. From a managerial perspective, facility type is not an obstacle to achieving a better sustainability level.

However, there were differences in the adoption of individual sustainability practices. For instance, apartments adopt waste reduction practices more easily, such as not using single-use plastic miniature shampoos, conditioners, and body wash bottles; better availability of recycling bins; and not using plastic straws, single-use plastic water bottles, or other beverage bottles. Other differences are summarized in the section on these findings.

From a theoretical perspective, this study makes a significant contribution to sustainability and competitiveness knowledge in the hospitality industry. The data sources were unique and reliable. These findings have been discussed in previously published literature. In the Central European context, the sustainability level is not a significant driver of customer ratings and competitiveness. This study further confirms that the sustainability level is not influenced by the type of facility. Moreover, the study also confirmed that there are significant differences in customer ratings by facility type: apartments have the highest ratings, followed by guesthouses and hotels.

Importantly, sustainability can be conceptualized as a potential signal to customers, whose effectiveness may depend on its observability, credibility (e.g., certification), and alignment with customer values. The present study captures the presence or absence of specific sustainable practices, but not how customers perceive or respond to them. Future research could explore these aspects, including distinguishing operational (back-of-house) versus communicative (guest-facing) practices, the role of certification as a moderator, and the intensity of sustainability communication on booking pages. This perspective can provide guidance for targeted sustainability investments that are more likely to influence customer perceptions. In the future, it would be also interesting to conduct similar studies in other countries and compare the results in other cultural contexts.

CRediT author statement

Jitka Vávrová: Data collection, Methodology, Conceptualization, Writing, Editing. **Lenka Červová:** Data collection, Data analysis, Writing. **Blanka Brandová:** Literature review, Writing, Editing.

Declaration of generative AI in the writing process

During the preparation of this work, the authors used generative AI and AI-assisted technologies, specifically Grammarly and ChatGPT, to improve the clarity, style, and grammar of the text. The use of these tools was limited to language correction and enhancement; all ideas, analyses, and interpretations presented in the work are solely those of the authors.

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Conflict of interest

The authors declare no conflict of interest.

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Appendix

Literature review summarization

Authors and Year of Publication, Country	Purpose	Summary Points
Olya, H., Altinay, L., Farmaki, A., Kenebayeva, A., & Gursoy (2021), Kazakhstan	To examine the effects of hotel's sustainability practices in relation to employees, customers, and the hotel itself on guests' behaviors and attitudes	The social and environmental aspects contribute positively to guest satisfaction and loyalty, whereas the economic dimension and familiarity do not show a significant correlation with guest loyalty, even if they may enhance guest satisfaction.
Abdelkader (2022), Kuwait	To examine the influence of adopting sustainability strategies on the competitiveness of five-star hotels	The study reveals that luxury hotels in Kuwait are dedicated to incorporating sustainability practices. The regression model outcomes suggest that sustainability criteria wield a moderate level of influence in attaining a competitive edge, as perceived by both employees and customers.
Verma and Chandra (2018), India	To examine the contributions of sustainability in tourists' hotel selection decision	Customers perceive energy conservation, recycling, and green scaping as key sustainable practices of hotels. The study brings a clear idea that sustainability, especially green practices, is the top factor in hotel selection.
Gerdt et al. (2019), Germany	To examine the influence of sustainability orientation and specific sustainability measures on customer satisfaction in the hospitality industry	Although only a minority of examined online reviews contained sustainability aspects, a relationship between sustainability orientation and customer satisfaction that is moderated by star classification was identified.
Alreahi, M., Bujdosó, Z., Lakner, Pataki, Zhu, Dávid, and Kabil (2023), Hungary	To explore the relationship between eco-friendly practices in hotels, hotel image, customer satisfaction, and loyalty, considering the star rating system and whether hotels are part of a chain or independent	Green hotels tend to garner higher levels of customer loyalty and satisfaction, with these trends strengthening as the hotel's star rating rises.
Qubbaj, A. I., Peiró-Signes, A., & Najjar (2023), Saudi Arabia	To explore the influence of green certificates on customers' online booking decisions and purchase choices when it comes to eco-friendly hotels	This study shows that green certificates enhance online customers' purchasing decisions in the hotel industry due to growing environmental concerns. Positive attitudes toward green hotels lead to higher chances of repeat visits and willingness to pay premium prices. Eco-friendly practices boost customer appeal and provide a competitive edge for hotels.

Barakagira, A., & Paapa, C. (2023), Uganda	To investigate the advantages and effects gained by hotel management when implementing eco-friendly practices	Implementing green practices brought numerous advantages for hoteliers, such as heightened profits, reduced material costs, a competitive advantage, and enhanced customer service. A weak correlation was observed between the adoption of green practices and the performance of five-star hotels.
Preziosi, Acampora, Lucchetti, and Merli (2022), Italy	To determine if green practices are a distinct dimension of service quality and viewed as excitement factors by hotel customers	Research shows that guests recognize a hotel's environmentally friendly practices as a key aspect of service. When hotels integrate green initiatives into their sustainability strategy, it boosts guest satisfaction and contributes to their overall enjoyment.
Salem, I. E., Elbaz, A. M., Al-Alawi, A., Alkathiri, N. A., & Rashwan, K. A. (2022), Oman	To reveal the factors influencing customers' favorable perception of green hotels, which can subsequently impact their behavioral intentions	The positive perception of green hotels is influenced by two main factors – environmental values and cognitive image – along with the peripheral factor of low-carbon knowledge. These elements collectively foster a favorable view of eco-friendly hotels, potentially making positive emotional perceptions less essential. This process works indirectly, as environmental values and low-carbon knowledge shape customers' cognitive image, enhancing their overall perception of eco-hotels.
Abrudan, I. N., Pop, C. M., & Lazăr, P. S. (2020), Romania	To examine various levels of importance of different facilities over the hotel's ranking (score)	For better customer ratings, only facilities for disabled people and electric vehicle charging stations are relevant (from the sustainability category).
Berezan, O., Raab, Yoo, and Love (2013), Mexico	To examine how sustainable hotel practices affect the satisfaction and return intention of tourists from different nationalities	Green practices have a positive relationship with guests' satisfaction levels and return intentions for Mexicans, Americans, and others. The study revealed that the relative importance of green practices differs with the nationality of the tourist.
Berezan, O., Millar and Raab (2014), Mexico	To assess tourist satisfaction with sustainable hotel practices and their motivations for participating	The study reports only minimal differences between demographic groups. Sustainable hotel practices are attractive only for a niche segment of customers.
Aznar, J., Sayeras, J., Galiana, J., & Rocafort (2016), Barcelona	To examine if hotel sustainability has a positive impact on financial performance and can be considered a positive strategy in the hotel industry	There is no clear relationship between sustainability and better financial performance.

Source: Authors' research