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Araştırma Makalesi/ Research Article

Use of Smart Technology in Environmentally Friendly Applications in Hotels in Kastamonu: A Review from a Resource-Based View Perspective

Kastamonu'daki Otellerde Çevre Dostu Uygulamalarda Akıllı Teknolojinin Kullanımı: Kaynak Tabanlı Bir Bakış Açısıyla İnceleme

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Abstract
This study aims to explore which smart technologies are used by hotels in Kastamonu, their sensitivity towards these technologies, and the challenges they face in environmentally friendly practices. A qualitative research approach was adopted in this study, employing a phenomenological design. Face-to-face interviews were conducted with the managers of seven star-rated hotels in the city center. The data obtained from the interviews were analyzed using the content analysis method via MAXQDA software. The study revealed that participants demonstrated sensitivity towards recycling, zero waste, smart energy systems, energy conservation, and waste segregation. Additionally, participants stated that they implemented energy-saving, water-saving, and smart electricity systems in their hotels. On the other hand, they highlighted challenges such as employee adaptation and high investment costs in implementing such practices.

Keywords: Smart technology, Environmentally friendly practices, Hotel, Kastamonu

Öz
Bu çalışma, Kastamonu'daki otellerin hangi akıllı teknolojileri kullandığını, bu teknolojilere karşı duyarlılıklarını ve çevre dostu uygulamalarda karşılaştıkları zorlukları araştırmayı amaçlamaktadır. Bu çalışmada, fenomenolojik bir tasarım kullanılarak nitel bir araştırma yaklaşımı benimsenmiştir. Şehir merkezindeki yedi adet yıldızlı otelin yöneticileriyle yüz yüze görüşmeler yapılmıştır. Görüşmelerden elde edilen veriler, MAXQDA yazılımı aracılığıyla içerik analizi yöntemi kullanılarak analiz edilmiştir. Çalışma, katılımcıların geri dönüşüm, sıfır atık, akıllı enerji sistemleri, enerji tasarrufu ve atık ayrıştırma konularına duyarlılık gösterdiklerini ortaya koymuştur. Ayrıca, katılımcılar otellerinde enerji tasarrufu, su tasarrufu ve akıllı elektrik sistemleri uyguladıklarını belirtmişlerdir. Öte yandan, bu tür uygulamaları hayata geçirirken çalışanların adaptasyonu ve yüksek yatırım maliyetleri gibi zorlukları vurgulamışlardır.

Anahtar Kelimeler: Akıllı teknoloji, Çevre dostu uygulamalar, Otel, Kastamonu

Extended Summary

Introduction

Today, climate change, the rapid depletion of natural resources, and environmental degradation are forcing the tourism sector, as well as all other sectors, to develop environmentally conscious practices. Hotels, which consume significant energy and resources, play a critical role in ensuring sustainable tourism. In this context, smart technologies are emerging as innovative tools that support environmental sustainability across energy efficiency, water management, and waste control. However, empirical findings on the use of these technologies in hotels in Kastamonu, one of Türkiye's developing destinations, are limited. This study aims to examine the smart technologies hotels in Kastamonu use for environmentally friendly practices, their contributions to environmental goals, and the challenges encountered within the framework of the Resource-Based View (RBV). The study aims to fill the gap in the literature and offer new contributions in the context of sustainable tourism and competitive advantage.

Methodology

A qualitative research approach was adopted, and an exploratory case study design was used. The population consists of star-rated hotels (at least 1 star) operating in Kastamonu's city centre as of 2025. According to data from the Provincial Directorate of Culture and Tourism, 8 hotels were identified, 7 of which participated in the study. The participants were hotel managers involved in environmental sustainability decision-making processes. A semi-structured interview form, developed in line with the literature and expert opinions, was used to collect data; interviews were conducted face-to-face between 10 and 25 February 2025 and documented via audio recording and note-taking. The data were analysed using content analysis techniques in MAXQDA software; a code-subcode-hierarchy model was adopted, and Fleiss' Kappa coefficient was calculated for reliability ($\kappa = 0.89$). This value indicates an 'almost perfect agreement' level between codings.

Results

Study findings indicate that hotel managers have developed a high level of awareness regarding environmentally friendly practices. Participants demonstrated particular sensitivity towards recycling, zero-waste initiatives, energy conservation, and water management. Among the smart technologies employed in hotels, smart card-based energy systems, LED lighting, sensor-activated taps, smart electrical systems, and digital menus stand out. The most significant contributions of these technologies include energy and time savings, reduced waste, and increased customer satisfaction. However, high investment costs and employee adaptation issues to technology have been identified as significant obstacles. Participants'

future goals include solar panels, wind turbines, electric vehicle charging stations, and smart waste collection systems.

Conclusion and Discussion

The results of the study reveal that smart technologies support environmental sustainability in hotel businesses and, when evaluated within the RBV framework, provide businesses with valuable, rare, difficult-to-imitate, and organised resources. Therefore, these technologies provide hotels with a long-term, sustainable competitive advantage. However, as seen in the Kastamonu example, high costs and staff adaptation issues are the biggest obstacles to widespread adoption. In this context, it is recommended that local authorities and government agencies provide financial incentives, while hotel managers facilitate adaptation through gradual transitions and training programmes. The study contributes to the literature, as there is a lack of understanding of how smart technology integration across green applications can be deployed in developing destinations. From a pragmatic standpoint, the results show that technological advances and awareness of environmental concerns are strategically crucial for enhancing brand image, customer satisfaction, and operational effectiveness.

1. Introduction

One of the most urgent global challenges facing the contemporary world is climate change (Tanveer et al., 2024), as well as environmental deterioration, depletion of natural resources, and global warming—driving all industries and especially tourism to implement sound practices in the protection of the environment (Abdou et al., 2022; Karaşan et al., 2024). Governments and entities have taken action to establish practices to sustain a life-friendly environment for generations to come. In tourism, the hotel sub-sector is particularly important due to its high energy and resource consumption, especially in relation to energy efficiency, water management, solid waste management, sustainable procurement practices, green certifications, and carbon footprint (Fukey and Issac, 2014). Governments and supranational organizations have responded with sustainability strategies, but their effectiveness depends on how hotels incorporate pragmatic actions into daily life operations.

At the same time, digitalization has emerged as a transformative force across various sectors, changing every aspect of tourism from customer service delivery to operational planning (Gürsoy & Çalhan, 2024). Specifically, smart technologies that leverage artificial intelligence, sophisticated sensors, and the Internet of Things (IoT) have emerged as significant sustainability enablers. These technologies align environmental objectives with operational excellence by improving waste management, preventing inefficiencies, and enabling real-time monitoring of energy and water use (Zhang & Deng, 2024; Kolobkova et al., 2021).

Recent systematic reviews reveal a growing academic interest in IoT-based sustainability applications in the hospitality sector (Poullas & Kakoulli, 2023). However, these studies also highlight that there remains some uncertainty about the types of solutions these technologies offer in practice and their effectiveness. Case studies show that IoT-based energy management systems can reduce energy consumption in hotel operations (Thongmun et al., 2025). It is stated that smart energy monitoring tools, especially when integrated with predictive analytics, can both achieve significant reductions in energy usage and shorten the return on investment period (Zaniboni, 2024). In addition, IoT applications are noted to make significant contributions to water management, increasing water efficiency through mechanisms such as leak detection, automatic irrigation, and real-time consumption tracking. Significant water savings have been reported in some large-scale hotel chains (Hospitality Insights, 2024). Beyond optimizing resource use, digital technologies are also transforming food waste management. Artificial intelligence-supported systems enable the measurement and analysis of kitchen waste, yielding concrete data on waste reduction through smart weighing systems and image processing technologies (Hillsdon, 2025).

Nevertheless, questions remain about how smart technologies are operationalized within sustainability practices, even with these encouraging results. Specifically, it is unclear how this integration takes place in under-researched or emerging hospitality markets. According to some studies, factors like environmental certification, affiliation with an international chain, customer demand for sustainability, and five-star hotel status play a significant role in the adoption of IoT technologies (Elshaer et al., 2025; Velaoras et al., 2025). However, these studies primarily focus on specific market conditions and do not adequately account for contextual differences (Eskerod et al., 2019). On the other hand, factors such as data security, system integration, technical infrastructure requirements, and high investment costs are cited as among the main barriers to the widespread adoption of IoT-based applications (Deliormanlı & Mercan, 2020; Hall et al., 2020; Phu Vinh, 2024).

The limited empirical evidence, particularly in emerging tourist destinations like Kastamonu, requires a contextual investigation of this problem. The research question of this study is as follows: “How do hotels in Kastamonu implement environmentally friendly practices using smart technologies?” Although the use of smart technologies in the hotel industry has been extensively investigated in large-scale tourist destinations (e.g., Eskerod et al., 2019; Poullas & Kakoulli, 2023; Adeel et al., 2024; Bekele et al., 2024; Afchar et al., 2026), there is a lack of research regarding the strategic use of smart technologies in emerging destinations with resource limitations and smaller market structures. Existing studies mainly focus on international hotel chains and luxury hotels, without examining how small- and medium-sized hotels in developing countries leverage technological adoption to gain a competitive advantage. Based on the entire population of star-rated hotels in Kastamonu and assessing their practices through

the Resource-Based View (Barney, 1991), this study contributes to the existing body of knowledge by placing smart sustainability practices in the context of a small destination framework and by applying the VRIO logic in a micro-tourism context. In line with this research question, the primary aim of this study is to assess the role of smart technologies in environmentally friendly practices within the hotel industry using the Resource-Based View (RBV) framework. In this respect, the study aims to identify the types of smart technologies used for sustainability, assess the role of smart technologies in achieving environmental objectives, and identify the most significant challenges in their implementation. Additionally, investigating whether these technologies offer a competitive advantage for hotel businesses within the RBV framework is one of the aims of this study. Finally, based on the findings, this study aims to offer recommendations for the development of environmentally friendly practices in hotel businesses in Kastamonu. In this respect, this study goes beyond identifying technological tools and instead focuses on their interpretation as strategic resources in the context of a small destination hospitality environment. By investigating the VRIO properties of these technologies in a resource-constrained environment, this study aims to fill the gap between the studies on the implementation of sustainability and strategic management theory in the tourism field.

2. Theoretical Framework

2.1. Environmentally Friendly Practices and the Hotel Industry

Sustainable tourism is important in the tourism industry as it considers environmental, social, and economic balances (Lu and Nepal, 2009). Accordingly, environmentally friendly practices in hotel operations serve as a practical manifestation of sustainable tourism principles, linking the abstract concept of sustainability with tangible managerial actions. Environmentally friendly practices play an important role in ensuring environmental sustainability and, at the same time, strengthen guests' environmental awareness and give businesses a competitive advantage (Süzer and Doğdubay, 2022). The adoption and dissemination of such practices, especially in local tourism destinations, can help reduce environmental impacts in the region and strengthen understanding of sustainable tourism (Liu et al., 2024).

Hotel businesses adopt various environmentally friendly strategies to reduce their environmental impact and use natural resources more efficiently (Nguyen, 2017). In this regard, with increasing environmental awareness, understanding sustainable tourism has begun to gain greater importance in the hotel industry. These environmental practices are based on sustainable resource management principles, such as energy efficiency, reduced water use, effective waste management, and protection of biodiversity. These elements contribute to minimizing hotels' environmental footprint and, at the same time, reduce their operating costs (Millar and Baloğlu, 2008). Environmental sustainability is not limited to ecological benefits; it also strengthens hotels' corporate image, increases

customer satisfaction (Yusof et al., 2017), and supports understanding of social responsibility (Singh, 2024). In this framework, integrating environmentally friendly practices into hotel operations is crucial to ensuring environmental, economic, and social sustainability. Therefore, the systematic and effective implementation of these practices is considered a strategic necessity for the long-term success of hotel businesses and achieving sector-wide sustainable development goals (Khalil et al., 2024).

2.2. Smart Technologies and Hotel Management

Today, smart technologies are defined as systems that combine advanced digital solutions such as artificial intelligence, big data analytics, Internet of Things (IoT), and automation (Nafrees and Shibly, 2021). The hospitality industry is also affected by this technological transformation and has begun implementing these innovations to improve service quality and optimise operational processes. For example, room technologies that allow guests to adjust temperature and lighting. Smart energy management systems, on the other hand, monitor energy consumption in real time, preventing waste and enabling hotels to reduce carbon emissions (Chan and Hsu, 2016; Kansakar et al., 2019). Artificial intelligence-based applications provide quick responses by predicting guest demand in advance, while big data analytics enable hotel managers to develop service strategies through more in-depth analyses of guest behaviour. All these technological developments not only increase operational efficiency but also promote a more conscious use of resources and more effective waste management by supporting environmental sustainability. In this context, hotels have the potential to increase guest satisfaction while achieving both environmental and economic sustainability goals (Kapiki, 2021).

The use of smart technologies in environmentally friendly practices in the hospitality industry is becoming increasingly widespread. Research shows that practices such as energy efficiency, water saving, and waste management play a critical role in the development of sustainable hotels (Kalefa and Gado, 2024). In addition, consumers' tendency towards environmentally friendly hotels is directly related to their level of awareness of environmental issues and sustainability (Gunduz Songur et al., 2023). Although green strategies implemented in hotels do not directly determine customer satisfaction, they do increase overall satisfaction (Kim et al., 2016). In addition, green technologies have been found to provide environmental benefits and to affect customer and employee satisfaction positively (Xess et al., 2021). Thongmun et al. (2025) examine how smart amenities and green communication shape guests' sustainable behaviors, pinpointing the importance of technological design in driving eco-conscious decision-making (Kruesi and Bazelmans, 2023; Thongmun et al., 2025). In a broader review, research underscores critical applications, including automated HVAC systems, water management technologies, and waste-reduction mechanisms, that foster operational sustainability (Afchar et al., 2026). Additionally, IoT-enabled solutions

for housekeeping — such as intelligent scheduling and resource optimization tools — demonstrate tangible gains in both efficiency and environmental performance (El Hajal & Yeoman, 2025; Kalsi et al., 2025; Pergelova et al., 2026). This study aims to fill a gap in the literature by examining how hotel businesses in Kastamonu use smart technologies to support environmentally friendly practices from a resource-based perspective. By providing a comprehensive assessment of the adoption processes of these technologies in tourism destinations in the region, it aims to contribute to businesses' strategic orientations toward sustainable competitive advantage. At the same time, it aims to bring new insights to the sustainable tourism literature by developing practical recommendations for hotel managers, policymakers, and academics.

2.3. Resource-based view theory

The Resource-Based View (RBV) argues that unique and difficult-to-imitate resources and competencies play a decisive role in businesses' sustainable competitive advantage. In this framework, the literature emphasises that organisational competencies such as information technology capacity, the use of artificial intelligence, social media management, and social commerce skills directly contribute to business performance (Acikgoz et al., 2024). Barney's (1991) basic characteristics of resources, such as being rare, valuable, inimitable, and unique to the organisation, have served as a foundational reference point in the development of this theory (Kozlenkova et al., 2014). Furthermore, RBV examines not only the valuable and scarce nature of resources, but also the mechanisms that enable these resources to be converted into long-term competitive advantage (Wade and Hulland, 2004). In this context, beyond the environmental benefits of smart technologies, the economic and strategic returns they provide to hotel businesses are important. For example, IoT-based energy management systems not only reduce carbon emissions but also enable hotels to gain a more advantageous position in price competition by reducing costs (Jones et al., 2016). Similarly, it is stated that smart customer experience tools, such as digital menus and in-room automation systems, increase customer loyalty and expand businesses' market share (Kim et al., 2016; Yusof et al., 2017). This demonstrates that, as predicted by RBV, technologies are not merely tools that support environmental performance; they are also strategic resources with the potential to create sustainable competitive advantage.

The RBV approach argues that businesses should evaluate strategic success not only in terms of opportunities in the external environment but also through internal resources and competencies under their control. According to this perspective, competitive advantage is achieved and sustained through the ability to use the business's resources effectively and uniquely (Acikgoz et al., 2024). However, the sustainability of this advantage depends on the ongoing development of these resources and their integration into the business's organizational structure. How hotels can use information technology (IT) innovatively and maintain a robust

management structure are among the factors that can bring long-term advantages and ensure that a hotel remains competitive in the hospitality industry. Evans (2016) notes that technology and a strong management structure are key factors that can help a hotel differentiate itself and achieve a sustainable competitive advantage in the hospitality industry. Wade and Hulland (2004) also argue that adopting the Resource-Based View (RBV) provides businesses with a long-term strategic direction that enables them to focus on both internal and external resources.

Barney (1991) shows that an innovative technology can be regarded as a strategic resource provided it has the characteristics of being valuable, rare, and inimitable. Thus, for example, according to Jones et al. (2016), Zaniboni (2024), and Thongmun et al. (2025), IoT enables cost reduction and sustainable performance. Since only a handful of hotels in Kastamonu are equipped with smart technologies due to the high initial investment and advanced technical skills required, they are considered scarce in the context of Kastamonu hotels. Hence, such technologies are not easily imitated by rivals in the short term (Eskerod et al. 2019). An example of a valuable, rare, unique, and non-substitutable resource is the AI technology used in Winnow, an innovative food waste management solution that leverages intelligent scales and computer vision. It enables high cost and environmental savings. The company Winnow is a relatively new player in the market, and its market penetration is rare. The algorithms and the data it collects through firsthand experience are company secrets and, as such, are inimitable. Hillsdon (2025) provides a detailed explanation of the resource.

In their comprehensive theoretical analysis of the Resource-Based View (RBV) in hospitality and tourism research, Kruesi and Bazelmans (2023) highlight differences in the literature regarding the definition and measurement of the term "resource," which is believed to be the source of competitive advantage. The authors point out conceptual and methodological shortcomings in previous research and argue that RBV should be approached more thoroughly and methodically (Ampauleng & Abdullah, 2023; Kero & Bogale, 2023; Kruesi & Bazelmans, 2023). Bekele and associates (2024) also examine how digital transformation initiatives contribute to more sustainable hotel operations, highlighting the strategic importance of technology investments, particularly in resource and energy management. According to Adeel and colleagues (2024), environmental technologies such as waste-to-energy infrastructure and solar energy systems can significantly influence consumer attitudes and eco-friendly behavior. They position sustainable intelligence as a mediating variable in this relationship. Together, these studies strengthen the theoretical connection between sustainable competitive advantage and environmental practices by providing a more tangible example of how RBV criteria can be applied to technological applications in the hospitality industry.

3. Methodology

This study used a qualitative case study design to examine the integration of smart technologies into environmentally friendly practices by hotels in the city center of Kastamonu. Qualitative research provides a flexible and exploratory way to understand individual experiences, perceptions, and in-depth knowledge of social phenomena (Creswell & Poth, 2016).

The study population consists of all star-rated (at least 1 star) hotels operating in the central district of Kastamonu as of 2025. According to data from the Provincial Directorate of Culture and Tourism, 8 hotels meet this criterion. Seven of these hotels agreed to participate in the study, corresponding to approximately 87.5% of the population. Hotel managers who play a direct role in determining or implementing environmental sustainability policies were selected as participants. In the study, the criterion sampling method was used to ensure that businesses meeting the specified criteria were included (Patton, 2002). This study design enabled the researchers to concentrate on organizations with a particular organizational structure and the ability to apply innovative technologies to environmentally friendly practices. Therefore, this study evaluated the applicability of sustainability practices not only at the discourse level but also at the organizational level.

This study was carried out specifically in Kastamonu for both contextual and academic purposes. First, Kastamonu is one of Türkiye's developing tourist destinations; empirical research on the application of sustainability-oriented technologies is limited there (Çakmak & Isaac, 2012; Timur & Getz, 2009). Although smart and eco-friendly applications have been examined more comprehensively in the large-scale tourist destinations of Istanbul and Antalya, Kastamonu exemplifies a new market structure in which organizations with relatively limited financial, management, and infrastructure capabilities operate (Türk & Sevim, 2025). With these characteristics, Kastamonu offers a meaningful research ground for examining how smart technologies are adopted under resource constraints and transformed into a strategic advantage. Second, the region has been promoted by national policies as part of Türkiye's "alternative tourism" and "sustainable tourism" initiatives, making it a strategically significant yet academically underexplored case (Ministry of Culture and Tourism, 2007). Finally, from a methodological perspective, Kastamonu provides a manageable research setting where the entire hotel population is accessible for in-depth qualitative investigation, thereby ensuring high representativeness within the local context while addressing a gap in the broader literature on sustainable tourism in secondary destinations (Gössling and Hall, 2009; Sharpley, 2009). Unlike prior studies focusing on selected case hotels or single-property analyses, this study captures 87.5% of the star-rated hotel population in the destination, thereby offering a near-complete ecosystem perspective within the local hospitality context.

A semi-structured interview form was used during data collection. Semi-structured interviews provide the researcher with flexibility, allowing participants to elaborate on their views and present new ideas (Bryman, 2016). The interview form was developed in line with the literature review (Kafa et al., 2020; Çolak and Karakan, 2021; Kıvılcım, 2021; Genç, 2022) and expert opinions and includes open-ended questions that will allow the participants to convey their experiences on environmentally friendly practices and the use of smart technologies in detail. The data were collected approximately one year ago; however, the findings remain relevant as the technological practices examined have not undergone significant changes during this period. The interviews were conducted face-to-face with seven hotel managers in the hotel environment. The interviews were audio-recorded, and notes were taken with the participants' consent. The research data was collected in accordance with the approval granted by Decision No. 7 following an application made to the Kastamonu University Ethics Committee on 7 January 2025.

The study's findings were analyzed using content analysis, a qualitative method that systematically organizes data into categories and themes (White and Marsh, 2006). The data were segmented, coded, and clustered according to the most frequently expressed patterns, with representative statements supported by direct quotations. To facilitate this process, the qualitative data analysis software MAXQDA was employed, which is widely recognized for its utility in qualitative research (Gizzi and Rädiker, 2021).

For this study, the Hierarchical Code–Subcode Model was adopted. First, the raw data were imported into MAXQDA, and during the open coding phase, line-by-line examination was conducted to identify meaningful units of analysis. These units were initially assigned subcodes, which were subsequently grouped into broader codes and organized into higher-order categories following the hierarchical structure of the model. Each code and subcode was clearly defined and systematically documented within MAXQDA. To ensure analytic rigor and transparency, coding decisions—such as merging or splitting categories—were tracked using analytic memos. Inter-coder reliability was assessed using Cohen's Kappa, and any discrepancies were resolved through discussion to achieve consensus.

Various measures were taken to ensure the validity and reliability of the study. To increase the content validity of the data collection tool, a semi-structured interview form was developed by taking the opinions of field experts. To enhance the accuracy of the findings, we used member checking and asked participants to review and confirm the appropriateness of the coding (Lincoln and Guba, 1985). In this study, inter-rater reliability was analysed using Fleiss' Kappa statistic in SPSS 26. During the analysis, two coders were asked to match quotations to appropriate themes. The Fleiss' Kappa coefficient obtained from the calculations was $\kappa = 0.89$. According to the interpretation scale developed by Landis and Koch (1977), values between 0.81 and 1.00 are accepted as 'almost perfect fit'. In this context, the

kappa value of 0.89 indicates a high level of agreement between the coders. This finding reveals that the thematic analysis was carried out systematically and that the coding was largely consistent. This high level of agreement between the coders increases the reliability of the content analysis and supports the methodological soundness of the study.

4. Findings

The study findings were examined under four headings. These include evaluations of demographic information, descriptive analyses of the hotels and the code system, and hotel managers' views on smart and eco-friendly technologies.

4.1. Demographic Information

The demographic data of hotel managers within the scope of the study are given in Table 1.

Table 1: Demographic Information of Participants

		Frequency			Frequency
Gender	Female	2	**Age**	18-27	1
	Male	**5**		28-37	1
Education	Primary education			**38-47**	**3**
	High school	-		48+	2
	Associate Degree	3	**Work Experience**	0-4 Year	1
	Bachelor's Degree	**4**		**5-9 Year**	**3**
	Postgraduate	-		10-14 Year	-
				15+	**3**

The dataset reveals that most respondents are male (5 out of 7) and that work experience is distributed unevenly, with the highest representation in the 15+ years category (3 individuals). Regarding age, the 38-47 age group is the most represented (3 individuals), while younger age groups are underrepresented. Additionally, education levels indicate that most respondents hold a Bachelor's degree (4 individuals), with none holding only a high school education or postgraduate qualifications.

4.2. Descriptive Analysis of the Hotels

The participants were also asked questions to obtain information about the hotels. The answers to these questions are given in Table 2.

Table 2: Descriptive questions about the hotel

Year of Foundation	Number of Stars	Number of Rooms	Number of Beds	Target Market
1992	3	54	110	Different
2011	1	8	16	Various
2012	3	103	250	Entertainment and business
2012	1	61	160	Stopover accommodation
2016	3	20	64	Various
2017	3	65	130	Vacation and business
2021	4	150	300	Various

The dataset reveals a wide variation in hotel characteristics. The largest hotel, founded in 2021, features 150 rooms and 300 beds and caters to various target markets. In contrast, the smallest establishment, founded in 2011, has only 8 rooms and 16 beds. Interestingly, hotels established in 2012 show a significant contrast; one has 103 rooms and 250 beds and serves entertainment and business travelers, while the other, with 61 rooms and 160 beds, is primarily a stopover accommodation. The most recent hotel in the dataset, from 2018, also stands out as the largest, suggesting an increasing trend toward larger capacities in recent years.

4.3. Descriptive Analysis of the Code System

Within the scope of the study, 7 semi-structured interview questions were directed to the hotel managers. In this context, the hotel managers were asked questions about their awareness of environmentally friendly practices and smart technologies, the contribution of smart technologies to the hotels, the impacts of environmentally friendly smart technologies, challenges/barriers to smart technologies, and future-oriented goals. The codes formed in line with the participant's answers are given in Table 3.

Table 3: Hotel Managers' Evaluation

	Question Codes	Answer Codes
1	Awareness of environmentally friendly practices	Zero waste / Waste oils / Recycling / Environmental cleaning / Environmentally friendly products / Waste separation / Animal-friendly / Sustainability / Smart technology
2	Awareness of environmentally friendly smart technologies	Smart lighting / Smart electrical system / Low flow taps / Smart kitchen appliances / Automation / Energy control system / Led lighting / Waste separation / Animal-friendly / Smart card system / Smart energy system / Water saving / Digital menu / Recycling
3	Environmentally friendly smart technologies	Recycling / Waste separation / Energy saving / Water saving / Filtered exhausts / Sensor taps / Energy control system / Sensor soap dispensers / LED lighting / Sensor leds / Thermostat heating system / Energy control system / Sensor lighting / Digital menu
4	Contributions of smart technologies to the hotel	Energy saving / Time saving / Prevention of waste / Customer satisfaction / Reducing environmental pollution / Recycling / Water saving / Prevention of waste

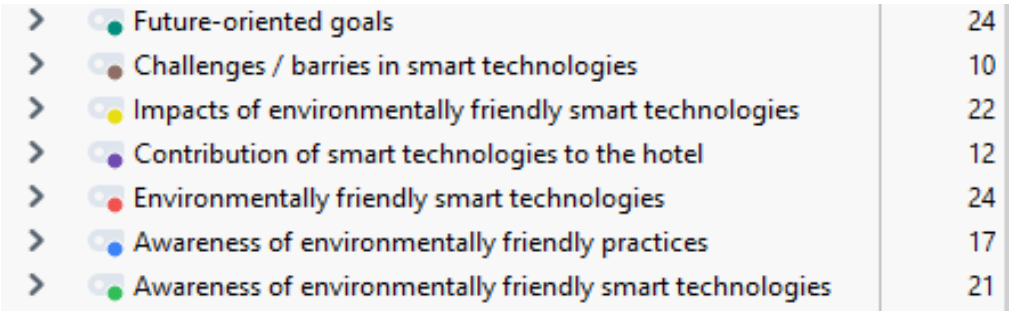
Tablo 3'ün Devamı

5	Impacts of environmentally friendly smart technologies	Unnecessary for the guest / Time saving / Comfort / Efficiency / Motivation / 6Branding / Competitive advantage / Environmental awareness / Productivity / Innovation / Modern system
6	Challenges/barriers encountered in smart technologies	Departure from the original / High investment cost / Employee adaptation / Procurement issues / We are not experiencing any difficulties / Technical support
7	Future-oriented goals	Solar panel system / Increase the use of smart technologies / Smart lighting / Energy management system / Wind turbines / Smart waste collection system / Electric vehicle charging station / Chatbot / Sensor lighting / Sensor faucet / Prevention of waste / Recyclable products / Touch system / QR code system

The data highlights hotel managers' strong awareness of environmentally friendly practices and smart technologies, with a focus on waste separation, recycling, and energy-saving systems. The most notable contributions of smart technologies include energy and time savings, waste prevention, and enhanced customer satisfaction. However, challenges such as high investment costs and employee adaptation remain significant barriers. Looking ahead, hotels aim to install solar panels, wind turbines, smart waste collection systems, and electric vehicle charging stations, demonstrating a commitment to sustainable innovation in the industry.

Based on the participants' answers, 130 codings were performed in MAXQDA. The highest number of codings was in environmentally friendly smart technologies (24 codes) and future-oriented goals (24 codes). The code system is given in Figure 1.

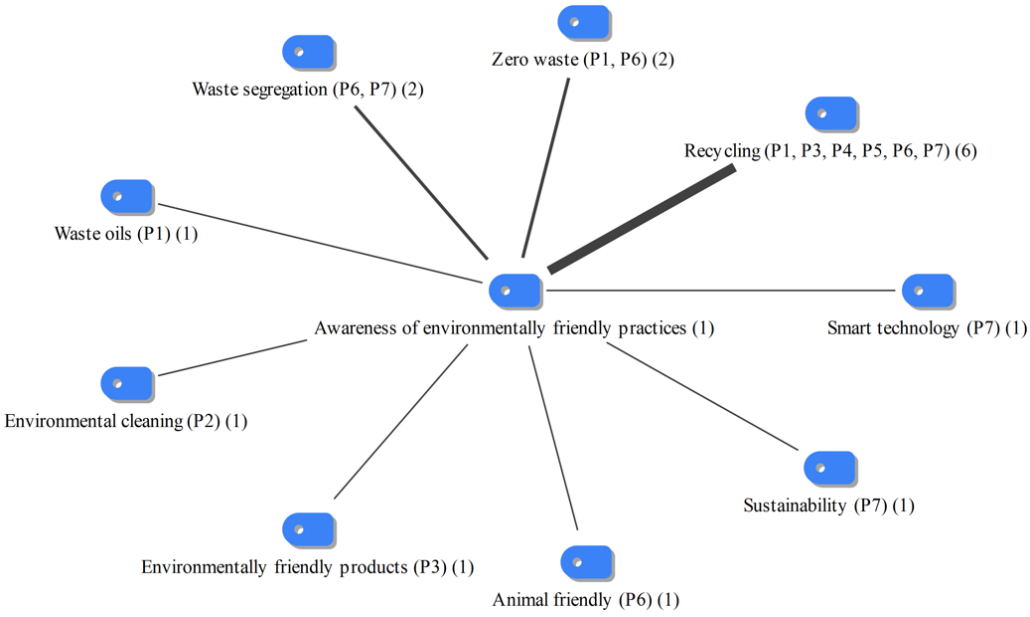
Figure 1: Code System



4.4. Hotel Managers' Views on Smart and Eco-Friendly Technologies

The first question asked of the participants was, "How much importance is given to environmentally friendly practices in your hotel? What is your approach in this regard?" The code map, created within the scope of the participants' answers, is shown in Figure 2.

Figure 2: Awareness of environmentally friendly practices



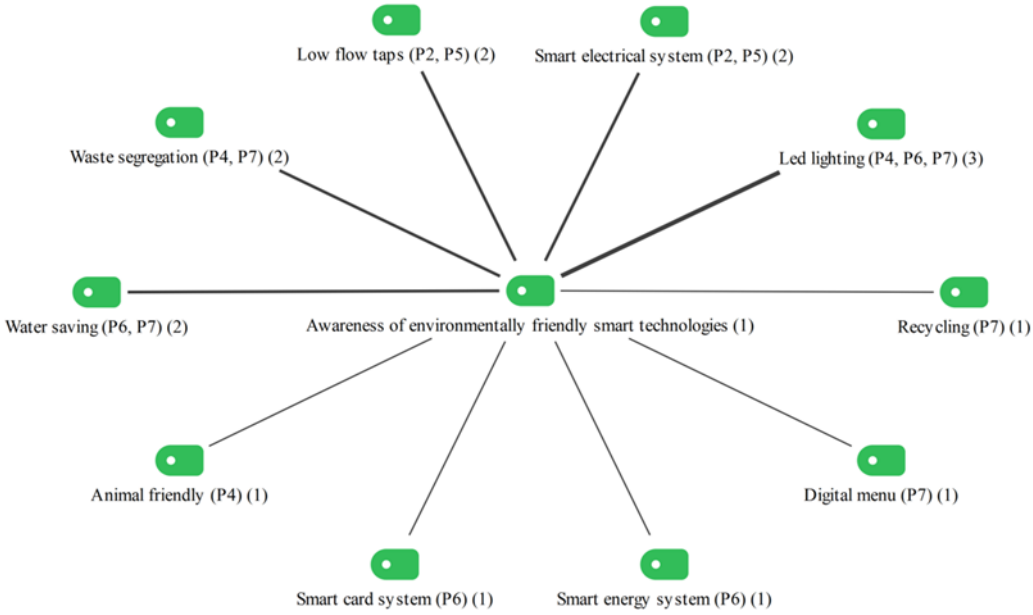
It was determined that the participants were most sensitive about recycling (6), zero waste (2), and waste segregation (2) in terms of awareness of environmentally friendly practices (Figure 2). The opinions of the participants coded P1 and P7 support the majority opinion.

P1: *"We try to utilize every waste as zero waste. Electricity and natural gas are used. Things that pollute the air are not used. Used oils are collected. We have to use some things standardized. You cannot give up plastic and packaged products. For example, we cannot give open water in a jug. It is necessary to give it in a bottle, for example."*

P7: *"We have a commission for environmentally friendly practices at the center. We reflect the decisions of the commission from the food and beverage part of the hotel to the staff awareness-raising part. We also have an internal sustainability commission. It meets once a month in a more professional manner. Technologically, we have our IT team. We also separate waste batteries ourselves. We separate the oil and plastics ourselves. We collect them all separately and give them to different state institutions."*

The second question asked participants, "Are you aware of smart technologies that support environmentally friendly practices (e.g., in-room energy control system, low-flow taps, waste separation systems, LED lighting)?" The code map, created within the scope of the participants' answers, is shown in Figure 3.

Figure 3: Awareness of environmentally friendly smart technologies



Regarding awareness of environmentally friendly smart technologies, participants were more sensitive to LED lighting (3), smart electrical systems (2), and low-flow taps (2) (Figure 3). Only the 10 most frequent codings are mapped. Other codes and their frequencies are as follows: smart kitchen equipment (1), automation (1), smart lighting (1), and energy control system (1). The opinions of the participants coded P2 and P6 support this view.

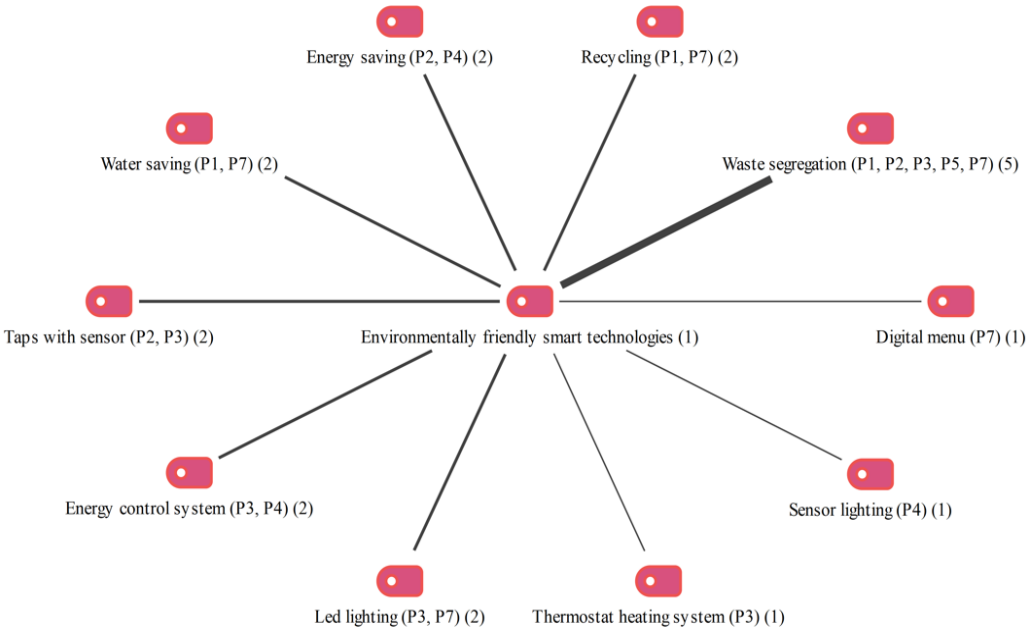
P2: *"Energy saving is in use in our hotel and is activated with a card. In this way, there is no electricity in any device except the devices that need to work when there are no guests. At the same time, sensor low-pressure taps are used in general areas. The hoods used in our kitchen are connected to filtered exhaust fans. In this way, air pollution is prevented. It is also connected to the automation system and managed by computer."*

P6: *"We use a card system. As soon as the guests insert the card, the energy is activated. As soon as they remove the card, all electricity is cut off, saving electricity. More or less, all our lighting is LED lighting. While a light bulb consumes 80-90 w of electricity, an LED consumes 8-9 w. Strip LEDs are better. In the kitchen, we ensure the coolers and cabinets are energy efficient. We use a dishwasher to save water. Businesses already need to do these to reduce expenses."*

The third question asked the participants was, "Do you use smart technologies in environmentally friendly applications (e.g., energy efficiency, water

saving, waste management)? If so, which technologies do you use?" The code map, created within the scope of the participants' answers, is shown in Figure 4.

Figure 4: Environmentally friendly smart technologies



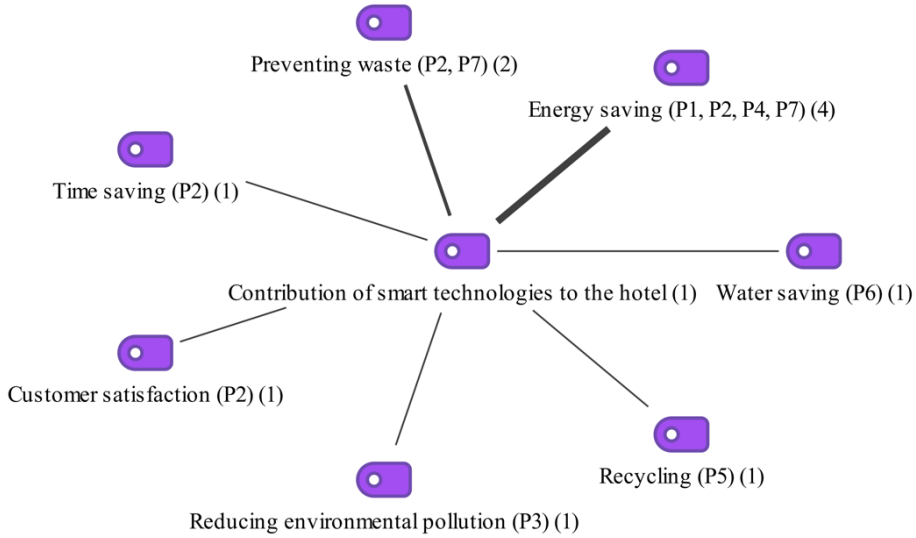
In the question to determine which environmentally friendly smart technologies the hotels use, themes such as waste segregation (5), energy saving (2), and water saving (2) came to the fore (Figure 4). Only the 10 most frequent codings are mapped. Other codes and their frequencies are as follows: LEDs with sensors (1), soap dispensers with sensors (1), and exhausts with filters (1). The opinions of the participants coded P2 and P3 support the majority.

P2: *"We give waste oil to the municipality. In order to increase energy efficiency, we use saver karts (energy saving cards), filtered exhausts, and low-pressure taps."*

P3: *"We use in-room energy control system, sensor taps, and sensor soap dispensers, LED light bulbs, sensor leads in corridors, thermal insulation, thermostat heating systems, and recycling bins for waste."*

The fourth question asked the participants: "Do you think that smart technologies contribute or can contribute to environmentally friendly practices in your hotel? If so, what are the most important contributions?" The code map, created within the scope of the participants' answers, is shown in Figure 5.

Figure 5. Contribution of smart technologies to the hotel



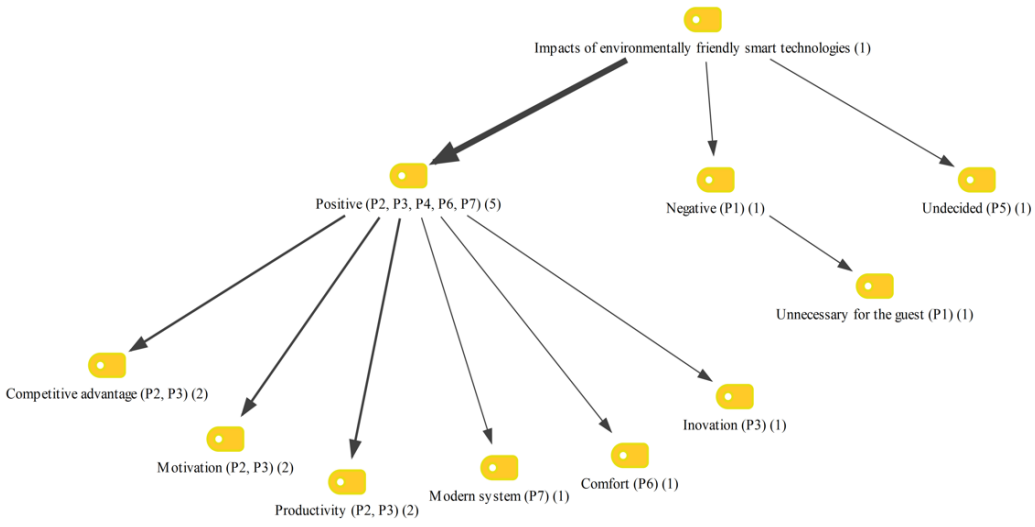
The participants emphasized energy saving (4) and preventing waste (2) in terms of the contribution of smart technologies to the hotel (Figure 5). The opinions of the participants coded P3 and P7 support this view.

P3: "Yes, it can significantly enhance the guest experience, improve operational efficiency, and provide a competitive advantage. Most importantly, it minimizes environmental pollution."

P7: "Yes, we do. In the future, we plan to switch to a room system with a QR code. Because the cards in the rooms are plastic, we will start to remove the use of plastic. We will both reduce the use of plastic and switch to technology."

The fifth question asked the participants: "What do you think about the effects of environmentally friendly technologies on your customers and employees? How do these technologies affect your stakeholders' perceptions of your business?" The code map, created within the scope of the participants' answers, is shown in Figure 6.

Figure 6. Impacts of environmentally friendly smart Technologies



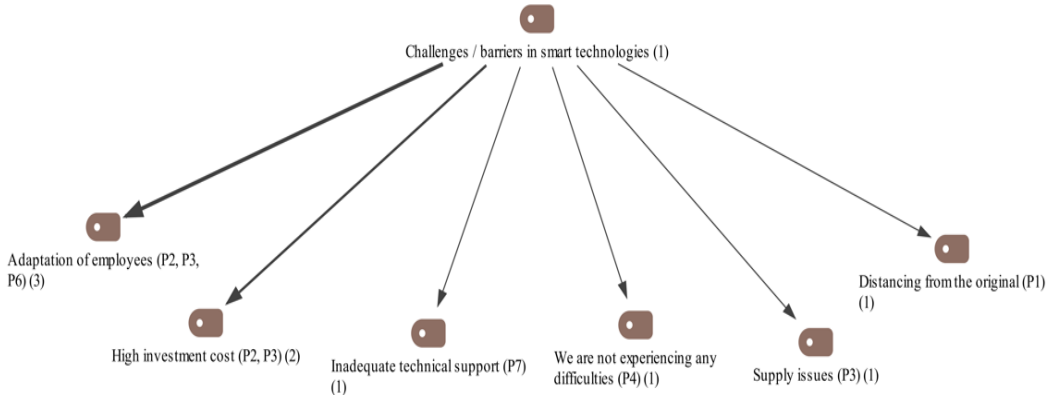
While 5 participants argued that environmentally friendly smart technologies have positive effects, 1 stated that they are unnecessary for the guest (P1), and 1 remained undecided. Among the positive impacts, factors such as competitive advantage (2), motivation (2), and productivity (2) came to the fore (Figure 6). Only the 6 most frequent codings are mapped for the positive impacts. Other codes and their frequencies are as follows: environmental awareness (1), branding (1), and time saving (1). The opinions of the participants coded P1 and P2 are given below:

P1: "The customer wants to be comfortable and safe. I do not think that people who come to have fun and rest will also consider whether there is an environmentally friendly application. I do not think it will be an attractive thing. It may sound selfish, but everyone pays attention to this in the case of their purse. I am paying money, and I will get my service. They will look at the service they receive."

P2: “Environmentally friendly technologies are welcomed positively by our customers and employees and reinforce the sensitivity of our business on sustainability. While our guests appreciate our environmentally conscious practices that increase their comfort, our employees gain motivation thanks to more efficient business processes. These technologies create a competitive advantage by enabling our business to be perceived as an environmentally conscious brand.”

The sixth question asked the participants: "What are the challenges or barriers you face in integrating smart technologies for environmentally friendly applications in your hotel? How do you plan to overcome these obstacles?" The code map, created within the scope of the participants' answers, is shown in Figure 7.

Figure 7: Challenges/barriers in smart technologies



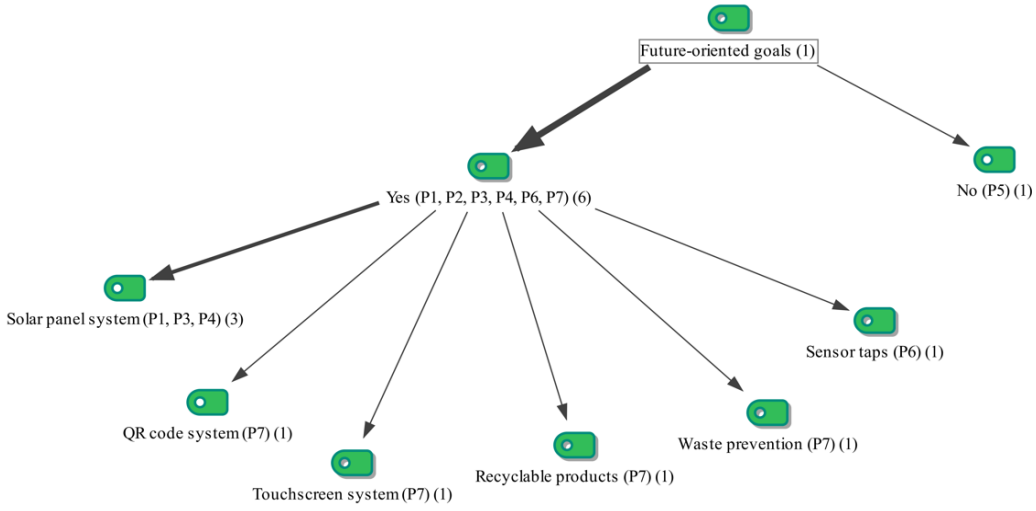
In terms of the challenges encountered in this context, the themes of employee adaptation (3) and high investment costs (2) emerged as priorities (Figure 7). The opinions of the participants coded P2 and P6 support this view.

P2: "One of the biggest challenges in integrating smart technologies is the high investment costs. In addition, harmonizing existing systems with these technologies and adapting personnel to new applications can also take time. In order to overcome these obstacles, we adopt a gradual transition strategy, implement pilots in priority areas, and organize training programs for our employees. At the same time, we aim to optimize costs by taking advantage of sustainability projects and government incentives."

P6: "Technology also has disadvantages now. It is difficult to use and perceive above a certain age. How widespread are the places and people who will use the technology should be looked at. People over a certain age do not use it, so the staff have to help them. We need to prepare people gradually for technology and innovation. After all, people can question as much as they know."

The seventh question asked the participants was, "Do you have any future-oriented goals, such as developing or expanding smart technologies in environmentally friendly applications?" The code map, created within the scope of the participants' answers, is shown in Figure 8.

Figure 8: Future-oriented goals



While 6 participants stated that they have future targets for such technologies, 1 participant (P5) stated they do not have any plans. The solar panel system (3) emerged as a key future goal (Figure 8). Only the 6 most frequent codings are mapped for the future-oriented goals. Other codes and their

frequencies are as follows: sensor lighting (1), chatbot (1), electric vehicle charging station (1), smart waste collection system (1), wind turbines (1), energy management system (1), smart lighting (1), and increasing the use of smart technologies (1). The opinions of the participants coded P3 and P7 are given below:

P3: "Our hotel will use smart technologies to minimize energy consumption and increase environmentally friendly practices. Consumption will be optimized with smart lighting and energy management systems, while investment will be made in renewable energy sources such as solar panels and wind turbines. Smart water meters will increase efficiency by monitoring water consumption, while smart waste collection systems will encourage recycling. Room management systems will contribute to energy savings, and electric vehicle charging stations will be increased. Guests will be informed and encouraged about environmentally friendly practices through digital platforms and chatbots. Thus, our hotel will offer both a sustainable and modern accommodation experience."

P7: "Yes. For slippers, for example, we are separating the bagged system. They are for single use in the cupboard, but we will completely remove the bag. There are laundry bags; we turn them into biodegradable bags. The disposable ones in the shampoo section have been removed. We switched to a push-matic system. It can be used as much as needed. The hotel management cost is low, as glass bottles of water will be given to the rooms using plastic bottles. There will be a transition to QR code."

A word cloud (Figure 9) has also been created based on the participants' responses:

Figure 9: Word cloud

The most frequently used terms in the word cloud reveal the study's focal points and key concepts. The prominence of the words 'Waste' (35 times) and 'Smart' (33 times) emphasizes the study's relationship to waste management and smart solutions. The frequency of the words 'Environmentally' (31 times) and 'Friendly' (30 times) indicates that sustainable, environmentally friendly practices are at the forefront. The frequent use of 'Energy' (30 times) and 'System' (29 times) together suggests that energy management and systemic approaches are important in the study. Finally, the term 'Technologies' (27 times) emphasizes how technological developments are integrated in this context. These data indicate that the study focuses on environmentally friendly waste management and energy systems enabled by smart technologies.

4.5. Analysis of Findings within the Resource-Based View (RBV) Framework

The VRIO framework of the Resource-Based View was used to assess the smart technologies in Kastamonu hotels to go beyond descriptive findings (Barney, 1991). This analytical method can be used to determine whether these technologies provide sources of short-term efficiency or long-term competitive advantage.

Table 4: VRIO-Based Evaluation of Smart Technologies Used in Hotels in Kastamonu

Smart Technology / Practice	Valuable	Rare	Inimitable	Organized	Type of Competitive Implication
LED Lighting Systems	✓ Reduces energy consumption and operational costs	✕ Widely adopted	✕ Easily replicable	✓ Operationally integrated	Temporary advantage / Operational efficiency
Card-Based Energy Control Systems	✓ Controls unnecessary energy use	✕ Increasingly common regionally	✕ Technologically imitable	✓ Embedded in operational processes	Competitive parity
Sensor-Based Faucets & Dispensers	✓ Enhances water efficiency	✕ Standardized technology	✕ Easily accessible in market	✓ Physically integrated	Competitive parity
Digital Menu / QR Code Systems	✓ Reduces paper waste and enhances modern image	✓ Relatively rare in small destinations	✕ Technologically replicable	△ Partially integrated	Short-term differentiation
Solar Panel Systems (Planned)	✓ Potential long-term cost reduction	✓ Limited adoption in Kastamonu	✓ Requires high capital investment and infrastructure	△ Planned but not fully implemented	Potential sustainable advantage
Internal Sustainability Committee	✓ Strengthens environmental awareness and coordination	✓ Rare at regional level	✓ Organizational culture-based, socially complex	✓ Integrated into decision-making processes	Sustainable competitive advantage
Integrated Energy Management Systems	✓ Optimizes energy performance	✓ Limited in small-city context	✓ Requires technical expertise and system integration	△ Partially institutionalized	Potential competitive advantage

The Resource-Based View (RBV) states that when a company's resources are rare, valuable, unique, and well-organized, it can gain a sustained competitive advantage (Barney, 1991). The VRIO framework was used in this study to systematically assess the smart technologies in Kastamonu hotels and determine their strategic implications.

According to the analysis, widely used technologies that lower operating costs and enhance environmental performance, such as card-based energy control systems and LED lighting systems, are clearly valuable. These technologies are neither uncommon nor hard to replicate, however. According to Wade and Hulland (2004), readily available information and technology-based resources in the market typically lead to operational efficiency rather than long-term competitive advantage. Therefore, rather than offering long-term differentiation, these technologies offer competitive parity or a short-term advantage.

Internal sustainability committees and other organizationally embedded resources, on the other hand, exhibit stronger VRIO characteristics. Due to their social complexity and relative rarity in the local context, these structures are challenging to duplicate. Competitive advantage in hospitality research, according to Kruesi and Bazelmans (2023), is often more about how technological resources are incorporated into organizational capabilities and culture than about simply owning technology.

In small-destination settings, integrated energy management systems and renewable energy investments (like solar panels) also show promise for creating a long-term competitive advantage. Even though these systems demand a great deal of financial and technical resources, their strategic value lies in their incorporation into long-term sustainability planning, not just in their technological existence.

In conclusion, the results indicate that although the majority of smart technologies in Kastamonu hotels improve operational effectiveness and environmental performance, sustainable competitive advantage mainly arises when technological resources are paired with organizational skills and strategic dedication. This contextualized application of the RBV highlights the significance of organizational embeddedness in converting environmental technologies into strategic assets.

5. Discussion and Conclusion

This study aims to examine the impact of smart technologies on the eco-friendly practices implemented by hotel companies and their performance. The results showed that the application of smart technologies significantly influenced the environmental sustainability performance of hotels. According to the Resource-Based Theory (RBV), smart technologies are valuable, rare, inimitable, and organizational resources, and thus can help hotel companies obtain sustainable

competitive advantage. However, the RBV literature emphasises (Barney, 1991; Kozlenkova et al., 2014) that for a resource to create a sustainable competitive advantage, it is not sufficient for it to merely improve environmental performance; it must also make a strategic contribution to business performance. Indeed, research indicates that smart technologies increase business efficiency, providing long-term cost advantages (Bekele et al., 2024), and strengthen customer satisfaction and loyalty (Kim et al., 2016; Yusof et al., 2017), support branding (Adeel et al., 2024), and thus establish a strong link between sustainability and competitive advantage. From this perspective, in the Kastamonu example, hotels that invest in technology despite limited resources both fulfil their environmental responsibilities and increase their chances of long-term success by differentiating themselves in the market. While smart technologies are not new to the hospitality industry, their strategic interpretation in resource-constrained emerging destinations remains underexplored. Unlike studies conducted in global hotel chains or smart-city environments, this study demonstrates how small-scale hotels reinterpret widely available technologies through organizational integration and sustainability-oriented management structures. Therefore, the originality of this study does not lie in the technological novelty itself, but in revealing how contextual factors transform operational technologies into strategic resources in small tourism destinations. From a theory-based perspective, our study reveals that the strategic value of smart technologies per se is determined more by the organisation in which they are deployed than by their technology attributes. Our study contributes to the RBV literature in hospitality research by showing that ubiquitous smart technologies, previously deemed commodities or inputs, can become a source of sustained competitive advantage for hospitality companies when integrated into their internal governance and management systems. Our study thus provides an applied interpretation of the VRIO logic in the context of small destination tourism.

To discover the functions and potential of smart technologies in the operational activities of hotels, such as energy efficiency, water conservation, waste management, etc. Chan and Hsu (2016) found that adopting energy-efficiency systems and lighting can reduce hotels' energy consumption by up to 20%. Technology can have an environmentally friendly and cost-saving effect on businesses by enabling more efficient use of resources. IoT-based systems have the potential to reduce environmental impacts, as reported by Jones et al. (2016). However, from the perspective of RBV, it is not enough for organizations to have advanced technological resources. It is also necessary to integrate the technology it possesses into the company. In this regard, the hotel managers interviewed for the study noted that they had not yet implemented any smart technologies in their hotels due to high investment costs and technological incompatibilities among the existing systems. These findings are also supported by the study by Hall et al. (2020). In this case, the organizational dimension of RBV comes to the fore, indicating that companies must have an organizational structure that can efficiently integrate their technological resources with business processes to transform them into competitive advantages. It is important to bear in mind that in contrast to the

studies carried out in large-scale international hotel chains (for example, the research by Hillsdon (2025) which reveals that the Hilton hotel chain has decreased its water consumption by 43% across the world), the limited use of smart technologies in the hotels in the Kastamonu city centre is a remarkable finding. This is because the high costs of implementing smart technologies and the need for employees to adapt to new working conditions and equipment appear to be insurmountable barriers for hotels in Kastamonu city centre. Again, the contextual difference between emerging destinations and global hospitality leaders should not be overlooked. The diverse economic, social, and organizational features of each context are likely to affect the adoption and use of smart technologies in distinct ways. As Yusof et al. (2017) revealed, environmentally friendly practices increase customer loyalty and strengthen hotels' market position. In this context, the capacity of smart technologies to improve customer experience is a rare resource that adds value to businesses. On the other hand, the study has some limitations. The sample is limited to a specific geographical region, and hoteliers in different destinations may vary in their ability to access and integrate these resources. In addition, more comprehensive, long-term research is needed to assess the impact of technologies better.

In conclusion, smart technologies not only contribute to environmental sustainability in eco-friendly hotel management but also provide hotels with long-term strategic advantages when evaluated within the RBV framework. For these technologies to become widespread, policies and incentive mechanisms should be developed to make it easier for hotel managers to conduct cost-benefit analyses. Future studies can contribute to the literature by comparatively examining the access to these technologies, integration processes, and the transformation of these resources into competitive advantages for hotels operating in different destinations. Mixed-method approaches combining qualitative interviews with quantitative surveys could also offer more robust evidence of the relationship between smart technology adoption and business performance. Additionally, longitudinal studies would be valuable in assessing how investment in smart technologies evolves over time and whether initial barriers, such as employee resistance, diminish as technologies become more embedded in organizational culture.

6. Theoretical and Practical Implications

This study offers theoretical and practical implications by examining the interaction of smart technologies with environmental attitudes. At the theoretical level, the findings reveal that smart technologies enhance operational efficiency in environmental sustainability and reinforce individuals' environmental attitudes. This suggests that individuals adopt technology as a tool and as part of their environmental responsibilities. When evaluated from a behavioral perspective, environmentalist attitudes shape intentions to use technology, and the link between digitalization and sustainability is increasingly stronger. Moreover, from a resource-

based perspective, the role of technology in transforming individuals' environmental behaviors indicates that smart systems have become strategic resources for businesses and individuals.

On a practical level, these findings emphasize the importance of supporting environmental policies with technological tools. Joint efforts by local governments, public institutions, and the private sector to develop environmentally friendly, smart solutions can deliver both environmental and social benefits. Integrating smart systems, especially in key areas such as energy efficiency, water saving, and waste management, effectively reduces environmental impacts. However, awareness-raising activities and training programs should be developed to enable individuals to use technological tools effectively while adopting an environmentalist attitude. In this regard, organizing public awareness campaigns can ensure the sustainability of environmentally friendly behaviors.

Meanwhile, there is a significant opportunity for new projects and digital solutions driven by the younger generation's interest in green technology. In light of this, policymakers need to create long-term plans to make sustainable technologies more widely available. Using impact-based environmental communication techniques in hotel rooms and common areas is another helpful suggestion. Instead of making general claims about sustainability, hotels could provide visitors with quantifiable environmental impact data, such as how much water, energy, or trees are saved by using specific smart technologies, like LED lights or low-flow taps. Hotels can increase the tangibility and credibility of their sustainability efforts by quantifying the environmental benefits (e.g., "This system saves X liters of water per day" or "This initiative reduces annual carbon emissions by X%). By connecting operational effectiveness to observable environmental outcomes, this transparency not only increases visitors' awareness of environmental issues but also strengthens the strategic value of smart technologies.

In summary, incorporating smart technologies into everyday life while maintaining an environmentally conscious mindset promotes eco-friendly living at the personal level. At the societal level, it builds the framework for long-term change. The study shows how strategic management frameworks can be effectively applied beyond large corporate environments to small-scale tourism destinations by empirically operationalizing the VRIO dimensions in a qualitative hospitality setting.

Statements and Declarations

The authors have no relevant financial or non-financial interests to disclose. No funding was received to assist with the preparation of this manuscript. The authors declare that ethical rules were followed in this study. Permission to conduct the interviews for this study was obtained from all respondents, who were fully

informed about the purposes of this study and how their responses would be used and stored.

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Katkı Oranı Tablosu

Hakem Değerlendirmesi: Dış bağımsız.	**Bilgilendirilmiş Onam Formu:** Tüm taraflar kendi rızaları ile çalışmaya dâhil olmuşlardır.
Teşekkür: Araştırmaya katkıda bulunan tüm otel yöneticilerine teşekkür ederiz.	**Araştırmacıların Katkı Oranı:** Yazarlar çalışmaya eşit oranda katkı sağlamıştır.
Destek Bilgisi: Herhangi bir kurum ve/veya kuruluştan destek alınmamıştır.	**Etik Kurul Onayı:** Kastamonu Üniversitesi, 07.01.2025 tarihli, 7 sayılı karar
Çıkar Çatışması: Yazarlar arasında çıkar çatışması yoktur.	