EVALUATION OF THE USE OF SMART TECHNOLOGY IN HOTELS IN TERMS OF SUSTAINABLE DEVELOPMENT

Avaliação do Uso da Tecnologia Inteligente em Hotéis em Termos de Desenvolvimento Sustentável

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ABSTRACT

Sustainable development is an important issue for hotels as it is in all sectors. Managers try to manage processes by preserving all economic, social and environmental balances. At this point, technology is seen as the most important helper. In this context, the aim of this research is to evaluate the effects of technologies used in hotels in terms of sustainable development from the perspective of managers. In this study, interviews were conducted with the managers of 4- and 5-star hotels. In total, 15 criteria have been determined. In the analysis of the criteria, the DEMATEL method, which is one of the multi-criteria decision-making techniques, was used. As a result of the findings, convenience, correct information and organizational compatibility criteria came to the fore as the first three criteria that most affected the other criteria. In addition, the criteria of competitive advantage, customer satisfaction and cost advantage were determined as the first three criteria that were most affected.

KEYWORDS

Hotel; Smart Technology; Sustainable Development; DEMATEL; Multi Criteria Decision Making.

RESUMO

O desenvolvimento sustentável é uma questão importante para os hotéis como em todos os demais setores. Os gestores procuram gerir os processos, preservando o equilíbrio econômico, social e ambiental. Neste ponto, a tecnologia é vista como o auxiliar mais importante. Em tal contexto, o objetivo desta pesquisa é o de avaliar, na perspectiva dos gestores, os efeitos das tecnologias utilizadas em hotéis em termos de desenvolvimento sustentável. Neste estudo, foram realizadas entrevistas com os gestores de hotéis de 4 e 5 estrelas, seguindo 15 critérios. Para análise dos critérios foi utilizado o método Dematel, que é uma das técnicas de tomada de decisão multicritério. Como resultado, conveniência, informações corretas e compatibilidade organizacional vieram à tona como os três principais critérios, por afetar os demais critérios. Além disso, os critérios de vantagem competitiva, satisfação do cliente e vantagem de custo foram determinados como os três critérios mais afetados.

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Hotel; Smart Technology; Desenvolvimento Sustentável; DEMATEL; Tomada de Decisão Multicritério.

INTRODUCTION

Due to global climate change, environmental pollution, the increase need for environmental protection, level of social awareness, adaptation to the age, ease of obtaining information, increase in the number of qualified employee and difficult competitive conditions, businesses have started to use different arguments to ensure their sustainability (Chung, 2020). Especially the hotel industry produces 84.7 billion kilowatts of energy, 219 billion gallons of water and 862 million kg of waste per year (Onunwo Chisom & Arc Tonye, 2020). Hotels are faced with a great deal of pressure regarding their environmental friendliness and the correct processing of labor (Varelas, Karvela, & Georgopoulos, 2021) due to their activities that affect the sustainability of the natural environment and the production of high amounts of natural resources, energy and food waste (Shmelev & Shmeleva, 2019).

In particular, hotels get help from various technologies in order to maximize their efficiency, save energy, use resources effectively, monitor competitors' performance, expand distribution channels, improve corporate image and create the best strategies (Leung, 2019). The use of smart technologies in hotels has led to the emergence of the concept of smart hotel. Smart hotels can be defined as businesses that use advanced technologies to interact with guests and provide services while minimizing manpower, and focus on producing maximum output with minimum input (Kim, Lee, & Han, 2020). If the relationship between new technologies and sustainability goals is managed correctly in hotels where resource consumption is intense, environmental problems can be reduced, social relations can be established and profitability can be maximized (Kadaei, Shayesteh Sadeghian, Majidi, Asaee, & Mehr, 2021).

In this context, the use of smart technologies in hotels can reduce energy use, provide feedback on consumption and suggest how to use resources efficiently (Coghlan, Becken, & Warren, 2022). When the existing literature is examined, although various studies have been carried out in areas such as guest experience (Leung, 2019; Yang, Song, Cheung, & Guan, 2021; Elshaer & Marzouk, 2022), attitude (Kim, Lee & Han, 2020), perceived benefit (Kim, Ariza-Montes & Han, 2021), using technology examples (Amer & Alqhtani, 2019; Dalgic & Birdir, 2020) automation systems (Stepan, Cimler, & Krejcar, 2018) and marketing (Jaremen, Jędrasiak, & Rapacz, 2016) related to smart hotel technologies, the effects of smart technology used in hotels on

sustainability have been discussed in very limited areas (Shafiee, Jahanyan, Ghatari & Hasanzadeh, 2022).

In this context, the effects of technology use in hotels on sustainable development were examined from the perspective of managers in this research. The opinions of the managers who have decision-making qualifications on investments are very valuable. Determining the effects of technology on sustainable development will shed light on the future plans of hotels. Considering that the research subject has been studied in a limited way, it can be said that the study will fill an important gap in the literature and will guide hotels in determining their future strategies. In this context, the research will directly contribute to both the literature and the sector. In addition, the absence of a similar study on the research subject clearly reveals the originality of this research.

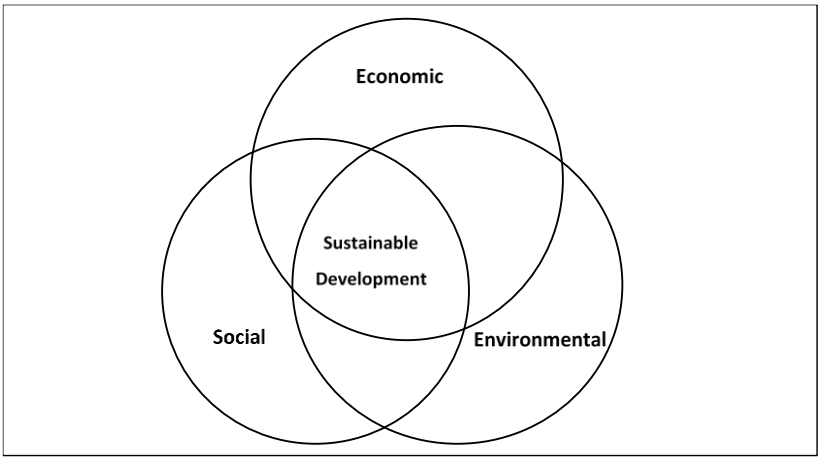
CONCEPTUAL FRAMEWORK: SMART HOTELS AND SUSTAINABLE DEVELOPMENT

Rapid developments in information and communication technologies have changed the operation processes, management style, structuring and purchasing styles in the hotel industry. In addition, rising labor costs and anticipated future labor shortages have prompted hotels to consider offering technology-based options to customers (Kim & Han, 2020). In this context, the concept of smart hotel has come up. Smart hotels are accommodation establishments that have a technologically integrated accommodation services system based on new information and communication technologies. The features of smart hotels are as follows; the availability of comprehensive internet, the implementation of smart technologies and smart devices, and effective policies for the dissemination of internet and information communication technology (ICT). Smart hotels are ahead of other facilities in the implementation of environmentally friendly systems that facilitate the achievement of sustainable development goals (Jaremen, Jędrasiak, & Rapacz, 2016).

Innovative technologies increase the use of resources that promote sustainable development, helping to achieve goals while minimizing ecological impacts (Kim, Lee, & Han, 2020). Sustainable development means not only protecting resources, but also producing and using them rationally and responsibly (Tas & Olum, 2020). As seen in Figure 1, sustainable development has three dimensions. These are economic, social and environmental. From an economic perspective, technology allows businesses to improve the level of sustainable

services. This situation provides the improvement of the economic pillar of sustainability. Businesses can maximize profits by saving time and resources. From a social perspective, hotel can contribute to the sustainable experience by providing better and more accurate data on the social pillar of sustainability through a variety of systems. This data relates to the relationship between the hotel and its partners and customers. From an environmental perspective, sensors, software, smart meters and various applications will contribute to environmental sustainability as they will make the consumption of scarce resources effective and efficient (Varelas, Karvela, & Georgopoulos, 2021).

Figure 1. Sustainable Development



Source: Campbell, 1996.

In order to ensure sustainable development, investments that serve social responsibility and environmental practices along with cost advantage should be made (Yenisehirlioglu & Turkay, 2021). The level of sustainability in tourism is one of the key factors leading to the growth of the industry (Shafiee et al., 2022).

The evolution of smart hotel technology offers hotel managers a wide variety of opportunities to pursue higher profitability by taking advantage of a variety of cost savings and revenue boosting options (Dalgic & Birdir, 2020). While hotel managers' intentions to adopt robotic technologies are positively affected by perceived advantage, competitive pressure and senior management support, they are negatively affected by the complexity of the perceived technology (Pizam et al., 2022). Information and communication technologies can reduce costs by allowing them to be in direct contact with the customer. Tourism company managers use a variety of applications to undertake a number of tasks that increase employee productivity in

the workplace, especially online reservations. In addition, virtual booking processes, virtual hotel tours, mobile applications, facial recognition technologies and interactive hotel room technologies reduce interaction and make it easier for guests to benefit from the services at the hotel (Atsız, 2021).

Technology has found a place in every department of the hotel industry. In recent years, innovative methods have been added to the forms of cooking, storage and distribution, especially as a result of the harmony of kitchen appliances with technology (Tas & Olum, 2020) and has begun to be used in the kitchen department. Devices such as smart ovens, smart refrigerators and smart grinders play an important role in preventing waste. Meuter, Ostrom, Roundtree & Bitner (2000) argue that customers prefer technology-based services because they offer better performance, are perceived as fun, efficient, and easy to use. For example, mobile check-in can enable customers to reduce waiting time, get to the room faster, and thus improve customers' perceived performance.

According to the literature, sustainable practices can result in positive feedback from hotel guests, increased loyalty and ultimately increased competitiveness and profitability for the hotel (Eskerod, Hollensen, Morales-Contreras, & Arteaga-Ortiz, 2019). A large number of environmentally conscious customers tend to purchase environmentally friendly products instead of substitutes, despite higher costs (Chung, 2020). The use of innovative technologies in hotel businesses defines the nature of technologies for efficiency, saving customers' time and effort, and solving their needs better than other options (Kim, Lee, & Han, 2020). Increasing resource use and the associated energy need are among the main challenges facing the economic, environmental, social, industrial and academic development of humanity (Harputlugil & de Wilde, 2021). The solution of these problems is possible with the integration of sustainable development and technology.

METHODOLOGY

The aim of the research is to evaluate the effects of technologies used in hotels in terms of sustainable development from the perspective of managers. In this context, interviews were conducted with the managers of 4- and 5-stars hotels in Kahramanmaras city center. The sustainable development indicators used in this research are given in Table 2. In the analysis of the criteria, the DEMATEL method, which is one of the multi-criteria decision-making techniques,

was used. In terms of tourism, travel and hospitality industries, making the right decision is one of the most encountered difficulties (Karakuş, 2021). There are two 5-star and five 4-star hotels in Kahramanmaras and interviews were conducted with 7 hotel managers within the scope of this research. Since the whole sample constituting the research universe was interviewed, a full count was made. During the data collection process, firstly, the hotels were contacted and an appointment was made for the appropriate day and time. The data were collected face to face by the researchers on the designated day and time. Research data were collected between 10 January 2022 and 21 January 2022.

DEMATEL Method - With the Decision Making Trial and Evaluation Laboratory [DEMATEL] method, the type of relations between the criteria determined by the interview technique with expert decision makers and their effects on each other can be determined. While doing this, decision makers can divide the criteria into cause-and-effect groups in order to better express the causal relationships (Huang, Shyu, & Tzeng, 2007). The basis of the DEMATEL method is graphical theory. For this reason, one of the most important features of the DEMATEL method is that it can reveal a model that explains the relationships by determining the degree of influence between the criteria and the extent to which they are affected by each other (Ayçin, 2019). In other words, categories are formed as influencing or affected by other criteria. Below is a brief summary of the application steps of the method.

Step 1: Creating the direct relationship matrix: A group of experts is asked to make a pairwise comparison between criteria in terms of effect. For comparison, the values 0, 1, 2, 3, 4 in Table 1, respectively; A scale corresponding to the expressions “no effect”, “low effect”, “moderate effect”, “high effect”, “very high effect” is used (Uygun et al., 2015). The pairwise comparison matrix A, which reflects the relations of the criteria, is formed according to the pairwise comparison scale. a=[Aij]nxn represents the level of effect of criterion i. on criterion j. in a matrix of size nxn (Chang, Chang, & Wu 2011).

$$A = \begin{bmatrix} 0 & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & 0 \end{bmatrix}$$

Table 1. DEMATEL The Pair-Wise Comparison Scale

Values	0	1	2	3	4
Meaning	No effect	Low effect	Moderate effect	High effect	Very high effect

Step 2: Normalizing the Direct Relationship Matrix: The direct relationship matrix A, which shows the relationships, is normalized by equation (1). λ is calculated using equation (2).

$$X = \lambda.A \quad (1)$$

$$\lambda = min\left\{\frac{1}{\max\sum_{j=1}^{n}|a_{ij}|}, \frac{1}{\max\sum_{j=1}^{n}|a_{ij}|}\right\} \quad (2)$$

Step 3: Creating the Total Relationship Matrix: The total relationship matrix T=[tij]nxn is obtained by the equation (3) below (Wu & Lee, 2007).

$$T = X(I-X)^{-1} \quad I: \text{Unit Matrix} \quad (3)$$

Step 4: Determining the level of influencing and affected factors (Sender and Receiver Group): The total relationship matrix T, the sum of the i. row and the sum of the direct and indirect effects of the Di criterion on the other criteria. Similarly, Rj in Equation (5) represents the sum of the j. column of the T total relationship matrix and is the measure of the sum of the direct and indirect influenced of the Rj criterion on the other criteria (Akyuz & Celik, 2015). After Di and Ri vectors are obtained, Di+Ri and Di-Ri values are calculated. According to these calculations, the Di+Ri value expresses the sum of the received and sent effects and indicates the level of effect of the i criterion within the system (Gok & Percin, 2016). Information about the direction of the relationship between the criteria is obtained by using the Di-Ri indicator (Chen & Chen, 2010; Paksoy, 2017).

Table 2 includes sustainable development indicators and their explanations. These indicators were determined by literature review and expert group interview. In this way, 15 criteria were evaluated. These criteria have been evaluated in general without grouping them into sustainable development dimensions (economic, social, environmental).

Table 2. Sustainable Development Indicators

Criteria	Explanation	Source
K_1: Productivity	Thanks to the technology used in the enterprises, maximum output is obtained by reducing the resource consumption to minimum levels.	Kim, Lee, & Han 2020
K_2: Convenience	Technologies are facilitating many seemingly complex tasks. For example, if a customer purchases a bottle of water from the hotel's bar, using his room card, this transaction not only allows the purchase to be forwarded to the accounting department, but also facilitates easy tracking by deducting it from the stock over the system.	

K_3: Audit	Technological systems used in hotels facilitate inspection in various fields (stock control, security, personnel tracking, etc.) and prevent waste.	
K_4: Creativity	The use of technology in different departments of hotels transforms the way activities are done. For example, the 3D printer food processor used in the kitchen department ensures that various shapes in the mind of the consumer are served on plates.	Hossain, Hussain, Kannan & Nair, 2021
K_5: Competitive Advantage	Technologies used in hotels diversify the production process of the service. This gives an advantage to the hotels.	Khatter, White, Pyke & McGrath, 2021
K_6: Cost Advantage	The monitoring of all processes by various systems and/or the use of technological infrastructure in areas where resource consumption is intense creates significant cost advantages for businesses.	
K_7: Accurate Information	Transmitting all processes in enterprises to managers/users via electronic systems ensures the transfer of real information about the current situation.	Çolak & Karakan, 2021
K_8: Marketing	The technological infrastructure of the hotels is seen as an important parameter in the purchasing decision processes of consumers.	Khatter et al., 2021
K_9: Service Capability development	Technology has completely improved the way of doing business. For example, instead of communicating with the reception to request the customer's needs in a hotel room, they request it from the voice assistance system in the room or through the mobile application, and the desired products are presented via a robot dedicated to the room service.	Çolak & Karakan, 2021
K_{10}: Customer satisfaction	Many studies show that the technologies used in hotel businesses have a positive effect on customer satisfaction.	Asadi, Pourhashemi, Nilashi, Abdullah, Samad, Yadegaridehkordi, Aljojo & Razali, 2020
K_{11}: Personalized technical solutions/service	Hotel businesses have a very complex structure. Customers coming for accommodation may have different demands and requests. Providing standard service to all customers can have a negative impact on satisfaction. Therefore, both ensuring the effective use of scarce resources and ensuring customer satisfaction are provided with personalized service.	Stylos, Fotiadis, Shin, & Huan, 2021
K_{12}: Organizational compliance	Technology accelerates operational processes, strengthens communication between staff and enables collaboration.	
K_{13}: Hotel – third party smart interactions	Hotel businesses interact with many different industries (food, souvenirs, furniture, entertainment services, etc.). It is very important for the interests of the business to get help from technology in the relations established with all the industries in which it interacts (for example, getting offers from more than one business in bulk purchasing processes, etc.).	
K_{14}: Consistency	The hotel industry is a service industry and its most important feature is that it is labor intensive. The importance of technology in the standardization of business practices is an undeniable fact.	Kim, Lee & Han, 2020; Stylos et al., 2021
K_{15}: Reliability	Technology can be expressed as an important argument in minimizing human errors.	

RESULTS

The pairwise comparison scale, which was prepared within the scope of the research and

answered by the decision makers, was coded separately by 7 participants. After collecting data from all participants, the average of the answers was taken and the analysis was carried out on this data set. The averages of the answers of the participants are given in Table 3.

Table 3. Direct Relationship Matrix (Participant Averages)

	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}	K_{11}	K_{12}	K_{13}	K_{14}	K_{15}
K_1	0.00	1.14	2.00	1.43	3.43	4.00	0.71	1.29	2.71	2.71	2.29	3.43	1.43	2.29	1.71
K_2	3.71	0.00	2.43	2.71	3.29	3.43	3.00	2.86	2.57	4.00	2.57	3.57	3.14	3.00	2.43
K_3	3.43	2.14	0.00	2.57	3.14	3.71	3.43	1.14	2.71	2.86	2.43	3.14	2.57	4.00	4.00
K_4	2.86	2.43	2.29	0.00	4.00	3.00	1.86	3.43	4.00	3.86	3.86	2.29	2.43	1.57	2.14
K_5	1.57	0.57	0.86	2.71	0.00	3.14	2.00	3.57	1.71	1.71	1.14	1.57	1.29	1.00	1.14
K_6	2.71	1.14	1.14	1.86	3.86	0.00	1.57	2.43	1.71	2.00	1.57	1.00	1.14	1.86	1.43
K_7	3.00	3.00	3.57	3.43	3.00	3.57	0.00	3.14	2.71	4.00	3.14	3.86	3.29	3.86	3.86
K_8	2.14	0.86	0.71	1.86	4.00	3.43	1.86	0.00	1.43	3.57	1.00	1.43	1.43	2.29	3.29
K_9	3.57	2.71	2.71	3.86	3.71	3.14	2.14	2.86	0.00	4.00	3.43	2.57	1.86	2.71	3.00
K_{10}	2.29	0.86	0.71	2.43	4.00	2.57	1.00	2.86	2.29	0.00	1.00	1.43	0.57	1.00	1.43
K_{11}	3.57	2.86	3.29	3.71	3.00	3.29	2.29	3.14	3.57	4.00	0.00	1.57	1.29	2.86	2.43
K_{12}	4.00	2.29	3.43	3.71	3.29	3.29	3.29	3.14	3.00	4.00	3.00	0.00	3.00	3.86	3.86
K_{13}	3.29	2.71	2.14	2.14	3.14	4.00	2.43	1.86	2.71	2.00	2.14	3.14	0.00	2.43	2.57
K_{14}	3.14	2.29	3.57	2.00	3.00	3.29	4.00	2.86	3.29	4.00	2.29	3.86	2.00	0.00	4.00
K_{15}	3.00	2.00	3.29	2.00	3.57	3.43	4.00	3.43	3.00	4.00	2.00	3.43	2.57	3.71	0.00

As explained in the DEMATEL section, a normalized direct relationship matrix was obtained by applying the formulas in Step 2 [equation 1 and equality 2] to the obtained data and arranging the number values corresponding to the linguistic expressions received from the participants. The normalized direct relationship matrix is shown in Table 4.

Table 4. Normalized Direct Relationship Matrix

	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}	K_{11}	K_{12}	K_{13}	K_{14}	K_{15}
K_1	0.000	0.024	0.041	0.029	0.071	0.083	0.015	0.027	0.056	0.056	0.047	0.071	0.029	0.047	0.035
K_2	0.077	0.000	0.050	0.056	0.068	0.071	0.062	0.059	0.053	0.083	0.053	0.074	0.065	0.062	0.050
K_3	0.071	0.044	0.000	0.053	0.065	0.077	0.071	0.024	0.056	0.059	0.050	0.065	0.053	0.083	0.083
K_4	0.059	0.050	0.047	0.000	0.083	0.062	0.038	0.071	0.083	0.080	0.080	0.047	0.050	0.032	0.044
K_5	0.032	0.012	0.018	0.056	0.000	0.065	0.041	0.074	0.035	0.035	0.024	0.032	0.027	0.021	0.024
K_6	0.056	0.024	0.024	0.038	0.080	0.000	0.032	0.050	0.035	0.041	0.032	0.021	0.024	0.038	0.029
K_7	0.062	0.062	0.074	0.071	0.062	0.074	0.000	0.065	0.056	0.083	0.065	0.080	0.068	0.080	0.080
K_8	0.044	0.018	0.015	0.038	0.083	0.071	0.038	0.000	0.029	0.074	0.021	0.029	0.029	0.047	0.068

K_9	0.074	0.056	0.056	0.080	0.077	0.065	0.044	0.059	0.000	0.083	0.071	0.053	0.038	0.056	0.062
K_{10}	0.047	0.018	0.015	0.050	0.083	0.053	0.021	0.059	0.047	0.000	0.021	0.029	0.012	0.021	0.029
K_{11}	0.074	0.059	0.068	0.077	0.062	0.068	0.047	0.065	0.074	0.083	0.000	0.032	0.027	0.059	0.050
K_{12}	0.083	0.047	0.071	0.077	0.068	0.068	0.068	0.065	0.062	0.083	0.062	0.000	0.062	0.080	0.080
K_{13}	0.068	0.056	0.044	0.044	0.065	0.083	0.050	0.038	0.056	0.041	0.044	0.065	0.000	0.050	0.053
K_{14}	0.065	0.047	0.074	0.041	0.062	0.068	0.083	0.059	0.068	0.083	0.047	0.080	0.041	0.000	0.083
K_{15}	0.062	0.041	0.068	0.041	0.074	0.071	0.083	0.071	0.062	0.083	0.041	0.071	0.053	0.077	0.000

After the normalized direct relationship matrix, the total relationship matrix was created by using equation 3. Values for the total relationship matrix are given in Table 5. In the evaluation of the findings obtained. the threshold value was accepted as 0.22 and it was assumed that the effects of the criteria under this threshold value were not significant.

Table 5. Total Relationship Matrix

	K_1	**K_2**	**K_3**	**K_4**	**K_5**	**K_6**	**K_7**	**K_8**	**K_9**	**K_{10}**	**K_{11}**	**K_{12}**	**K_{13}**	**K_{14}**	**K_{15}**
K_1	0.14	0.11	0.15	0.16	0.23	0.24	0.13	0.16	0.18	0.21	0.15	0.19	0.12	0.17	0.16
K_2	0.27	0.13	0.20	0.23	**0.30**	0.29	0.22	0.24	0.23	**0.30**	0.20	0.24	0.19	0.23	0.22
K_3	0.27	0.17	0.15	0.22	0.29	**0.30**	0.23	0.21	0.23	0.27	0.20	0.23	0.18	0.25	0.25
K_4	0.24	0.16	0.18	0.16	0.29	0.27	0.18	0.24	0.24	0.28	0.21	0.20	0.17	0.19	0.20
K_5	0.14	0.08	0.10	0.15	0.13	0.19	0.13	0.17	0.13	0.16	0.11	0.13	0.10	0.12	0.12
K_6	0.17	0.10	0.11	0.14	0.21	0.13	0.12	0.16	0.14	0.17	0.12	0.12	0.10	0.14	0.13
K_7	0.28	0.20	0.24	0.26	**0.32**	**0.32**	0.18	0.27	0.25	**0.33**	0.23	0.27	0.21	0.27	0.27
K_8	0.17	0.10	0.11	0.15	0.24	0.22	0.14	0.13	0.15	0.22	0.12	0.14	0.12	0.16	0.18
K_9	0.27	0.18	0.20	0.25	**0.30**	0.28	0.20	0.24	0.18	**0.30**	0.22	0.22	0.17	0.22	0.23
K_{10}	0.15	0.09	0.10	0.15	0.21	0.18	0.11	0.16	0.14	0.12	0.10	0.12	0.08	0.11	0.12
K_{11}	0.26	0.18	0.21	0.24	0.28	0.28	0.20	0.24	0.24	0.29	0.15	0.19	0.15	0.22	0.21
K_{12}	**0.30**	0.19	0.23	0.27	**0.32**	**0.31**	0.24	0.27	0.26	**0.32**	0.23	0.19	0.21	0.26	0.27
K_{13}	0.24	0.16	0.18	0.20	0.27	0.27	0.19	0.20	0.21	0.23	0.18	0.21	0.12	0.20	0.20
K_{14}	0.27	0.18	0.23	0.22	**0.30**	**0.30**	0.24	0.25	0.25	**0.31**	0.20	0.25	0.18	0.18	0.26
K_{15}	0.26	0.17	0.22	0.22	**0.31**	**0.30**	0.24	0.26	0.24	**0.30**	0.19	0.24	0.19	0.25	0.18

When Table 5 is examined, it is seen that the criteria with the highest impact on the other criteria are respectively K12 organizational compatibility, K7 correct information, K2 convenience and K14 consistency. The criteria most affected by these criteria are respectively; K5 competitive advantage (K2: 0.30, K7:0.32; K12:0.32), K6 cost advantage (K2:0.29; K7:0.32; K12:0.31) and K10 customer satisfaction (K2:0.30, K7:0.33; K12:0.32). However, when the relevant table is examined, it is seen that the highest effect value is the effect of K7 correct information criterion

on K10 customer satisfaction (0,33). Considering the threshold value, the ones with the least impact on other criteria are K5 competitive advantage, K6 cost advantage and K10 customer satisfaction. In addition, when the table is examined as a column, it is seen that the criteria most affected by the other criteria are again K5 competitive advantage, K10 customer satisfaction and K6 cost advantage. Accordingly, while these criteria are the criteria that have the least impact on the others, they are also the criteria that are most affected by the others. In general, the least affected criteria are K2 convenience and K13 hotel-third party smart interactions.

In addition, when Table 5 is examined, it is possible to say that the K1 productivity criterion is affected relatively more than the other criteria. The criteria that most affected the K5 competitive advantage criterion were determined as K7 correct information (0.32), K12 organizational compatibility (0.32) and K15 reliability (0.31), respectively. K10 customer satisfaction, which is one of the most affected criteria, was affected by K7 correct information (0.33), K12 organizational compatibility (0.32) and K14 consistency (0.31) criteria. Lastly, the K6 cost advantage criterion is the most affected K7 correct information (0.32), K12 organizational compatibility (0.31) and K3 audit (0.30), K14 consistency (0.30) and K15 reliability (0.30).

Table 6 shows the level of influencing and influenced factors. The D+R value shows the effect intensity between the criteria. When Table 6 is examined, it is seen that the criteria of K12 organizational compatibility and especially K7 correct information, K15 reliability and K14 consistency are most related to other criteria, respectively. The criterion with the highest effectiveness in the system is the K12 organizational compliance criterion with a value of 6.82.

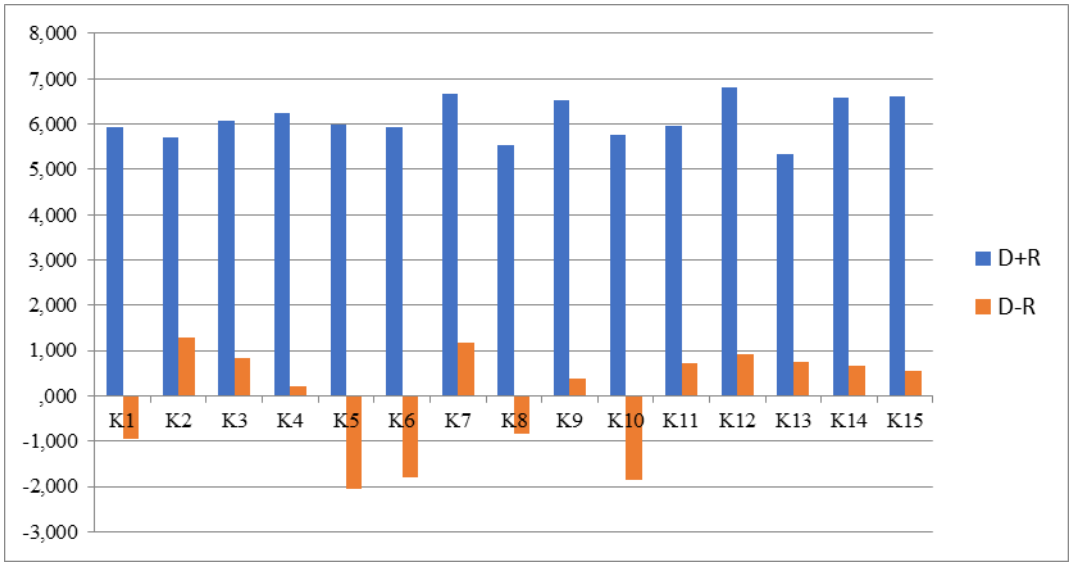
Table 6. Level of influencing and influenced

Criteria	K_1	K_2	K_3	K_4	K_5	K_6	K_7	K_8	K_9	K_{10}	K_{11}	K_{12}	K_{13}	K_{14}	K_{15}
D+R	5.94	5.69	6.06	6.25	5.98	5.93	**6.66**	5.53	6.52	5.75	5.95	**6.82**	5.33	**6.57**	**6.60**
D-R	**-0.94**	**1.30**	0.85	0.22	**-2.06**	**-1.81**	**1.18**	-0.85	0.37	**-1.85**	0.71	**0.92**	0.76	0.67	0.54

When the relationship intensity between the criteria was examined, it was determined that the lowest relationship intensity criterion was K13 Hotel-third party smart interactions. In addition, the D-R value in the table shows the direction of the relationship between the criteria. As expressed in Figure 2, it is seen that the level of influencing the other criteria by the criteria with positive D-R values is higher than the level of being affected. In this context, K2 facilitation (1.30>0), K7 correct information (1.18>0) and K12 organizational compatibility (0.92>0) are the

criteria with the highest deglevelree of influencing. According to Table 6 and Figure 2, the criteria with the highest level of influenced are K5 competitive advantage (-2.06<0), K10 customer satisfaction (-1.85<0), K6 cost advantage (-1.81<0)

Figure 2. Level Of Influencing and Influenced



CONCLUSION, DISCUSSION AND RECOMMENDATIONS

The digital revolution has radically changed business processes in the world we live in. New digital technologies have brought significant innovations in factories, hospitals, cities and hotels (Pencarelli, 2020). Information and communication technologies have accelerated the adoption of the "green" method, especially in the field of energy use, and have become an important factor that increases progress in all fields (Koo & Chung, 2014). Businesses have focused their operations, innovations and strategic development plans on sustainability, which allows them to develop a stable competitive advantage and provide sustainable value to society (Varelas, Karvela, & Georgopoulos, 2021).

The technological transformation has had profound effects on the way tourism services-related products are produced, distributed and delivered, and on policies (Biz & Grechi, 2021). This study

aimed to determine the effects of smart technologies used in hotels in terms of sustainable development and the criteria that come to the fore in this regard. Hotel businesses are chaotic structures in which many processes are intertwined. Therefore, simplification of processes is very important. In this context, the facilitation factor was determined as the criterion that most affected the other criteria in this study. Çolak & Karakan (2021) stated that with the use of smart technologies by hotel managers, service speed and customer satisfaction will increase, waiting time will be shortened, and process follow-up will be easier [sales/stock tracking will become easier, etc.]. Buhalis & Leung (2018) similarly emphasize that the use of smart technology in hotels will simplify hotel daily operations, automate processes, increase competitiveness and affect revenue performance.

Another criterion that is most affected among the sustainable development criteria is accurate information. Big data collected from both internal and external services in hotel businesses enable managers to make decisions in different areas [occupancy rates, labor costs, stock control, performance measurement, etc.] as well as to follow and predict trends (Zhang, Shu, Ji, & Wang, 2015). Therefore, information is the most important power and accessing the right information in real time accelerates the reaction time of the businesses. However, another criterion that comes to the fore in this research is organizational compatibility. Reaching the right information quickly and on time with the help of technology will facilitate the processes and, in this context, the organizational harmony in the business will be maintained synchronously. Especially in the hotel industry, which has various different operational processes [food and beverage, front office, housekeeping, security, purchasing, sales and marketing, etc.], it is possible for all departments to act as a single department. At this point, it is possible to define all departments in the hotel as a link in the chain. If one of the links of the chain breaks or becomes dysfunctional, it will affect the whole.

The competitive advantage criterion was found to be the most affected criterion in the research. Hotels use technological facilities to provide high quality customized and diversified services. As such technology features affect the purchasing preferences of customers, it differentiates businesses in the competitive market (Yang et al., 2021). Connecting processes through smart technologies in hotel supports profitability, competitiveness and the collective efficiency of the ecosystem (Buhalis & Leung, 2018). Hotels get help from technology to ensure sustainability in today's competitive conditions. This situation also has a direct effect on customer satisfaction.

There are many studies that show that the technological infrastructure available in hotels positively affects customer satisfaction (Beldona, Schwartz & Zhang, 2018; Han, Hou, Wu, & Lai, 2021; Elshaer & Marzouk, 2022). Within the scope of this research, customer satisfaction was among the most affected criteria. In addition, the technologies used in hotels help to improve customer service, expand operational capacity and create cost advantages (Buhalis & Moldavska, 2021). As in all sectors, providing cost advantage is among the priority duties of hotel managers. It is inevitable to get help from technology in the successful fulfillment of the task.

Smart technologies are valuable arguments for transforming data into valuable resources, enabling service providers to deliver efficiency, sustainability and unforgettable experiences (Stylos et al., 2021). Businesses should make the necessary technological investments by making the right plans especially during the establishment phase. Even if this situation increases the investment costs, it will create an advantageous situation in the long run. It is very difficult for companies that do not produce solutions in accordance with the requirements of the age to be successful. Finally, considering the limitations and limitations of the research, it may be suggested to researchers in the future to evaluate technology and sustainable development from the perspective of the customer, and to analyze the social, economic and environmental dimensions of sustainable development separately in the context of technology.

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