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THE IMPACT OF ARTIFICIAL INTELLIGENCE ON THE HOSPITALITY SECTOR

– Innovating efficient practices for hosts

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Abstract (Group part)

This work project examines the transformative impact of Artificial Intelligence (AI) on the hospitality sector, focusing on enhancing sustainable practices, innovating efficient practices for hosts, and leveraging chatbots to improve guest experiences. Through a comprehensive review of current literature and advanced applications, it explores how AI technologies can optimize operations, personalize services, and promote sustainability. The study highlights the integration of AI with existing business processes to maximize benefits and addresses the ethical implications of automated systems. This research underscores AI's potential to revolutionize the hospitality industry, offering insights for stakeholders and suggesting directions for future innovation.

Abstract - Innovating efficient practices for hosts (Alessandro Vena)

This section of the project examines hosts' perceptions regarding the adoption of artificial intelligence (AI) to reduce energy costs, improve customer service, and promote sustainable behaviours. Through this analysis, we aim to find a possible solution to these issues in the context of intelligent energy consumption analysis, which seeks to reduce apartment energy costs and meet customers' sustainability expectations while generating greater efficiency in property management.

Keywords: Artificial intelligence, hospitality, guest, host, sustainability, chatbot, forecasting, efficiency, digital transformation, new product development, technological innovation, technology adoption, technology strategy, short-term rental

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1. Introduction (Group part)

The hospitality industry is widely acknowledged for its substantial contributions to global economic growth. This sector is dedicated to delivering memorable experiences and providing impeccable service to guests, continually adapting to changing consumer expectations, technological advancements, and increasing sustainability concerns. One of the most transformative forces reshaping the industry is the integration of Artificial Intelligence (AI), which continues to redefine traditional service and management models.

This work project aims to investigate the critical role that AI plays in the hospitality industry, emphasizing how this technology is revolutionizing both opportunities and challenges. Our investigation began with a comprehensive literature review to provide an overview of the hospitality sector, AI, and the current state of AI usage, with a particular focus on the perspectives of guests and hosts, as well as sustainability concerns. Motivated by the desire to understand the practical implications of AI on the sector, we adopted a threefold research structure: enhancing sustainable practices, leveraging chatbots to improve guest experiences, and innovating efficient practices for hosts.

To achieve these objectives, we employed two complementary methodological approaches. First, a quantitative approach involved conducting surveys among guests to collect data on their motivations, interests, and expectations regarding AI and the new trends in the hospitality sector. Second, a qualitative approach consisted of interviewing hosts to gain insights into their perspectives, challenges, and opportunities in utilizing AI to manage their properties.

By analysing the collected data, we formulated eight distinct research questions, which were thoroughly examined in the analysis section to draw pertinent implications. Ultimately, we propose three innovative solutions designed to revolutionize the hospitality sector in a more efficient and sustainable manner, creating tangible benefits for the broader community using AI. These proposals represent a well-considered balance between the needs of various

stakeholders and the industry's growing demand for technological transformation, ensuring a more sustainable and efficient future for hospitality.

2. Literature review (Group part)

The scope of this literature review is to explore the dynamics of the hospitality industry, focusing on sustainability and technological innovations such as Artificial Intelligence (AI). The review begins by contextualizing the hospitality industry within the broader framework of travel and tourism, emphasizing its economic and social importance in Europe. It discusses the traditional components of the industry and notes the transformative impact of short-term rental platforms which have reshaped consumer preferences and market operations.

The text delves into emerging trends and challenges within the industry, highlighting issues such as the lack of clear regulations, the phenomenon of overtourism, and the pressing need for sustainable practices. The discussion underscores the sector's substantial environmental footprint, advocating for enhanced sustainability measures in European buildings and the pivotal role of EU directives aimed at reducing energy consumption and greenhouse gas emissions.

AI's role is critically examined, defining its fundamental concepts before exploring its application in the hospitality sector. The review outlines how AI technologies are revolutionizing customer interactions through personalization and automation, enhancing guest experiences, and improving operational efficiencies for hosts. It also considers AI's potential to contribute to sustainability by fostering more efficient resource management and lessening the environmental impact of tourism activities.

From the perspectives of guests, hosts, and environmental impact, this review assesses the multifaceted influence of AI on the hospitality industry. For guests, AI enhances service personalization and efficiency. For hosts, it provides tools for improved revenue management

and operational practices. In terms of sustainability, AI is recognized as a key enabler of greener practices within the industry. By integrating these diverse perspectives, the review aims to offer a comprehensive understanding of the current and potential impacts of AI and sustainability initiatives on the stakeholders in the hospitality sector. It underscores the need for continuous innovation and adaptation as essential drivers for future development and sustainability in this dynamic industry.

2.1 The hospitality industry (Group part)

According to Calvo and Sanchez (2016) “Hospitality is the act or practice of being hospitable, of receiving and entertaining guests, visitors or strangers, with liberality and goodwill” (3). The hospitality industry can be defined as a subset of the travel and tourism industry and mainly comprises the accommodation and food and beverage industry (Surender 2022). The accommodation industry includes all establishments offering overnight and lodging services such as hotels, hostels, holiday homes, etc. (Statista 2022). On the other side, food and beverage refers to the industry that deals with all food-related services such as packaging, preparation, and service, which includes restaurants, fast food outlets, bars, etc. (Jagmohan 2013). “Accommodation is the main service offered by a hospitality unit. If there is no accommodation service, hospitality does not exist" (Ionel 2021, 1). This service is essential to enable the functioning of the other hospitality sector.

2.1.1 The European hospitality: the role and figures

The tourism sector in Europe has reached an extraordinary level of development, fostered not only by the continent's invaluable cultural heritage, but also by the well-established system of hotels, restaurants, bars, and other activities that make up the European hospitality industry (HOTREC 2023). This sector exerts a significant impact both socially and economically. With over two million businesses operating in the sector and more than ten million workers employed, hospitality is one of the largest sources of employment and economic prosperity in

Europe (HOTREC 2023). Moreover, it contributes substantially to the continent's gross domestic product, at 2-3 % (HOTREC 2023). The wide range of hospitality-related economic activities, ranging from accommodation management to food preparation and service, creates a dynamic and resilient economic fabric that fuels tourism and contributes to the overall growth of the European economy.

2.1.2 The importance of Short-Term Rental (STR) in the accommodation sector

Within the accommodation industry, the Short-Term Rental (STR) sector, also known as "vacation rental," has assumed a predominant role since the emergence of booking platforms. Short-term rental refers to furnished homes that guests typically consider as an alternative to hotels and are given through internet platforms operated by individuals and investors (Furukawa and Onuki 2019). The STR industry represents a key segment of the hospitality industry that is highly appreciated by consumers for its flexibility, cheaper prices, and greater accessibility compared to the experience offered by hotels. In Europe, the number of users is estimated to reach 210.40 million by 2028, with a projected annual growth of 1.20% until then and an expected market value of US$35.13bn (Statista 2023). These figures highlight the importance of this sector within the Hospitality industry and the European economy.

2.1.3 Booking Platforms: the impact in the Short-term rental sector

With their birth in 1990 and their development in the early 2000s, booking platforms revolutionized the short-term rental and hospitality industry (Giannoni, Brunstein and Guéniot 2021). These platforms enable the host to reach a large number of people, administer properties more effectively, and provide benefits such as revenue optimization and booking management. At the same time, guests enjoy competitive costs, a large choice, and transparency ensured by other consumers' feedback (Cardoso 2018). These factors justify the exponential growth of booking platforms. In the first half of 2023, in Europe, guests booked a total of 237 million

nights through these platforms, an increase of 18.8% compared to the previous year (European Commission 2023).

The four most used platforms in Europe are Booking.com, Airbnb, Expedia Group, and TripAdvisor, which enjoy worldwide popularity (Bianchi 2024). Booking.com leads the way with 565.2 million site visits worldwide (Bianchi 2024). These platforms have revolutionized the STR sector, offering hosts and guests numerous advantages. However, the impressive growth of these platforms has triggered several emerging trends and issues that require further attention.

2.2 Issues and trends (Group part)

As highlighted in the previous paragraph, the hospitality, and Short-Term Rental (STR) sectors stand out for their significant complexity and the variety of stakeholders involved, such as guests, hosts, technology, and the entire supply chain connected to them. In this constantly evolving context, these sectors face increasingly challenging dynamics, driven by the rise of the sharing economy and the advancement of Artificial Intelligence (AI). These forces are marking an era of unprecedented opportunities and new challenges, promising to reshape market dynamics with increasingly personalized and innovative experiences. Faced with these changes, complex issues related to regulation, social impact, and sustainability emerge. These challenges necessitate deep reflection and the development of adaptive strategies, which we will explore in the next paragraph, positioning ourselves at the heart of the sector's future dynamics.

2.2.1 Lack of regulation and problems concerning over-tourism

The Short-Term Rental (STR) market, part of the sharing economy, introduces beneficial outcomes, such as extra income for users, enhanced allocation and utilization of resources, and the creation of new economic activities within cities and municipalities (Quattrone, et al. 2016). However, one of the main challenges the STR sector faces is the absence of clear regulations at

both the national and European levels. There is still an ongoing debate about whether STR should be considered part of the hospitality and tourism accommodation sector or a private form of income (Iacovone 2023). This debate arises as the STR industry is shifting towards the professionalization of hosts managing the properties, which has consequently changed the internal structure of sharing economy platforms from peer-to-peer to a business-to-consumer model (Iacovone 2023). This transition has resulted in professional hosts capturing most profits, displacing non-professional hosts, and establishing professional hosting as the main strategy for achieving a competitive advantage on these platforms (Iacovone 2023).

Another element to consider is the negative side effects of extensive urban exploitation, primarily due to uncontrolled and unregulated tourism operations, often referred to as overtourism. This problem has considerably contributed to a scarcity of available housing in popular tourist sites, rising rental rates, and decreased liveability in some areas (European Parliament 2023).

As illustrated in Figure 1 (Appendices), in August 2023, the EU recorded 124.7 million nights booked through the four main online platforms, representing a 28% increase in booked nights compared to pre-pandemic levels in 2019 (European Parliament 2023). In response to the increase in short-term rental, not all major tourist destinations have enacted local regulations to restrict access to these accommodations (European Parliament 2023). Only a few cities, such as Amsterdam, New York, and Berlin, have introduced policies limiting STR to only the primary residence or parts of it (Iacovone 2023). Meanwhile, in cities like Barcelona and Paris, renting a secondary home requires a license or a change in categorization from residential to commercial (Iacovone 2023).

2.2.2 Driving sustainability in European buildings: The role of EU directives

Over the last decade, the hospitality industry has embraced “going greener” (Khatter 2023). According to Khatter (2023), “The hospitality industry is characterized by its significant

consumption of energy and natural resources to cater to the needs of its clientele" (1). Amid rapid development, there is a growing recognition of the importance of quality and sustainability, highlighting the sector's increased environmental responsibilities (Khatter 2023). However, using non-toxic items and reducing waste alone are insufficient for making a significant sustainable impact (Khatter 2023). A transformation of the entire industry is necessary, starting with its infrastructure—the buildings (Khatter 2023). Buildings are the largest energy consumers in Europe (European Commission 2024). With 85% of the EU's buildings constructed before 2000, about 75% are energy inefficient (European Commission 2024). In 2021, buildings accounted for 42% of the EU's total energy consumption and contributed to over one-third of the EU's greenhouse gas emissions related to energy (European Commission 2024). To address these issues and enhance energy efficiency, the EU has implemented a legislative framework, which includes the revised "Energy Performance of Buildings Directive EU/2010/31 and Energy Efficiency Directive EU/2023/1791" (European Commission 2024). These directives aim to establish a decarbonized building stock by 2050, foster a stable investment environment, and empower consumers and businesses to make more conscious energy and cost-saving decisions (European Commission 2024).

This means that at least 75% of European buildings will need renovation in the next 25 years (European Commission 2024). Furthermore, according to European directives, a building that does not meet the specified requirements within the given timeframe cannot be sold or rented out (European Commission 2024). Moreover, homeowners and hosts should note that investing in sustainable real estate operations can lead to improved property values (between 2% and 10%) and significantly higher rental incomes (2% to 8%) (Bassi and Moscatelli 2020). This is a crucial aspect for all hospitality and short-term rental operators who will need to improve the energy efficiency of their buildings in the coming years. Today's challenge is to make residential real estate more sustainable by enhancing building energy efficiency, sustainability of the

production process, minimizing waste, limiting the consumption of non-renewable resources, and using environmentally friendly materials (Bassi and Moscatelli 2020).

2.2.3 New trends and the use of Artificial Intelligence in the hospitality sector

Currently, technological innovations and Artificial Intelligence (AI) are driving businesses to shift from traditional systems to digital transitions. As we will explore in the next section, AI is identified as a 'family of technologies' capable of recognizing, analysing, acting, learning, and demonstrating enhanced features of human intelligence (Kong, et al. 2023, 1). In many sectors, including the hospitality industry, the adoption of AI is essential as it presents numerous opportunities and challenges (Pongsakon 2023).

In the highly competitive hospitality industry, hosts face the dual challenge of meeting elevated customer expectations and reducing costs (Pongsakon 2023). The adoption of AI offers a pathway to enhance performance and maintain a competitive edge (Pongsakon 2023). By leveraging AI and automation, hosts can optimize operations, enhance service quality, and improve productivity and efficiency, while also making their operations more sustainable by reducing waste (Koo, et al. 2021). From the guest's perspective, AI facilitates personalized requests, suggestions, and purchases, enabling direct engagement through technology (Ruel and Njoku 2021). Additionally, given the sector's lack of clear and general guidelines, AI can establish standards and ensure the accuracy of fraud prevention measures by analysing the vast, data-intensive information collected through bookings (Pongsakon 2023). AI can also support the implementation of smart tourism agendas that emphasize sustainability, resilience, and improved well-being (Ruel and Njoku 2021).

2.3 Sustainability in hospitality: understanding and solutions (Group part)

The hospitality sector is integral to the tourism industry as it forms a crucial part of the overall traveller’s experience. To fully understand the environmental impact of the hospitality industry,

it is essential to begin by analysing the impact of the tourism sector, given the close link between the two sectors and their significant environmental effects (Halleux 2017).

Tourism is a major economic driver and a steadily growing global phenomenon that exerts strong environmental pressures. It is anticipated that the number of tourists will reach 1.8 billion by 2030, underscoring its relevance and impact (Baloch, et al. 2022). This sector significantly contributes to environmental degradation through CO2 emissions, intensive use of natural resources such as water and energy, and the generation of solid and liquid waste (Baloch, et al. 2022). Tourism-related emissions account for 4.9% of global emissions, with 20% attributable to accommodation and 75% to transportation (Halleux 2017). Water consumption is another critical concern, utilized for a variety of tourism services including sanitation, cooking, and luxury facilities like spas and swimming pools. According to the European Environment Agency (EEA), the daily water consumption of a tourist is approximately four times higher than that of a permanent resident (Collins, Kristensen e Thyssen 2009). Additionally, the waste generated in the tourism sector significantly surpasses that produced by the resident population (Halleux 2017).

The hospitality industry is notable for its significant environmental impact, which includes substantial water and energy consumption, as well as waste generation. The environmental impact of accommodation is often underestimated, despite its significant emissions (19 kg of CO2 per guest per night) and high levels of energy and water usage (UNWTO 2012). Understanding and addressing the environmental effects of the hospitality and accommodation industry is crucial not only for reducing its negative impacts on the environment but also for ensuring the long-term sustainability of the tourism sector.

2.3.1 The role of sustainable tourism in the hospitality industry

The environmental impact of tourism and the hospitality industry, as highlighted above, is significant and not negligible. For this reason, the concept of sustainable tourism proves to be

fundamental for the development and survival of this sector, revealing its relevance at both a global and European level. According to the United Nations World Tourism Organisation (UNWTO), sustainable tourism is defined as "Tourism that takes full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities" (UNWTO 2005, 12). This definition advocates a balance between economic, social, and environmental aspects, reflecting the principles and definitions also proposed by the European Commission.

The latter reaffirms the fundamental role of sustainability for the competitiveness of the sector, proposing a holistic approach involving all the main stakeholders, with numerous initiatives reported in the "Agenda for a Sustainable and Competitive European Tourism" (European Commission 2023). The European Commission has developed the European Tourism Indicators System (ETIS), aimed at helping tourist destinations address environmental, social, and economic challenges (European Commission 2023).

In the area of accommodations, two initiatives have been proposed by the European Union: the EU Ecolabel, which can be used on a voluntary basis by hosts to promote their environmental awareness, and the EMAS programme, aimed at improving and promoting environmental performance in the hospitality industry (European Commission 2023). There is a clear focus of the major global and European organisations on finding ways to address and develop sustainable tourism, which needs the collaboration of all the main stakeholders in this industry, including hosts and guests who play a key role.

2.3.2 Guest and host perspectives towards sustainability in hospitality

The concept of sustainability, once undervalued in the tourism and hospitality industry, has become a key element. It is now regulated and promoted by leading global and European institutions (UNWTO and the European Commission), representing a competitive advantage sought after by key players in the hospitality and accommodation industry.

According to a Booking.com report (2023), 53% of tourists are inclined to choose more sustainable solutions due to the recent news on climate change, with even 80% confirming the importance of sustainable travel. This emerges from an analysis conducted on a sample of 33,000 tourists from 35 countries around the world, who are re-evaluating the concept of value, giving more and more importance to a unique and regenerative experience that therefore does not only seek to lessen its impact on the environment but also contributes positively to the community visited (Booking.com 2023).

In addition, regarding accommodations, the same research revealed that 65% of tourists value staying in facilities certified as sustainable, while 59% will actively seek such accommodation in the future (Booking.com 2023). In this context, accommodation hosts must not only respond to travellers' increased need for sustainable solutions, but also recognize their role in positively impacting the environment and host community. Hosts, therefore, are adopting sustainable solutions for a variety of reasons, as evidenced by perceived benefits such as financial savings, competitive advantage, economic profits, employee loyalty, customer retention, regulatory compliance, risk management and social responsibility (Khatter 2023).

2.3.3 The current sustainable technologies

The technological practices adopted nowadays in the sector are aimed at mitigating environmental impact, focusing mainly on the efficient management of water and energy resources, despite their considerable initial cost (Chemmanur and Fenech 2024). Among the most effective solutions are the use of energy-efficient lighting systems, such as LED lights, and the use of HVAC sensors systems that are programmable according to outdoor temperature and room occupancy (Vincent 2023). In addition, water-saving technologies, such as recycling grey water from toilets, are increasingly being adopted. Intelligent inventory management tools enable accurate analysis of food consumption, reducing waste (Vincent 2023). The use of renewable energies such as solar, wind, geothermal, biofuel and hydrogen, together with the

use of biodegradable and compostable materials, is another strategy to reduce environmental impact (Vincent 2023).

However, a more accessible alternative to promote sustainability is to obtain sustainability certification through the transparent collection and disclosure of data on environmental practices. Among the companies providing such services, Travalyst is a leader, also offering solutions to major booking platforms such as Booking.com, Expedia Group and TripAdvisor (Travalyst 2024). These technologies not only actively contribute to reducing environmental impact, but also serve as a tool to communicate, promote, and certify sustainability efforts.

2.4 Defining artificial intelligence: A comprehensive overview (Group part)

Artificial intelligence (AI) is a discipline poised at the intersection of computer science and human cognitive processes, aiming to both understand and create entities capable of intelligent behaviour. According to Mijwil (2022) artificial intelligence constitutes a foundational pillar within the domain of computer science and is dedicated to the creation of computational systems capable of performing tasks that traditionally require human intelligence. In his paper "Has the Future Started? The Current Growth of Artificial Intelligence, Machine Learning, and Deep Learning", Mijwil highlights the distinction between artificial intelligence, machine learning, and deep learning emphasizing the progression from a broad attempt to replicate human intelligence (AI), towards more focused efforts on data-driven learning (ML), and further, to the emulation of neural processes for complex problem solving (DL). This tiered conceptualization underscores the nuanced advancements in the field and highlights the specific contributions of each area to the overarching ambition of creating intelligent, autonomous systems (Mijwil 2022).

Russell and Norvig identify AI as a field that encompasses the development of systems equipped with capabilities such as learning, reasoning, problem-solving, perception, and language understanding with a significant emphasis is placed on the rational agent approach,

where an agent is anything that can perceive its environment through sensors and act upon that environment through actuators (1995). The core objective of AI, in this context, is to create agents that operate optimally, maximizing their expected utility based on their perceptual inputs and the knowledge they have acquired. Drawing on Kaplan and Haenlein's exploration of artificial intelligence in "Siri, Siri in my hand: Who's the fairest in the land? On the interpretations, illustrations, and implications of artificial intelligence" defined AI as a system capable to correctly interpret external data, to learn from such data, and to use these learnings to achieve specific goals and tasks through flexible adaptation, stands at the forefront of business innovation and strategy (2019). Russell and Norvig (1995), evidenced different perspectives on what constitute AI and its objectives. These are "Thinking Humanly," "Thinking Rationally," "Acting Humanly," and "Acting Rationally."

This classification underscores the diverse methodologies within AI, highlighting key philosophical and practical inquiries. "Thinking humanly" aims to replicate human cognition, striving to endow machines with the ability to think. Haugeland describes this ambition as creating "machines with minds, in the full and literal sense" (1985), echoed by Bellman's definition focused on automating tasks like decision-making and learning (1978) "Thinking rationally" focuses on enabling machines to reason logically, distinct from mimicking human thought. Charniak and McDermott view this as studying "mental faculties through the use of computational models" (1985), and Winston defines it as enabling machines "to perceive, reason, and act" (1992). "Acting humanly" involves machines performing tasks that would be deemed intelligent if done by humans. Kurzweil encapsulates this as the creation of "machines that perform functions that require intelligence when performed by people" (1990). "Acting rationally" is about designing agents that optimize outcomes, with Poole, Mackworth, and Goebel focusing on "the design of intelligent agents" (1998).

These definitions together paint a comprehensive picture of AI, spanning from efforts to replicate human cognition and behaviour to the rational design of intelligent agents. They underline the diverse objectives within the field, ranging from understanding and mimicking human thought processes to achieving optimal problem-solving and decision-making capabilities in machines.

2.5 Artificial intelligence in the hospitality sector (Group part)

The application of Artificial Intelligence (AI) in the hospitality and tourism sector reflects a transformative journey that is profoundly influencing guest experiences and operational efficiencies. Spanning three decades, the proliferation of AI research has mirrored technological advancements, shifting from foundational technologies to the exploration of consumer interactions with AI-driven services. As shown in the paper “30 years of artificial intelligence (AI) research relating to the hospitality and tourism industry “, “AI research relating to the hospitality and tourism industry shows a growing trend. The first paper was published in 1991, and since 2018, the number of publications and citations rapidly increased, obtaining considerable research attention” (Kong, et al. 2023, 2169). As stated by Huub Ruel and Esther Njoku in their paper "AI Redefining the Hospitality Industry", This transformative technology has fundamentally altered the traditional models of tourism and hospitality “disrupting the traditional system, as this technological innovation enables customers to access reliable and accurate information that allows them to customise their requests, make reservations and purchase hotel and tourism products and services directly through technological platforms, rather than dealing with a hotel, booking agent, or professional travel agent” (2021, 55). AI's role in hospitality extends beyond mere automation to enable service innovation through the delivery of personalized services. Smart services and robotics, including chatbots and robots, are “employed to augment human intelligence and physical capabilities” (2021, 56). This innovation “streamlining services, enabling reduction of errors, improving speed of decisions

and service, identifying demand signals, identifying guests by names through facial recognition technology, predicting customer demands, providing real-time language translation software to interact with international customers and providing interactive virtual, as well as physical assistance for customers" (2021, 56). Such capabilities significantly enhance the guest experience by catering to their specific needs with a personal touch, setting businesses apart from their competitors (2021).

In the article "Artificial Intelligence (AI) and Robotics in Travel, Hospitality, and Leisure," published in Electronic Markets (2021) the authors explore the transformative impacts of AI and robotics on the Travel, Hospitality, and Leisure (THL) sectors positing that AI and robotics are not just technological trends but foundational elements reshaping the future of the THL sectors (Koo, et al. 2021). AI "also represent important efforts to enable the local-global nexus. In this sense, technology-based social reality is another facet of smart tourism that builds on AI and robotics capabilities and requires further exploration" (Koo, et al. 2021, 1).

2.5.1 Applications

The uses and applications are vast, the comprehensive paper titled "Artificial Intelligence: A Systematic Review of Methods and Applications in Hospitality and Tourism" (Doborjeh, et al. 2021) offers a crucial examination of Artificial Intelligence (AI) applications and methodologies within the tourism and hospitality sector. This review encapsulates AI's transformative role across various facets of the industry, ranging from data modelling, demand forecasting, to enhancing customer service experiences. The study done by Doborjeh, Hemmington, Doborjeh, and Kasabov, systematically analyses content from 146 articles published between 2010 and 2021, identifying themes such as AI methods and applications in the THL sector (2021). The analysis reveals a significant trend towards employing analytical AI methods for big data, including statistical machine learning, Artificial Neural Networks (ANNs), and Deep Learning Neural Networks (DLNNs), each tailored for specific hospitality

and tourism contexts. These methodologies have been instrumental in clustering, classification, and prediction tasks, facilitating nuanced insights into tourist behaviour, demand forecasting, and service personalization. Moreover, the review highlights the adoption of AI-based applications such as robotics, Virtual/Augmented Reality (VR/AR), and chatbots/virtual assistants within the sector. These applications are reshaping guest experiences by providing immersive engagements, personalized services, and efficient customer interactions, underscoring AI's critical role in driving service innovation and operational excellence.

2.6 Guest perspective (Group part)

The paper "Leveraging ChatGPT and other generative artificial intelligence (AI)-based applications in the hospitality and tourism industry: practices, challenges, and research agenda," by Dwivedi, Pandey, Currie, & Micu (2023), offers an in-depth analysis of how generative AI technologies, notably ChatGPT, are revolutionizing the hospitality and tourism sectors. The study addresses the integration of these technologies to enhance customer experiences and streamline operational efficiencies, while also highlighting potential challenges and ethical considerations. Dwivedi et al. (2023) propose comprehensive research about various applications of ChatGPT, ranging from enhancing visitor experiences through accurate and timely information to supporting supply side stakeholders by providing insights into customer preferences and operational strategies.

One of the main applications regards the AI Chatbots. “Chatbot, short for chat robot, with the help of artificial intelligence, communicates with humans and has an underlying computer program associated with it” (Ramachandran 2018, 1). The incorporation of AI through chatbots within the hospitality and tourism industry marks a significant evolution towards enhancing guest experiences and operational efficiencies. The article “Adoption of AI-based chatbots for hospitality and tourism” delves into the adoption dynamics of AI-powered chatbots within the hospitality and tourism sector, providing a nuanced understanding of consumer behaviour

towards these technologies (Pillai and Sivathanu 2020). By extending the Technology Adoption Model (TAM) with additional constructs pertinent to the hospitality context, such as perceived trust, perceived intelligence, anthropomorphism, and technology anxiety, the study offers a comprehensive framework to assess the adoption intentions and actual usage of chatbots by consumers.

The findings reveal that factors like perceived ease of use, perceived usefulness, perceived trust, perceived intelligence, and anthropomorphism significantly influence consumers' intentions to adopt chatbots for their travel planning needs. Contrary to expectations, technological anxiety did not present a substantial barrier to chatbot adoption, suggesting an increasing familiarity and comfort with digital technologies among consumers in the hospitality domain. The study also highlights the negative moderation effect of stickiness to traditional travel agents on the relationship between adoption intention and actual chatbot usage, indicating a lingering preference for human interaction in travel planning among certain consumer segments.

2.7 Host perspective (Group part)

Renting out a house can provide an attractive supplementary income; however, the success of this activity depends on the host's ability to generate revenue (Bassi and Moscatelli 2020). Before delving fully into this sector, we could define “hosts” as individuals who manage their properties by interacting with all stakeholders and have listed their properties on online rental platforms like Airbnb and Booking.com (Quattrone, et al. 2016). Short-term hosts are a significant component of the sharing economy, as without hosts there would be no short-term rentals (Guttentag 2019). Furthermore, they have flexibility and the possibility to adjust various parameters, such as price, use of instant booking, and specific cancellation policies, to maximize their revenue (Giannoni, Brunstein and Guéniot 2021).

They are attracted by both financial and experiential advantages, such as the enjoyment of meeting new people and sharing unused space (Guttentag 2019). Even so, those who focus

solely on profit are encouraged to manage their apartments strictly as businesses, rather than as opportunities for home sharing. As Iacovone (2023) suggests, “Hosts with more than ten listings had a lower price per night than single hosts (-9.2%) and an increase of 8.9% in monthly revenue” (2). To succeed in the STR market, hosts must analyse the market, understand consumer needs, and observe new trends in hospitality such as innovation and sustainability. On this basis, the future goal for hosts is to exploit innovative and sustainable systems that simplify property management and reduce costs, thereby increasing the profitability and efficiency the property (Bassi and Moscatelli 2020).

2.7.1 Responsibilities of a Short-Term Rental (STR) host

A host's primary responsibilities in short-term rentals involve a wide range of activities aimed at enhancing the guest experience and operational efficiency. These responsibilities include providing basic materials such as bedding, towels, and household equipment, as well as listing the property on rental platforms with detailed information such as pricing, availability, apartment characteristics, location, size, photos, house rules, and tips (Airbnb 2024). They are also responsible for delivering excellent customer service, which includes responding quickly to customer inquiries and addressing unexpected issues (Airbnb 2024). Additional duties involve guest management logistics, such as checking in and out visitors, cleaning, and establishing insurance for damages (Airbnb 2024). On the financial side, tasks include managing finances (such as handling payments, taxes, and platform fees), reservation administration, property upkeep, and formulating investment plans for property improvements (Airbnb 2024). Furthermore, implementing marketing strategies to promote the listing and maintaining quality control are critical to success (Airbnb 2024). A host's strategic responsibilities also include pricing and revenue management, which involves adjusting prices based on key factors that influence pricing and guest preferences to increase reservations, meet expectations, and enhance profitability (Chattapadhyay and Mitra 2019).

2.7.2 The role of technology and AI in supporting hospitality hosts

In the hospitality sector, AI and Big Data are enhancing phases of revenue management, particularly in setting short-term rental rates. Hosts typically face the challenge of pricing, complicated by unique listing features such as concierge and tour guide services, besides standard factors like competitions and seasonal demand (Gibbs, et al. 2018). Platforms like Airbnb and Booking.com use machine learning to offer dynamic pricing recommendations, based on demand trends, competition, and expected property supply (Gibbs, et al. 2018). This approach helps hosts maximize their financial return on investment.

Additionally, AI combined with Internet of Things (IoT) technology in apartments optimizes operational efficiency and sustainability. Back-of-house management systems, as illustrated in Figure 2 (Appendices), are categorized into three major areas: Guest-Facing Systems, In-Room IoT Sensors, and Hospitality Services (Kansakar, Munir e Shabani 2019). IoT devices such as thermostats and motion detectors can reduce electricity costs by 20–45% by improving temperature and lighting management in unoccupied rooms (Kansakar, Munir e Shabani 2019). These systems not only enhance guest comfort but also support cost-saving and environmental sustainability. Further innovations in guest-facing systems are revolutionizing hospitality by collecting visitor preferences to create personalized service profiles, thus enhancing service customization, and fostering repeat business (Kansakar, Munir e Shabani 2019). Hospitality services now extend beyond keyless entry and automatic check-ins to include location-based services like digitally guided tours and local recommendations, improving the overall guest experience (Kansakar, Munir e Shabani 2019).

In today's technological landscape, tools like AirDNA, Wheelhouse, PriceLabs, and Mashvisor support property managers, yet their integration into business models is often limited. The rapid advancement of technology and a growing commitment to sustainability and waste reduction

underscore the essential role of AI in transforming the hospitality industry, making it a necessary component for real and effective change.

3. General motivation and areas of the study (Group part)

Building upon the findings presented in our earlier literature review, this chapter outlines the key motivations driving our research within the hospitality industry. Our examination of the literature on AI in the hospitality sector has revealed significant insights but also highlighted notable gaps. This realization prompted a deeper investigation into the personal experiences of those directly impacted by these trends, particularly hosts and guests. The primary motivation for this research is to delve into the personal experiences, expectations, and concerns of stakeholders that are underrepresented in existing literature.

As detailed in the literature review, the hospitality industry's impact on the environment is profound and multifaceted. This research aims to build on that foundation by exploring whether AI can serve as a tool for the industry to respond to environmental pressures and the increasing consumer demand for eco-friendly travel experiences. Understanding these dynamics is crucial for evaluating the industry's progress toward sustainability and the effectiveness of current practices, thereby bridging the theoretical frameworks discussed previously with real-world AI applications and stakeholder attitudes toward adopting them.

Following up on the potential of AI technologies, this research further investigates the transformative impact of AI on the hospitality sector. Specifically, we will examine AI-driven tools such as chatbots, which have introduced new efficiencies and personalized guest interactions. The aim is to critically assess how chatbots can enrich the guest experience and how they are perceived by guests, providing insights into strategic applications. Furthermore, we aim to understand the hosts' perceptions of AI and whether they consider it a useful tool to increase operational efficiency.

By focusing on both hosts and guests, we aim to capture a broad spectrum of perspectives concerning their experiences, desired improvements, key challenges, and views on sustainability and AI. This exploration will help us understand how these stakeholders perceive the use of AI. The insights gained will serve to paint a comprehensive picture of AI's impact on the industry's landscape, which can guide future strategic decisions, innovations, and policymaking in the hospitality sector.

4. Research structure: a threefold approach (Group part)

We have structured our investigation around three distinct research topics: Enhancing sustainable practices, leveraging chatbots to improve guest experiences, and innovating efficient practices for hosts. Each section not only addresses specific research questions but also builds a comprehensive narrative that explores the implications and applications of Artificial Intelligence (AI) and sustainable technologies in hospitality.

4.1 Innovating efficient practices for hosts (Alessandro Vena)

We believe that the role of the host in the short-term rental sector is of vital importance, as they are responsible for deciding the services offered to guests and managing all apartment-related activities, such as accounting, management of rental platforms, investments, maintenance, and customer service. In this context, we have decided to delve deeper into the themes that emerged in our literature review by analysing the perspective of the hosts. Through three research questions, we aim to understand how hosts perceive the adoption of artificial intelligence in their properties to increase apartment efficiency by reducing energy costs, improve customer service, and promote sustainable behaviours.

The first research question in this section (Q6) aims to analyse the impact of European directives on zero-emission accommodations and the effect of energy costs on hosts'

perceptions. The study will explore their willingness to implement AI to reduce energy costs and maintain the profitability of short-term rentals.

The seventh research question (Q7) examines hosts' willingness to invest in AI to promote sustainable behaviours among guests. We will assess how artificial intelligence can be used to reduce energy consumption and costs while simultaneously influencing guest behaviour.

Finally, the last research question (Q8) investigates hosts' propensity to invest in chatbots to improve customer experience and simplify customer service processes. Considering the hospitality industry's adaptation to technological innovations and consumer acceptance of such trends, we will evaluate the economic implications and guests' willingness to use, and potentially pay for, services offered by chatbots.

5. Data collection methods (Group part)

In this section, we will describe how we used both quantitative and qualitative data collection methods to explore the integration of Artificial Intelligence (AI) in the hospitality sector. Our quantitative approach involves a detailed survey aimed at gathering data across a broad demographic to analyse how diverse groups perceive and utilize AI in relation to sustainability and customer experiences. This allows for a systematic examination of responses to draw meaningful insights into potential market trends and behaviours. Complementarily, our qualitative approach includes conducting interviews with short-term rental hosts to delve deeper into their experiences and viewpoints on using AI for property management and enhancing sustainability. This combination of methods enriches our understanding of the nuanced impacts of AI applications and supports the development of informed strategies for its future integration.

6. Data analysis (Group part)

Data analysis is conducted across three primary research topics: “Enhancing sustainable practices” (Q1-Q2), “Leveraging chatbots to improve guest experiences” (Q3-Q4-Q5), and

“Innovating efficient practices for hosts” (Q6-Q7-Q8). For each topic, the relevance and rationale for selecting the specific research question are outlined. This is followed by a detailed assessment of the research methodology, including how the analysis is conducted and a description of the analytical tools used. The results of the analysis are then presented, leading to a discussion of the practical implications these findings have for the hospitality industry.

6.1 Innovating efficient practices for hosts (Q6-Q7-Q8) (Alessandro Vena)

6.1.1 Q6 - How do hosts perceive the potential of AI to reduce energy costs in short-term rentals?

As reviewed in our literature, the European Union mandates that all member states transition to zero-emission buildings by 2050, a directive that underscores a strong commitment to sustainability (European Commission 2024). This directive, along with the increasing interest in sustainable living, motivates hosts to explore new solutions for reducing energy costs and achieving zero-emission housing.

The economic returns and sustainability of the short-term rental sector heavily depend on the strategic decisions made by hosts. They significantly influence the guest experience through the features offered in their apartments, established policies, and the implementation of technologies and services. These choices are crucial for achieving environmental sustainability and economic profitability in the sector, highlighting the importance of understanding hosts' motivations, challenges, and their readiness to adopt Artificial Intelligence (AI) and other advanced technologies in their operations.

Our research question focuses on analysing hosts' perceptions of using AI to comply with European directives and to develop innovative solutions for improving the sustainability and efficiency of their properties. This study aligns with the broader industry trend of integrating AI and automation to enhance management practices, optimize energy usage, and assess the economic impacts of operational decisions. Through this research, we aim to elucidate the

perceived benefits of AI among hosts and their willingness to adopt such technologies to promote sustainability in short-term rentals.

H6: The use of AI in managing short-term rentals leads to reductions in energy costs.

6.1.1.1 Evidence assessment

To validate this hypothesis, during the interviews, we recorded all considerations that the hosts wanted to share with us to improve their service through AI. Specifically, we concentrated on the following topics to identify opportunities and potential solutions:

- Hosts' most energy-intensive expenses for each of their apartments and the impact of these on the overall short-term revenue.
- Hosts' awareness of the new European directive and the energy classification of the apartments they rent.
- The presence of automation systems and AI within their apartments.
- Hosts' willingness to invest in artificial intelligence to monitor guests' instantaneous consumption and analyse their usage to identify potential energy cost savings.

6.1.1.2 Findings

The most alarming finding was that most hosts were unaware of their apartment's energy classification, and some did not even know what it was. Measuring the energy performance of an apartment is crucial since it acts as a main indicator of energy efficiency and helps analyse possible improvements in energy consumption and then to save costs.

Additionally, our findings indicated that nearly all the hosts interviewed allocated between 5 and 10% of their revenue to cover energy-related expenses, including electricity, gas, and water. The testimony of Interviewee C.R. is particularly instructive. She reported: "Last year, I realized that I couldn't cover the energy expenses during the winter months due to the rising costs of gas and electricity caused by the war in Ukraine". This host had established the pricing for overnight

stays six months in advance and did not adjust it to reflect these changes. She observed that it would have been advantageous to predict increases in costs and adjust the rates promptly, rather than awaiting the arrival of the energy bill in coming months.

Interviewee A.P. discussed with us the benefits of integrating home automation systems into their smart apartment. He renovated their flat three years ago and chose to install a system that allows for remote management of all devices, including air conditioning, heating, and shutters, via a smartphone application. He stated: "Since I installed home automation, I can turn on the heating or air conditioning with a single click on my smartphone". He further explained: "Previously, due to the apartment's location more than an hour away from my current residence, I would activate the air conditioning immediately after cleaning and maintain it until the arrival of the guests. According to last year's data, this has helped me to reduce my energy bills".

Another account is shared by the same Interviewee A.P., regarding his home in the Italian Alps. He explained that in the previous years, low winter temperatures caused the water lines to freeze, resulting in leaks. He states: "In the last two years, I have opted to install a sensor that automatically circulates warm water through the pipes when the temperature falls below zero degrees, to prevent them from freezing". He continues saying: "Thanks to this solution, I was able to save more than 500 euros on plumbing fees for pipe replacement during guest stays".

Generally, all hosts agree that heating and air conditioning are the most major energy costs in their flats, and many are looking for ways to cut these costs. Interviewee R.M. stated: "'Despite installing solar panels three years ago, I have been unable to meet the apartment's' energy needs during certain times of the year". In response to our question about the rationale for choosing the power of the solar panel, he stated, "The power was selected based on the cadastral characteristics of the apartment, such as square footage and energy class". We suggested that another essential parameter for determining the right power should have been an analysis of

guest past consumption statistics prior to installation. The respondent stated: “It was a mistake not to consider these aspects, even though it would have taken a large amount of time and been practically impossible to apply to additional short-term rental homes with the resources at my disposal”. By failing to account the guests' real consumption, he was unable to attain energy self-sufficiency and was forced to rely on the electricity supply. In this scenario, AI would have been useful to compute and give a full analysis on historical consumption depending on characteristics such as the booking period, the number of guests, the purpose of their stay, their age, and their inclination towards sustainability.

To determine whether the information and testimonies from the hosts were supported by academic literature and industry statistics, we furthered our analysis by examining the findings of a study conducted by Onuh, Feng, Chen, & Garcia de Soto (2022) on building energy consumption in the United Kingdom. The study indicates that annual energy consumption in smart buildings was reduced by over 38% through the integration of IoT technologies into building systems, including lighting and all devices and systems aimed at regulating and managing thermal comfort.

Furthermore, we believe that guest interest in particular technologies influence the decisions regarding the hosts' investments in their apartments. For example, guest survey findings on their perceptions of sustainable technologies show that insulation technologies, solar panels and recycling bins are the technologies they perceive as sustainable in the accommodations. These technologies not only provide economic benefits, but also boost the visibility of apartments with sustainable features that meet client needs, resulting in an increase in bookings and earnings.

6.1.1.3 Implications

The examination of these testimonials is critical for understanding how AI may aid in the reduction of energy usage in this sector. We discovered that many hosts do not manage their

homes analytically and are unable to use guests' previous consumption data to optimize energy expenditure. This is due to the requirement for continuous monitoring of costs and consumption, an activity that is too demanding in terms of time and costs. Furthermore, we noticed that hosts are interested in themes such as AI and sustainability and are willing to invest in these technologies. However, many are unaware of how AI can help them save money and make their housing more sustainable. We noted that nearly all hosts interviewed manage their apartments in a straightforward manner, lacking a strategic managerial approach aimed at maximizing the potential of their properties.

In this context, AI can help hosts understand how to improve their service and increase their profitability. Simultaneously, AI may encourage hosts to align with broader environmental goals, such as EU rules to achieve zero emissions in buildings by 2050 and to adapt to future industry trends.

6.1.2 Q7 - Are hosts willing to invest in AI to promote sustainable behaviours among guests?

In 2021, 64.4% of energy consumption in EU households was attributed to space heating, followed by 14.5% from water heating, 13.6% from lighting and electrical appliances, and 6% from cooking, with the remaining percentage used for space cooling and other purposes (Figure 3, Appendices) (Eurostat 2023).

Energy consumption may be higher during short-term rentals, as guests often disregard their usage, which is generally included in the cost of the stay and thus less of a concern for them. For hosts, energy costs—along with the percentage retained by rental platforms, taxation, and other variable expenses—are significant factors affecting profitability. To increase profits, hosts might charge higher prices or attempt to reduce these costs by influencing guest behaviour.

In this sector, hosts' decisions are driven by consumer behaviour and needs. Guests significantly influence their accommodation choices, selecting options that best meet their requirements such

as comfort, price, location, and, as noted in our literature review, increasingly sustainability criteria as well. Consequently, guest preferences shape the market using classic demand and supply dynamics. Apartments that do not meet guests' expectations are likely to evolve over time to meet market demands. It is important to examine how guest behaviour influences host decisions and how hosts might benefit from it.

Our research question investigates hosts' willingness to invest in AI to influence consumer behaviour. The impact on energy consumption in homes is significant, with potential for improvement to reduce waste, lower energy costs, and promote environmentally responsible behaviours. Our objective is to determine whether AI can modify guest behaviour and whether hosts are willing to engage in innovative projects that entail initial investments and costs. The study will explore the percentage of energy costs borne by hosts, their readiness to compensate guests, the availability of automation tools in apartments, and their commitment to sustainability. Additionally, we will assess guests' responses to these interventions. This research aims to understand the benefits of AI as perceived by hosts and its potential to revolutionize the short-term rental sector.

H7: Hosts are willing to invest in AI to promote sustainable guest behaviours.

6.1.2.1 Evidence assessment

To determine if hosts are inclined to invest in AI to change guest behaviours towards sustainability practices and generate benefits for all stakeholders, we discussed the following topics during our interviews with the hosts:

- Hosts' most energy-intensive expenses for each of their apartments and the impact of these on the overall short-term revenue.
- Hosts' interest and motivations for adopting sustainable practices within their apartments.

- Hosts’ willingness to offer a 1-3% refund to guests who engage in sustainable behaviours during their stay.
- Hosts' willingness to invest in artificial intelligence to monitor guests' instantaneous consumption and analyse their usage to identify potential energy cost savings.

We analysed host attitudes towards sustainability in the short-term rental industry to assess whether their commitment is a real mission or merely opportunistic. Furthermore, we investigated their interest and reasons for investing in AI to influence guest behaviour, as well as their willingness to share energy cost savings to foster sustainability and create a virtuous cycle where everyone benefits in the industry.

6.1.2.2 Findings

According to the interviews, most hosts believe that adopting sustainable practices in their apartments, including the utilization of renewable energy sources, integration of smart home technologies, use of biodegradable materials, and provision of environmentally friendly experiences near the property, enhances value by attracting guest who prioritize sustainability as a key factor in their accommodation choices.

Two years ago, Interviewee C.R. installed solar panels and rainwater harvesting systems to irrigate his garden, and he replaced non-recyclable goods in his flats, such as plastic plates and cups and toxic cleaning products, with biodegradable and environmentally friendly alternatives. She says: "Since my house was identified as sustainable on platforms such as Airbnb and Booking.com, I've seen an increase in apartment ratings and bookings". In this regard, Interviewee A.P., who manages a property in the Italian Alps, states: "A year ago, I received negative reviews because my apartment had a gas cylinder and manually regulated radiators”. For this reason, he adapted to avoid further negative reviews and replaced the cylinders with an induction stove and installed a thermostat for indoor temperature control. He adds: "This change has resulted in both an increase in positive reviews and a reduction in energy bills”.

Other hosts wanted to share their observations regarding guest behaviour, which is sometimes completely unsustainable. Host R.M. shared: "Just last week, during checkout, I found the heating turned up to the maximum with the windows open". She also added: "In my opinion, the concept that needs to change is that guests are not incentivized to be cautious about energy expenses because they are unaware of how much they spend and believe it is infinite since it is included in the stay price".

Interviewee C.R. noted that some guests do not properly recycle rubbish, compelling him to sort it personally at checkout. She said: "I displayed a QR code with recycling instructions, but not everyone follows these guidelines". She continued: "Fortunately, some guests do follow and appreciate this type of guidelines. For instance, once a guest mentioned this initiative in a review and suggested placing a bin for organic waste in the garden. Following this advice, I also noticed a reduction in the waste tax".

All hosts would be willing to invest in AI to shift guest behaviour toward a more sustainable approach and to address the issues raised by other interviewees previously. Regarding this aspect, Interviewee A.P. conveyed: "As of today, I would be willing to invest 10,000 euros provided I can recoup the investment in the following years, benefiting from the reduction in energy costs". In addition, when queried about the possibility of offering a 1-3% reimbursement of the apartment's cost to guests who adopt sustainable behaviours during their stay, all respondents expressed affirmative reactions. Specifically, Interviewee M.L. stated, "Yes, I would immediately join this initiative, and I find it very interesting." He continued, "This doesn't mean that the guest should be anxious about consumption and try to save costs as much as possible, but simply that they adopt conscious behaviours, such as not leaving windows open with the air conditioning on, not wasting water, correctly sorting waste, etc.".

These small adjustments could result in significant energy savings over time and attract consumers for whom sustainability is a critical factor influencing their decisions in selecting their stay.

To further validate this hypothesis and the feedback we've gathered from host interviews, we have decided to analyse the responses from a survey conducted with guests to understand their willingness to engage in sustainable behaviours through a refund of 1-3% of the stay price. Our findings show that hosts are inclined to invest in AI technology only if it is economically advantageous and receives positive reception and utilization from guests. According to the survey results, 171 out of 200 respondents are in favour of having a system that provides instant consumption monitoring in exchange for a 1-3% refund on the energy price of their stay. Moreover, this initiative appears to motivate guests who previously showed little interest in sustainability, now drawn by the economic incentive. This finding is significant as it demonstrates, based on feedback from hosts, the crucial role of guest behaviour in enhancing sustainability within the hospitality industry. In this context, AI can assist hosts by monitoring and calculating the compensation due to guests and providing them with sustainable recommendations through a chatbot.

6.1.3 Implications

As we have observed, guest behaviour significantly contributes to enhancing sustainability within the hospitality industry. Upon validating this hypothesis, we have ascertained that AI can be an effective tool for motivating guests to adopt sustainable behaviours during their stay, especially when there is an economic incentive that encourages them to be more responsible. AI could be a valuable tool for hosts to assess real-time consumption and calculate the refund given to guests at the end of their stay. Additionally, based on the actual behaviour of guests during their stay, AI can provide recommendations on how guests might enhance their sustainability practices, potentially increasing the refund they receive.

This approach aims to promote more sustainable behaviour among guests, which has several benefits. Along with reducing energy expenses for the host and increasing the attractiveness of sustainable listings, it invites guests to actively participate in green initiatives during their stay and in their daily lives. This approach benefits not only the hospitality industry's immediate environment, but also broader sustainability efforts, creating a long-term impact on guest behaviour beyond their temporary accommodations.

6.1.4 Q8 - Are hosts willing to offer chatbots to enhance the customer experience and facilitate customer service?

Understanding which tasks are perceived by hosts as particularly time-consuming and resource-intensive, as well as which services are appreciated and requested by guests, is crucial. This knowledge enables us to assess the hosts' interest in adopting innovative chatbot solutions that function as customer service and travel agents, providing advice, personalization, and enhancing experiences around the apartment. Chatbots can deliver responses in very short times, and their effectiveness increases with usage (Pritchett e Coron 2019). They offer quick, accurate, and personalized responses to consumer needs (Pritchett e Coron 2019).

This research question explores whether chatbots can effectively simplify customer service and enhance the customer experience. We also aim to determine whether the costs of implementing chatbots can be absorbed by guests or if they represent a worthwhile investment for hosts, facilitating rapid responses to customer inquiries and improving the overall perception of their stay. The study will examine the extent to which hosts are willing to invest in this technology, considering the economic implications. This analysis is particularly significant considering the guests' willingness to use and potentially pay for the services provided by chatbots, offering a clear picture of who is prepared to invest in such innovations and at what cost.

H8: Hosts are willing to offer chatbots to enhance the customer experience and facilitate customer service.

6.1.4.1 Evidence assessment

To evaluate whether hosts are willing to implement chatbots to improve customer experience through personalized suggestions and to facilitate customer service, we explored the following topics during our interviews with the hosts:

- Activities host consider most time-consuming and would like to be simplified.
- Hosts' willingness to utilize home automation tools or chatbots to streamline customer service and deliver tailor-made experiences to guests.
- Hosts' willingness to pay for the chatbot that not only offers automated customer support but also customizes suggestions and assistance based on guest profiles.

We conducted research in these areas to determine hosts' willingness to integrate a chatbot within their properties, aiming to simplify customer service while also enabling personalized experiences for guests near the property. We sought to ascertain whether hosts are prepared to offer this service to guests and the amount of disposable income they are willing to invest to develop and provide it during each guest's stay.

6.1.4.2 Findings

The interviews revealed that the most time-consuming and energy-intensive tasks for hosts are related to customer service and the check-in and check-out operations. Host M.L. expressed increasing concern about the demands of his role, emphasizing the constant need to be reachable by phone and to respond promptly to every guest request. He described the daily challenges: "I always have to carry my phone with me; even at night, I receive calls from guests who have left their keys inside the house or contact me because there is an issue such as a boiler breakdown or a washing machine that won't start ". He continued: "Most of the time, I recognize these are trivial matters that could be resolved in a minute, but the guest is lazy and does not want to find a solution on their own".

We then inquired whether he had considered implementing a chatbot in their apartment to address customer needs by anticipating and training it for potential guest inquiries. We suggested: "If the boiler issue recurs, we could program the chatbot to direct the guest to the web page and the boiler model for troubleshooting instructions, thereby facilitating the resolution process". We continued by explaining that chatbots can establish a precedent and learn from situations as they arise, thus increasing efficiency in processing guest requests and reducing the burden on hosts. After presenting this proposal, the host expressed strong interest in a chatbot system and requested more information related to its implementation.

Interviewee C.R. confirmed the observations of Interviewee M.L. and, in response to this issue, decided to provide her guests with a house manual. These manual details the procedures for addressing common problems that may arise during their stay. She states: "I noticed that guest requests were frequently recurring, which led me to develop a manual that not only guides the handling of common issues but also provides recommendations on restaurants, attractions, and parking". She continues: "Since introducing this manual, I have observed a decrease in calls for assistance and an increase in positive reviews of the apartment". However, before concluding, she notes: "I have not achieved the desired result. I realized that requests vary significantly depending on the age of the guests. For example, younger guests tend to search for information independently on the web, which sometimes exacerbates the problem if they cannot find specific information about the appliances in the apartment".

The integration of a chatbot within host accommodations extends beyond merely simplifying customer service for managing emergencies and providing assistance; this technology can also deliver added value by offering personalized information and experiences to customers. The hosts we interviewed noted that, at least half of the cases, customers commonly request recommendations for local restaurants, events, or typical activities of the property area. Interviewee A.P. described how he had installed a chalkboard in his apartment, listing the best

local restaurants, bars, nearby supermarkets, and recommended activities. This host commented: "Since I put up this chalkboard, many of my customers have appreciated the initiative, and I have noticed an increase in positive reviews". He added: "It would undoubtedly have been more appropriate to tailor these suggestions based on age groups or other characteristics. For example, last month a guest who visited a local I had listed on the board told me it was a local for younger people and did not meet their expectations." He concluded: "If there were an artificial intelligence that could personalize these experiences, I would definitely use it; it would simplify customer service and increase positive guest's reviews."

Interviewee R.M. stands out for his particularly innovative approach to managing his apartments. She developed a chatbot that responds automatically to consumers immediately after they book. This system delivers pre-set messages via the booking platform chat, providing information on how to reach the apartment, a link to book a car, and another to organize nearby experiences. The interviewee stated: "The implementation of this chatbot has significantly simplified the management of the apartments and customer service, but I realize the need for more accurate customization that tailors assistance to the age of the customers, the reason for their stay, their interests, and expectations during the vacation." She added: "I would be willing to pay 10% of the price of the stay for a chatbot that could reduce direct customer contacts by at least half". This conclusion is also shared by other interviewed hosts, who expressed willingness to pay up to 10% of the cost of the stay to simplify customer service and increase positive reviews.

The hypothesis is also reinforced by survey data on the use of chatbots by customers, which reveals a strong interest in these systems capable of offering personalized service and attention to detail comparable to that of human concierges. Furthermore, as seen in the validation of research question 3, the use of AI concierges to streamline travel logistics and enhance the

overall quality of the experience is a technique that particularly resonates with tourists who have extended stays.

6.1.4.3 Implications

Upon confirming this hypothesis, we found that most hosts consider customer assistance to be one of the more challenging activities and would prefer it to be simplified. Additionally, all respondents support the idea of implementing a chatbot that provides personalized experiences and advice. Interviews revealed that hosts who offered additional services, such as recommendations and suggested experiences, received positive reviews and experienced an increase in bookings. Therefore, implementing a chatbot that simplifies and accelerates responses to unexpected issues, requests, or personalized experiences could be key to improving customer service, enhancing guest engagement with the offered experiences, and making their stay more unique and comfortable.

7. Solutions and practical applications (Group part)

Using distinct qualitative and quantitative research approaches, we investigated and examined the perspectives of both hosts and guests within the short-term rental industry, with a special emphasis on sustainability. We developed specific hypotheses which, upon evaluation, revealed significant implications for all considered research questions.

Despite representing opposite sides in the short-term rental industry, both hosts and guests have shown a clear interest in implementing Artificial Intelligence (AI) to promote sustainability and improve the sector, although for different reasons. Hosts primarily use AI to reduce energy costs, streamline customer service, and attract environmentally conscious customers. Conversely, guests are motivated to use AI for more effective customer service, participation in reimbursement programs, and contributing to minimizing the environmental impact of the

industry. These dynamics underscore the potential of AI as a beneficial tool for both parties involved in the hospitality sector.

Moreover, economic interests primarily motivate both hosts and guests, often preceding ethical considerations. Within this framework, AI emerges as an indispensable tool for enhancing sustainability awareness and identifying unexplored opportunities for cost reduction that benefit hosts and generate additional revenue for guests. Effective collaboration between hosts and guests is essential, as they mutually influence each other's choices, and their balance can influence the sector's sustainability and efficiency.

During our research, we identified three principal applications through which AI could profoundly influence this sector: “Intelligent energy consumption analysis”, “Project refund” and “Chatbots as customer service and concierge agents”. We will proceed by exploring each of these applications, beginning with the “Intelligent energy consumption analysis”.

7.1 Intelligent energy consumption analysis: reducing costs and meeting customers’ sustainability expectations (Alessandro Vena)

The European Commission's (2024) directive mandating all member states to transition to zero-emission buildings by 2050 underscores a significant commitment to sustainability. This directive, along with increasing interest in sustainable living, encourages hosts to view AI as a viable solution for reducing energy costs in their apartments and meeting the evolving preferences of guests.

From our quantitative and qualitative analyses, which included feedback from hosts and survey results from guests, it is evident that AI can optimize resource use in accommodations through real-time monitoring of consumption and analysis of historical data, while also aligning with guests' sustainable interests. Our research revealed strong customer interest in sustainable technologies within lodging facilities, particularly in solutions like solar panels and building insulation.

Further investigation within our quantitative analysis indicates that enhancing education and communication about sustainability can help overcome the undervaluation of certain initiatives, increasing customer awareness and fostering greater appreciation for diverse efforts.

Understanding consumer preferences for sustainable technologies is crucial in influencing hosts' investment decisions, helping them maintain competitiveness and be perceived as sustainable over the long term. In this context, AI can be used to develop new models that minimize the economic burden on hosts while catering to guest preferences for technologies. AI's ability to analyse large volumes of data and create predictive models for daily service needs such as water, electricity, and natural gas-based on guest behaviour is invaluable. This capability not only predicts consumption but also advises hosts on the most appropriate technological investments for their apartments. The ability to continuously monitor consumption enables hosts to swiftly adapt to market variables and unexpected events, optimizing operational costs. For example, when selecting solar panels, a host will consider various factors such as the size of the apartment, energy insulation, and solar exposure. AI can provide detailed insights into historical consumption, aiding in the selection of the most suitable solution for short-term guest needs. Moreover, an AI-enhanced chatbot can continuously scout new technologies, recommending to hosts the most advanced and sustainable solutions available on the market that also align with guest interests and reviews.

Finally, the implementation of AI systems involves a cost-benefit analysis that considers not only the initial investment but also potential long-term energy savings and increases in property value. This evaluation should include predictive models to quantify the economic benefits derived from reduced energy consumption and improved resource management, enabling hosts to make informed decisions based on solid evidence. This analysis also incorporates variables such as investment depreciation rate, operational costs, maintenance, and fluctuations in energy

prices, providing a comprehensive overview that guides host toward optimal decisions in terms of sustainability and economic performance.

8. Conclusion (Group part)

We believe that the future of the short-term rental sector is intricately linked to the utilization of Artificial Intelligence (AI) and new technologies, which are essential in addressing the primary challenges encountered so far. The ideas presented are just a starting point, as AI has diverse applications within this sector. AI has the potential to be a revolutionary innovation in shifting the industry toward higher sustainability and efficiency.

This development results from the synergetic integration of the solutions we have identified and which we can see from Figure 4 (Appendices): “Intelligent energy consumption analysis” enables hosts to select optimally sustainable and efficient technologies for their properties, considering both the specific needs of guests and the historical energy consumption data of the apartment. Additionally, this analytical tool facilitates the calculation of “Refunds” for guests based on their demonstrated sustainable behaviour during their stays. This functionality is further enhanced by “Chatbots”, which not only streamline customer service for hosts and enrich the guest experience but also empower hosts to remain abreast of the latest available technologies and provide guidance to guest on adopting more sustainable practices to maximize their refunds.

Leveraging the robust capabilities in analytics, data storage, and processing speed of AI within this sector yields numerous benefits. For hosts, AI represents an enhancement in energy and operational efficiency, as well as increased visibility by meeting the demands of sustainability-oriented guests. For guests, it offers the opportunity to receive economic recognition, more personalized service, and a more environmentally responsible stay. Beyond these stakeholders, the entire community and the environment also benefit, as AI promotes more responsible

environmental behaviours and fuels a virtuous cycle, incentivizing everyone to adopt more sustainable practices.

However, it is crucial to emphasize that the implementation of AI cannot occur in isolation. Effective integration of these solutions with existing technologies and business processes is imperative to maximize benefits and ensure continuous innovation within the hospitality sector. This approach not only enhances operational efficiencies but also fosters an ecosystem conducive to sustained technological advancement.

In conclusion, we assert that the adoption of AI and emerging technologies is not merely advantageous but fundamental to the future of the short-term rental sector. By embracing these innovations, the industry can anticipate not only improved service delivery and operational efficiencies but also a substantial shift towards more sustainable and personalized guest experiences.

9. Understanding of study limitations (Group part)

Our study employed quantitative methods for research questions 1-5 and qualitative methods for research questions 6-8, providing comprehensive insights into the impact of Artificial Intelligence (AI) on the hospitality sector. Recognizing the limitations of each approach is crucial for accurately interpreting the results and expanding the scope of future research.

In our quantitative analysis, we gathered significant insights into the perceptions and impacts of AI concierge chatbots and sustainable technology in the travel and hospitality sector. Despite its valuable contributions, it is important to acknowledge various limitations that could affect the interpretation and generalizability of the results.

A primary limitation concerns the sample size and its demographic diversity. Although we obtain 200 responses to the survey, this still represents a small or demographically homogeneous sample, which restricts the ability to generalize results to a broader population.

The findings may predominantly reflect the opinions of specific demographic groups based on geographical location, age, or socioeconomic status. Another limitation is the use of self-reported data, which introduces inherent biases, such as social desirability bias. Participants may provide responses they perceive as socially acceptable rather than those reflecting their true opinions. This bias is particularly concerning given that participants are mostly acquaintances of the authors, who might feel obliged to express greater interest in chatbots or sustainability to support our' research.

Another significant limitation involves the factors included in the regression analysis. The study may not have fully accounted for all potential variables influencing user perceptions and behaviours. For example, the regression analysis for question 3 could have been enriched by including other critical factors such as prior technological experiences, cultural attitudes towards AI, and specific travel-related needs that were not comprehensively controlled for in the analysis. This inclusion could refine the results, enhancing the explanatory power of the models used, which currently exhibit modest R-squared values (0.341) and Adjusted R-squared values (0.299).

Regarding the qualitative part of our analysis, we conducted interviews with ten hosts. Although this analysis provided preliminary insights, the sample size could have been expanded to further strengthen the results. However, time constraints and the reluctance of many hosts to share sensitive information hindered significant sample expansion. Methodological expansion could have included large-scale interviews segmented by country to explore different perspectives on AI adoption and interest in reducing environmental impact. Such research extension would have allowed us to analyse how cultural, economic, and political variables influence AI usage across different national contexts. A detailed investigation like this could have identified regions particularly receptive to adopting innovative technologies, facilitating the identification of innovation clusters and areas of technological resistance.

Furthermore, the scope of the research could have been extended to include not only private residences but also hotels, bed and breakfasts, hostels, and other hospitality facilities. This broader approach would have provided a more complete and representative view of the impact of our proposals on the entire hospitality sector. By analysing different types of facilities, it would have allowed for a detailed comparison of results across various facility types, promoting a thorough assessment of the effectiveness and scalability of our proposals in the hospitality sector.

We could have conducted a simulation of the prototype in a home setting. Such a simulation would have provided a clear, empirical overview of the immediate effects of the proposed solutions in terms of energy efficiency and sustainability, among other relevant indicators. This would have also allowed us to assess the direct impact on the performance of the dwelling, including energy savings, carbon emission reductions, and other tangible benefits.

Finally, interviewing leading platforms such as Airbnb and Booking could have allowed us to explore common challenges for hosts and their views on sustainability. This could have also included assessing the possibility of implementing incentives for sustainable behaviours and discussing the feasibility of integrating such initiatives. Engaging in dialogues with startups and entities in the water, energy, and sustainability sectors, as well as with software developers and engineers, would have broadened our understanding of development methodologies, associated costs, and the compatibility of innovative technologies with existing infrastructures.

By addressing these limitations and considering additional efforts that could have been implemented, we aimed to provide a comprehensive understanding of our contributions and the scope of future research in the field of AI adoption in the hospitality sector.

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10.1 References (Alessandro Vena)

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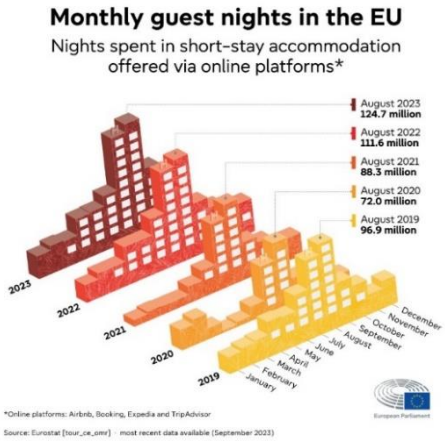
11. Appendices (Group part)

11.1 Table of Figures (Group part)

Figure 1 - The number of nights guests spent in short-stay accommodation in the EU using online platforms.

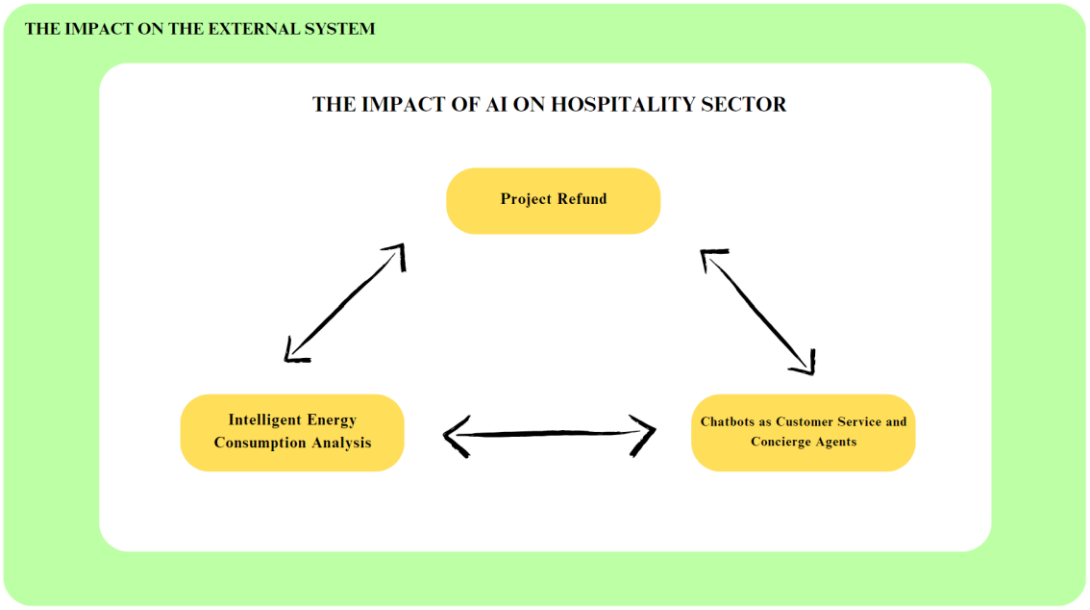


Sources: European Parliament 2023

Figure 2 - The state-of-the-art hospitality services.

Sources: Kansakar, Munir e Shabani 2019

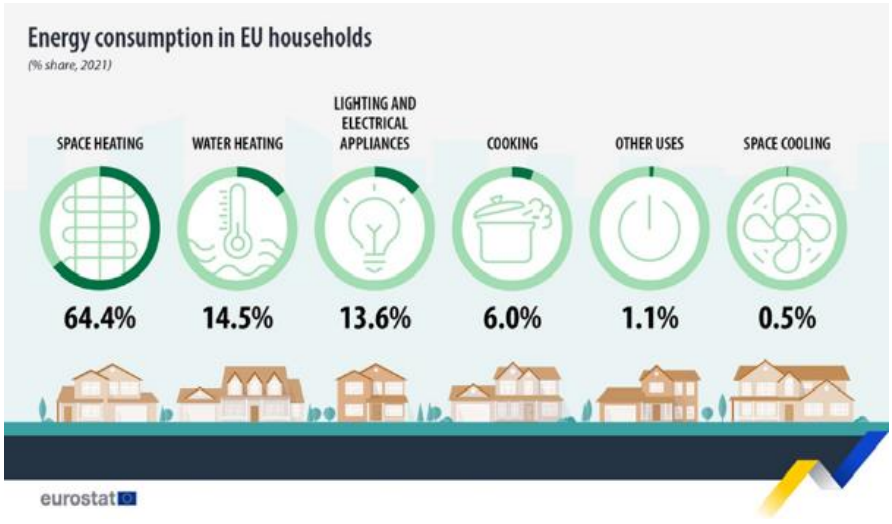
Figure 4 - The impact of AI on the hospitality sector



Sources: Authors

11.2 Table of Figures (Alessandro Vena)

Figure 3 - Energy consumption in EU households (% share, 2021)



Sources: Eurostat 2023

11.3 Interviews (Alessandro Vena)

11.3.1 Interview with the Host R.M. and Alessandro Vena

Alessandro Vena: “Good morning, I am Alessandro Vena, and in collaboration with Filippo Fuscagni and Lorenzo Alessandrini, we are conducting a detailed study on the impact of artificial intelligence on the hospitality industry as part of our master's thesis. Today, we seek to engage with you to discuss your property and your responsibilities as a property manager. Our objective is to gather data, personal experiences, and insights which will deepen our comprehension of the industry and explore how AI could potentially enhance or solve challenges within this sector.”

R.M.: “Good morning, Alessandro. I find your research topic to be highly intriguing and I am eager to contribute to your study through my experience!”

Alessandro Vena: “To commence, could you confirm if managing short-term rental properties constitutes your primary professional occupation? “

R.M.: “Not at the moment.”

Alessandro Vena: “How many short-term rental properties are you currently managing?”

R.M.: “I am currently overseeing five properties. This number allows me to achieve a balance between personal involvement and optimal management, ensuring that each property is maintained sustainably and meets high guest satisfaction standards.”

Alessandro Vena: “Of these properties, how many do you personally own?”

R.M.: “I own four of them.”

Alessandro Vena: “What are your average annual revenues per property?”

R.M.: “On average, the revenue generated per property ranges between €5,000 to €10,000 annually. This income supports my ongoing efforts to enhance the eco-friendliness and guest experience of each property.”

Alessandro Vena: “What is the average percentage of variable costs in relation to the revenue for your properties?”

R.M.: “Variable costs account for approximately 15% to 20% of the revenue. I acknowledge that these costs are relatively high, and I am actively exploring methods to reduce them.”

Alessandro Vena: “What energy classification are your properties currently assigned?”

R.M.: “Currently, they are classified as energy class G. While this is merely a starting point, I am dedicated to investing in enhancements to significantly improve their energy efficiency.”

Alessandro Vena: “Are you aware of the European Energy Performance of Buildings Directive, which aims for zero-emission buildings by 2050?”

R.M.: “I am not aware of that; I will need to find out more!”

Alessandro Vena: “Which appliances or activities are the most energy-intensive within your apartments?”

R.M.: “Based on the analysis of electric invoices, air conditioning and heating systems are the most energy-intensive appliances in my apartments.”

Alessandro Vena: “Do you employ renewable energy sources such as solar panels, wind power, thermal energy, etc. in your apartments?”

R.M.: “Yes, solar panels have been implemented in one of my properties. “Despite installing solar panels three years ago, I have been unable to meet the apartment's’ energy needs during certain times of the year.”

Alessandro Vena: “What type of solar panel did you choose, and based on what parameters did you select the power of the solar panel?”

R.M.: “The power was selected based on the cadastral characteristics of the apartment, such as square footage and energy class.”

Alessandro Vena: Could other parameters have been used for determining the right power, such as an analysis of past guest consumption statistics prior to installation?”

R.M.: “Yes, indeed. It was a mistake not to consider these aspects, even though it would have taken a large amount of time and been practically impossible to apply to additional short-term rental homes with the resources at my disposal.”

Alessandro Vena: “Would you be willing to invest in artificial intelligence to monitor the instantaneous consumption of guests and analyse their usage to identify potential energy cost savings?”

R.M.: “Yes, if this can help me save on the apartment's energy costs and increase the efficiency of the apartment, I would be willing to spend 5,000 euros today on this technology.”

Alessandro Vena: “Do you believe that guests’ behaviour affects the overall sustainability of the sector and your energy expenses? What do you think about this?”

R.M.: “Yes, absolutely, just last week, during checkout, I found the heating turned up to the maximum with the windows open. In my opinion, the concept that needs to change is that guests are not incentivized to be cautious about energy expenses because they are unaware of how much they spend and believe it is infinite since it is included in the stay price.”

Alessandro Vena: “How significant do you consider the guests' perception of your property's equipment?”

R.M.: “It is extremely important to me because it provides insights into areas of improvement for the property and facilitates the attainment of positive reviews.”

Alessandro Vena: "Would you consider offering a 1-3% reimbursement of the apartment's price to guests who engage in sustainable behaviours during their stay?”

R.M.: “Yes, I would be willing to provide the refund if this initiative attracts guests interested in sustainability.”

Alessandro Vena: “Which aspects of property management would you like to see simplified?”

R.M.: “I would like to see simplifications in customer support and the check-in/check-out processes.”

Alessandro Vena: “Do you currently utilize home automation tools or AI in managing your apartment? If not, would you be interested in employing a chatbot to streamline customer service?”

R.M.: “I developed a chatbot that automatically responds to customers immediately after they book. This system sends pre-set messages via the booking platform chat, providing information on how to reach the apartment, a link to book a car, and another to organize nearby experiences. The implementation of this chatbot has significantly simplified the management of the apartments and customer service, but I realize the need for more accurate customization that tailors’ assistance to the age of the customers, the reason for their stay, their interests, and expectations during the vacation.”

Alessandro Vena: “How much would you be willing to invest in a chatbot that not only offers automated customer support but also customizes suggestions and assistance based on guest profiles?”

R.M.: “I would be willing to pay 10% of the price of the stay for a chatbot that could reduce direct customer contacts by at least half.”

Alessandro Vena: “Would you like to share any other considerations regarding your role as a property manager or any thoughts on the use of AI in this sector?”

R.M.: “Absolutely, I believe that AI can play a transformative role in property management. It not only improves operational efficiency but also enhances guest experience by offering personalized services. As a property manager, AI tools help me analyse data more effectively, predict maintenance needs, and optimize energy use. However, it's important to balance technology with human touch to ensure that the hospitality remains warm and personal.”

Alessandro Vena: “Thank you very much for your time and for participating in our interview.”

11.3.2 Interview with the Host A.P. and Alessandro Vena

Alessandro Vena: “Good evening, I am Alessandro Vena, and in collaboration with Filippo Fuscagni and Lorenzo Alessandrini, we are conducting a detailed study on the impact of artificial intelligence on the hospitality industry as part of our master's thesis. Today, we seek to engage with you to discuss your property and your responsibilities as a property manager. Our objective is to gather data, personal experiences, and insights which will deepen our comprehension of the industry and explore how AI could potentially enhance or solve challenges within this sector.”

A.P.: “Good evening, Alessandro. Alessandro. Your research topic is fascinating, and I'm excited to contribute to your study with my experience!”

Alessandro Vena: "To commence, could you confirm if managing short-term rental properties constitutes your primary professional occupation?"

A.P.: “No”

Alessandro Vena: “How many short-term rental properties are you currently managing?”

A.P.: “I am currently managing one property.”

Alessandro Vena: “Do you personally own this property?"

A.P.: “Yes, I am the owner of this property.”

Alessandro Vena: "What are your average annual revenues per property?”

A.P.: “I think I am under €10,000.”

Alessandro Vena: "What is the average percentage of variable costs in relation to the revenue for your properties?"

A.P.: “Above 10% of revenues.”

Alessandro Vena: "What energy classification are your properties currently assigned?"

A.P.: “I am not aware of it.”

Alessandro Vena: “Are you aware of the European Energy Performance of Buildings Directive, which aims for zero-emission buildings by 2050?”

A.P.: “No, I do not know what it is at all.”

Alessandro Vena: “Which appliances or activities are the most energy-intensive within your apartments?”

A.P.:” I think air conditioning and heating.”

Alessandro Vena: “Do you employ renewable energy sources such as solar panels, wind power, thermal energy, etc. in your apartments?”

A.P.: “No.”

Alessandro Vena: “Would you be willing to invest in artificial intelligence to monitor the instantaneous consumption of guests and analyse their usage to identify potential energy cost savings?”

A.P.: “Yes, I would be willing to invest. As of today, I would be willing to invest 10,000 euros provided I can recoup the investment in the following years, benefiting from the reduction in energy costs.”

Alessandro Vena: “Do you believe that guests’ behaviour affects the overall sustainability of the sector and your energy expenses? What do you think about this?”

A.P.: “Yes, absolutely.”

Alessandro Vena: “How significant do you consider the guests' perception of your property's equipment?”

A.P.: “I place great importance on guest perception because the platforms where I offer my properties rely on guest reviews. For example, a year ago, I received negative reviews because my apartment had a gas cylinder and manually regulated radiators. For this reason, I decided to adapt to avoid further negative reviews and replaced the cylinders with an induction stove and installed a thermostat for indoor temperature control. This change has resulted in both an increase in positive reviews and a reduction in energy bills.”

Alessandro Vena: "Would you consider offering a 1-3% reimbursement of the apartment's price to guests who engage in sustainable behaviours during their stay?”

A.P.: “Yes, if it gives me greater visibility to guests interested in sustainability and a reduction in energy costs, I am willing to offer a refund of 1-3% of the flat cost to guests who adopt sustainable behaviour during their stay.”

Alessandro Vena: “Which aspects of property management would you like to see simplified?”

A.P.: “Customer service and assistance. During stays, guests often ask me for advice, which is why I decided to install a chalkboard in my apartment, listing the best local restaurants, bars, nearby supermarkets, and recommended activities. Since I put up this chalkboard, many of my customers have appreciated the initiative, and I have noticed an increase in positive reviews. It would undoubtedly have been more appropriate to tailor these suggestions based on age groups or other characteristics. For example, last month a guest who visited a local I had listed on the board told me it was a local for younger people and did not meet their expectations. If there were an artificial intelligence that could personalize these experiences, I would definitely use it; it would simplify customer service and increase positive guest’s reviews.”

Alessandro Vena: “Do you currently utilize home automation tools or AI in managing your apartment? If not, would you be interested in employing a chatbot to streamline customer service?”

A.P.: “Yes, since I installed home automation, I can turn on the heating or air conditioning with a single click on my smartphone. Previously, due to the apartment's location more than an hour away from my current residence, I would activate the air conditioning immediately after cleaning and maintain it until the arrival of the guests. According to last year's data, this has helped me to reduce my energy bills. In addition, in my apartment in the Italian Alps in previous years, low winter temperatures caused the water lines to freeze, resulting in leaks. In the last two years, I have opted to install a sensor that automatically circulates warm water through the pipes when the temperature falls below zero degrees, to prevent them from freezing. Thanks to this solution, I was able to save more than 500 euros on plumbing fees for pipe replacement during guest stays”.

Alessandro Vena: “How much would you be willing to invest in a chatbot that not only offers automated customer support but also customizes suggestions and assistance based on guest profiles?”

A.P.: “I would be willing to pay 10% of the price of the stay.”

Alessandro Vena: “Would you like to share any other considerations regarding your role as a property manager or any thoughts on the use of AI in this sector?”

A.P.: “I hope AI can offer new, more efficient solutions and make this sector more sustainable.”

Alessandro Vena: “Thank you very much for your time and for participating in our interview.”

11.3.3 Interview with the Host C.R. and Alessandro Vena

Alessandro Vena: “Good morning, I am Alessandro Vena, and in collaboration with Filippo Fuscagni and Lorenzo Alessandrini, we are conducting a detailed study on the impact of artificial intelligence on the hospitality industry as part of our master's thesis. Today, we seek to engage with you to discuss your property and your responsibilities as a property manager. Our objective is to gather data, personal experiences, and insights which will deepen our comprehension of the industry and explore how AI could potentially enhance or solve challenges within this sector.”

C.R.: “Good morning, Alessandro. I hope I can be of help to you!”

Alessandro Vena: “To commence, could you confirm if managing short-term rental properties constitutes your primary professional occupation?”

C.R.: “No, I do it as a hobby”

Alessandro Vena: “How many short-term rental properties are you currently managing?”

C.R.: “I am currently managing two properties.”

Alessandro Vena: “Of these properties, how many do you personally own?”

C.R.: “I own both of them”.

Alessandro Vena: “What are your average annual revenues per property?”

C.R.: “I think above 15,000 euro each.”

Alessandro Vena: “What is the average percentage of variable costs in relation to the revenue for your properties?”

C.R.: “I believe above 15% of the revenues.”

Alessandro Vena: “What energy classification are your properties currently assigned?”

C.R.: “I do not know.”

Alessandro Vena: “Are you aware of the European Energy Performance of Buildings Directive, which aims for zero-emission buildings by 2050?”

C.R.: “I am not aware of that.”

Alessandro Vena: “Which appliances or activities are the most energy-intensive within your apartment?”

C.R.: “Based on the electricity invoices, I believe that the air conditioning and heating are the most energy-demanding appliances in my apartments. In addition, last year, I realized that I couldn't cover the energy expenses during the winter months due to the rising costs of gas and electricity caused by the war in Ukraine. I established the pricing for overnight stays six months ago and didn't adjust it to reflect these changes. I realized it would have been better to anticipate cost increases and adjust the rates promptly instead of waiting for the energy bill to arrive in the coming months.”

Alessandro Vena: “Do you employ renewable energy sources such as solar panels, wind power, thermal energy, etc. in your apartments?”

C.R.: “Yes, I installed solar panels and rainwater harvesting systems to irrigate my garden.”

Alessandro Vena: “What type of solar panel did you choose, and based on what parameters did you select the power of the solar panel?”

C.R.: “I do not remember.”

Alessandro Vena: “Would you be willing to invest in artificial intelligence to monitor the instantaneous consumption of guests and analyse their usage to identify potential energy cost savings?”

C.R.: “Certainly, if this allows me to reduce energy costs and increase energy efficiency in the use of my apartment.”

Alessandro Vena: “Do you believe that guests’ behaviour affects the overall sustainability of the sector and your energy expenses? What do you think about this?”

C.R.: “Yes, I believe that the behaviour of some guests is disrespectful towards the environment. Indeed, some guests do not properly recycle rubbish, compelling me to sort it personally at checkout. I've tried everything, for example, I displayed a QR code with recycling instructions, but not everyone follows these guidelines. Fortunately, some guests do follow and appreciate this type of guidelines. For instance, once a guest mentioned this initiative in a review and suggested placing a bin for organic waste in the garden. Following this advice, I also noticed a reduction in the waste tax.”

Alessandro Vena: “How significant do you consider the guests' perception of your property's equipment?”

C.R.: “It is crucial! Due to the increasing focus of guests on sustainability, I installed solar panels and rainwater harvesting systems to irrigate my garden, and I replaced non-recyclable goods in my apartment, such as plastic plates and cups and toxic cleaning products, with biodegradable and environmentally friendly alternatives. This initiative, in addition to energy savings, has brought me numerous benefits. Since my house was identified as sustainable on platforms such as Airbnb and Booking.com, I've seen an increase in apartment ratings and bookings.”

Alessandro Vena: "Would you consider offering a 1-3% reimbursement of the apartment's price to guests who engage in sustainable behaviours during their stay?”

C.R.: “If this truly allows for a change in guest behaviour, then yes.”

Alessandro Vena: “Which aspects of property management would you like to see simplified?”

C.R.: “Check-in/check-out and customer assistance for unexpected issues within the home. To address potential problems that may occur within the apartment, I decided to provide guests with a house manual. This manual details the procedures for addressing common problems that may arise during their stay. I noticed that guest requests were frequently recurring, which led me to develop a manual that not only guides the handling of common issues but also provides recommendations on restaurants, attractions, and parking. Since introducing this manual, I have observed a decrease in calls for assistance and an increase in positive reviews of the apartment. However, despite successfully simplifying this process, I have not achieved the desired result. I realized that requests vary significantly depending on the age of the guests. For example, younger guests tend to search for information independently on the web, which sometimes exacerbates the problem if they cannot find specific information about the appliances in the apartment.”

Alessandro Vena: “Do you currently utilize home automation tools or AI in managing your apartment? If not, would you be interested in employing a chatbot to streamline customer service?”

C.R.: “Yes, I would like to use a chatbot to simplify customer service.”

Alessandro Vena: Do you use home automation tools or AI in managing your apartment? If not, would you like to use a chatbot to simplify customer service?

C.R.: Yes, I would like to use a chatbot to simplify customer service.

Alessandro Vena: “How much would you be willing to invest in a chatbot that not only offers automated customer support but also customizes suggestions and assistance based on guest profiles?”

C.R.: “Yes, I would be willing to allocate a portion not exceeding 10% of the stay price for this service”

Alessandro Vena: “Would you like to share any other considerations regarding your role as a property manager or any thoughts on the use of AI in this sector?”

C.R.: “As a property manager, I prioritize efficiency and customer satisfaction. AI tools can streamline operations, from tenant communication to predictive maintenance, enhancing overall management effectiveness.”

Alessandro Vena: “Thank you very much for your time and for participating in our interview.”

11.3.4 Interview with the Host M.L. and Alessandro Vena

Alessandro Vena: “Good morning, I am Alessandro Vena, and in collaboration with Filippo Fuscagni and Lorenzo Alessandrini, we are conducting a detailed study on the impact of artificial intelligence on the hospitality industry as part of our master's thesis. Today, we seek to engage with you to discuss your property and your responsibilities as a property manager.

Our objective is to gather data, personal experiences, and insights which will deepen our comprehension of the industry and explore how AI could potentially enhance or solve challenges within this sector.”

M.L.: “Good morning, you have a very interesting topic!”

Alessandro Vena: “To commence, could you confirm if managing short-term rental properties constitutes your primary professional occupation? “

M.L.: “Yes.”

Alessandro Vena: “How many short-term rental properties are you currently managing?”

M.L.: “I am currently managing four properties.”

Alessandro Vena: “Of these properties, how many do you personally own?”

M.L.: “I own three of them”.

Alessandro Vena: “What are your average annual revenues per property?”

M.L.: “I believe above 20,000 euros each”

Alessandro Vena: “What is the average percentage of variable costs in relation to the revenue for your properties?”

M.L.: “I think around 15% of revenues.”

Alessandro Vena: “What energy classification are your properties currently assigned?”

M.L.: “Of all of them I don't remember, I know that some are class A while other I don't know."

Alessandro Vena: “Are you aware of the European Energy Performance of Buildings Directive, which aims for zero-emission buildings by 2050?”

M.L.: “Yes, I have heard of it but I do not know its contents!”

Alessandro Vena: Which appliances or activities are the most energy-intensive within your apartment?

M.L.: “I believe that the air conditioning and heating are the most energy-intensive appliances in my apartments.”

Alessandro Vena: Do you use renewable energy sources such as solar panels, wind power, thermal energy, etc., within your apartments?

M.L.: “No”

Alessandro Vena: “Would you be willing to invest in artificial intelligence to monitor the instantaneous consumption of guests and analyse their usage to identify potential energy cost savings?”

M.L.: “Certainly, I would be willing to invest €10,000 today in this technology if it can help reduce energy costs and enhance apartment efficiency.”

Alessandro Vena: “Do you believe that guests’ behaviour affects the overall sustainability of the sector and your energy expenses? What do you think about this?”

M.L.: “Yes, guests' behaviour significantly impacts both the sustainability of the sector and our energy expenses. Their conscientious choices can greatly influence resource consumption and overall environmental impact.”

Alessandro Vena: “How significant do you consider the guests' perception of your property's equipment?”

M.L. “Guests' perception of my property's equipment is paramount, directly impacting their experience and satisfaction.”

Alessandro Vena: "Would you consider offering a 1-3% reimbursement of the apartment's price to guests who engage in sustainable behaviours during their stay?"

M.L.: "Yes, I would immediately join this initiative, and I find it very interesting. This doesn't mean that the guest should be anxious about consumption and try to save costs as much as possible, but simply that they adopt conscious behaviours, such as not leaving windows open with the air conditioning on, not wasting water, correctly sorting waste, etc."

Alessandro Vena: "Which aspects of property management would you like to see simplified?"

M.L.: "The activities that consume most of my time in property management are related to customer service and the check-in and check-out operations. I have realized that customer service is one of the activities that demands the most time. I always have to carry my phone with me; even at night, I receive calls from guests who have left their keys inside the house or contact me because there is an issue such as a boiler breakdown or a washing machine that won't start". Furthermore, I've found that most of the time, I recognize these are trivial matters that could be resolved in a minute, but the guest is lazy and does not want to find a solution on their own."

Alessandro Vena: "Do you currently utilize home automation tools or AI in managing your apartment? If not, would you be interested in employing a chatbot to streamline customer service?"

M.L.: "I don't use any AI tools in managing my apartment, what does this allow me to do?"

Alessandro Vena: "The chatbot could address customer needs by anticipating and training it for potential guest inquiries. For example, if the boiler issue recurs, we could program the chatbot to direct the guest to the web page and the boiler model for troubleshooting instructions, thereby facilitating the resolution process. Chatbots can establish a precedent and learn from situations

as they arise, thus increasing efficiency in processing guest requests and reducing the burden on hosts."

M.L.: "Interesting, I would like to receive further information related to its implementation."

Alessandro Vena: "How much would you be willing to invest in a chatbot that not only offers automated customer support but also customizes suggestions and assistance based on guest profiles?"

L.M.: "I would be willing to pay 10% of the night price."

Alessandro Vena: "Would you like to share any other considerations regarding your role as a property manager or any thoughts on the use of AI in this sector?"

M.L.: "Absolutely, personally, I had never considered how AI could be applied to this sector. I would be very interested in adopting these tools if they are indeed feasible."

Alessandro Vena: "Thank you very much for your time and for participating in our interview."