

Applications and Implications of Service Robots in Hospitality Sector: A Case Study

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ABSTRACT

Purpose – Previous research has emphasized that service robots cause radically change current service production and delivery practices and, consequently, service management and marketing strategies. This research explores the use of current state-of-the-art service robotics in the hospitality industry and aims to better understand how this technology can transform service operations.

Design/Methodology/Approach – An exploratory qualitative approach was adopted for this study. Case study pattern and holistic single case pattern were preferred from qualitative research patterns as the method of inquiry. This qualitative study was conducted using a thematic analysis approach. The criterion sampling method was performed to collect data with one participant through in-depth, semi-structured individual interview. Data were analyzed using a thematic approach that built on a priori themes or categories were adopted for data analysis.

Findings – Analysis of participant's perspectives and experiences showed the 8 themes of the roles of service robotics in service encounters including substitute, support, supporting new business models, improve, differentiate, creative experiences & competition, upskill, and data collection. Unlike the previous research, supporting new business models, creative experiences & competition, and data collection were also found as new technology roles specific to service robots. By developing a new conceptual DRiTE Model (Development of Robotics in Tourism Ecosystem), the research not only contributes theoretical implications to the literature but also offers business strategies (management, marketing, etc.) for hospitality firms to manage innovative, automated service offerings.

Discussion – Despite previous research having extensively discussed the use of technology in services, it can be interpreted that the current global tourism industry on the use of robotics in service encounters is still in its infancy. Over time, these micro-scale changes will evolve to form a global ecosystem. This means that the way they do business will change on a global scale through various diffusion areas such as brand, service type or stakeholder network. The paper's novelty and uniqueness lie in suggesting a new conceptual DRiTE of addressing the implications of this research and offering insight for hospitality services-related managers into how to effectively research implications can be implemented.

1. Introduction

Robotics, which has become a multi-million Euro industry today, has formed a core pillar in the manufacturing industry, especially in the 2000s. As statistics reveal, growth in the robotics industry will continue and be permanent. Since the first use of robots in the manufacturing industry, the robotics industry has continuously expanded to new markets and developed new applications. Today robotics is no longer a technology for only manufacturing but has evolved to also address a much wider range of applications and domains where a variety of services are provided to different end users (ISO, 2022).

Robots are steadily gaining traction in specific segments of the service economy, from baggage handling in airports to loading inventory in warehouses (Oxford Economics, 2019). Paluch et al. (2020) indicate that our economies are facing a turning point in history like the industrial revolution in manufacturing that started in the 18th century. Especially the advent of service robotics (virtual and physical service robots) will lead to rapid innovation that has the potential to dramatically improve the customer experience, service quality, and

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productivity all at the same time. Service robotics encompasses a broad field of applications, most of which have unique designs and different degrees of automation-from full tele-operation to fully autonomous operation (IFR, 2022).

In a business environment where the level of competition and the rate of technological change are quite high, and customer preferences are constantly changing, businesses must reinvent themselves and update their ways of doing business and processes (Tuomi et al., 2021). It is generally accepted that cost and quality are needed but not sufficient for sustainable competitiveness, and it becomes important to be able to change with innovative approaches (Paksoy and Ersoy, 2016). From this point of view, it becomes very difficult for businesses that cannot keep up with the change to be competitively successful (Omerzel, 2015). Tourism businesses also need to quickly adapt to the changes in information and technology in order to maintain their sustainability and competitive power, especially for increasing supply and demand (Şanlıöz et al., 2013).

Service automation, artificial intelligence and robotics provide vast opportunities to travel, tourism and hospitality companies to improve their operations and productivity, deliver consistent product quality and transfer some of the service delivery processes to the customers (Ivanov et al., 2017). However, little is known about the theoretical or practical impact of service robotics on hospitality management and marketing. There are few empirical studies to be found (Ivanov et al., 2020; Tuomi et al., 2021).

In this context, this research explores the use of current state-of-the-art service robotics in the hospitality industry and aims to better understand how this technology can transform service operations as mentioned in the literature. It focuses particularly on the role of service robots in relation to service production and delivery. This study seeks to answer the following research questions:

Research Question 1: what is the standpoint from which we should explore implementing service robots?

Research Question 2: In what ways are service robots currently transforming service production and delivery in hospitality service encounters?

Research Question 3: What are the eventual key implications of this on service operations, management, and marketing?

The findings of this research advance academic discourse on whether or not service robots are used in hospitality to produce and deliver customer services, if so how they are used. In doing so, this research provides much-needed empirical evidence in this field. It will allow hospitality researchers and practitioners to better understand how service robots are transforming service encounters. In addition, the research presents a new conceptual DRiTE Model, which is created via critical analysis and then synthesis of knowledge from the literature and research findings. By developing DRiTE Model, the present study not only contributes theoretical implications to the literature but also offers business strategies (management, marketing, etc.) for hospitality firms to manage innovative, automated service offerings. The findings contribute to the literature in determining the role that service robots will play in the global tourism industry in the near and far future. In addition, they provide an up-to-date conceptualization of the different roles robotics technology plays in hospitality service encounters. The paper's novelty and uniqueness lie in suggesting DRiTE Model of addressing the implications of this research and offering insight for hospitality services-related executives into how effectively research implications can be implemented. Future research should undertake empirical studies to test and validate the DRiTE Model presented in this research.

2. Literature Review

2.1. Industrial & Service Robots

Robotics refers to the science of design, construction, operation, and implementation of robots, as well as computer systems for control, feedback, and information processing (Dadios et al., 2018). Artificial intelligence (AI), robotics and other forms of 'smart automation' are advancing at a rapid pace and have the potential to bring great benefits to the economy, by boosting productivity and creating new and better products and services (PwC, 2018). The requirement for higher efficiency and accuracy in industry and manufacturing, called for more flexibility and intelligence industrial robots (Liu et al., 2009). AI and robotics will have a tremendous impact on customers, businesses, and communities alike (Koo et al., 2021). Robots are continuously transformin

g industrial production worldwide and thereby also inducing changes in a variety of production-related economic and social relations (MPRA, 2021). In near future robots are part of human society (Madakam et al., 2019).

There are many definitions for what a robot is, and this often leads to discrepancies between statistics quoted about robots. The commonly accepted definition in the UK is that provided by the British Robot Association which is as follows: "An industrial robot is a re-programmable device designed to both manipulate and transport parts, tools, or specialized manufacturing implements through variable programmed motions for the performance of specific manufacturing tasks" (BARA, 2022). Jia et al. (2021) defines service robot as "A movable or immovable physical device that can perform user (e.g., guests or owners) instructions automatically or semi-automatically". An industrial robot can be considered as a set of integrated subsystems that correspond to a manipulator or mechanical arm, a terminal effector, motor elements or actuators, information sensors, and controllers (Urrea et al., 2016).

IFR (2020) defined the service robot as "performs tasks excluding industrial automation, usually application-specific design, often fewer than 3 axes and sometimes not fully autonomous but remote-controlled" in its report.

Based on the literature, we think that the development process of service robots consists of four basic stages:

- a. **Mechanical-electronic (ME):** It is the period when mechanical robots that attract more attention but can perform basic functions are developed. In the later stages of this period, the first robots that fulfill the basic functions electronically and industrially began to be produced and used.
- b. **Electronic-autonomous (EA):** It is the period when the functionality of industrial robots increases, they can perform a wide variety of actions, they can operate together with humans, the first examples of service robots emerged, and robots began to integrate with social life.
- c. **Mid-Term Autonomous-AI (AA-1):** It is the period when autonomous industrial and service robots can exhibit advanced functions enriched with AI. This term refers to robots that perform their actions by adapting to their environment, collect information from their environment, interact with people as well as work together.
- d. **Long-Term Autonomous-AI (AA-2):** This period indicates that service robots will continue to develop as a vital component in both the services sector and social life in the distant future. This period appears to be a period in which robots will perform all tasks that are risky, repetitive and monotonous, complex and difficult, or that are not/would not be preferred to be done by humans.

Since the two periods mentioned are shaped historically, they will not change in terms of their basic features. However, the third period we defined (AA-1) may encounter remarkable changes in terms of the definition we have made now and the characteristics of the period, depending on the developments to be experienced. We predict that change will be more about the direction of change than the speed of change. The approaches of users and developers will determine the direction of this change in the face of cobot, robotic process automation, fog computing, extended reality, metaverse and similar developments that will expand the boundaries of Industry 4.0 or set the boundaries of a new era.

The affordance of service robots understood as a relational concept that connects the materiality of a technological artifact with the subjective goals and perceptions of its users, is therefore fundamentally different from that of industry robots (Sprenger and Mettler, 2015).

According to our evaluation based on the literature, it can be stated that there are four basic parameters that determine the qualities of service robots. The order of priority of these parameters may vary depending on the type of service robot. These parameters can be counted as:

- a. Appearance (aesthetics and exterior)
- b. Functionality (software and hardware)
- c. Interaction (machine-human, machine-machine)
- d. Confidence (temperature, low error and risk)

It can be accepted that the first two parameters (appearance and functionality) gain importance in the ME and EA periods, and the other two parameters (interaction and trust) in the AA-1 period. We can say that new parameters will come to the fore in the AA-2 period, which we started to live with the possibilities of Industry 4.0 and the developments in technology.

Service robots have witnessed widespread acceptance among various professional and personal applications owing to benefits such as enhanced usability, delivery of accurate and high-quality services, reliability, and reduced operational costs and human errors (Malani and Lanjudkar, 2016).

Robots that can perform routine tasks effectively will also provide services that require high cognitive and analytical skills (e.g., financial services), at the same efficiency. For example, service robots can analyze large volumes of data, integrate internal and external information, recognize patterns and relate these to customer profiles. Within minutes, these robots can propose best-fitting solutions and make recommendations (Wirtz et al., 2022).

The real value of customer service robots lies more in the data they collect through their sensors when interacting with customers face-to-face more than their cost-effectiveness. In this way, customer service robots have great potential for developing interactive marketing and rebranding strategies and tracking and analyzing customer behavior (A3, 2022). Before robots are deployed for services, organizations must understand what customers want and expect regarding service quality provided by robots (Chiang and Trimi, 2020).

2.2. Robots in Tourism Industry

Due to its nature, the tourism industry is extremely sensitive to technological developments and these developments are widely used in many different places. Various businesses such as accommodation businesses, museums, airports, food and beverage businesses are suitable for the use of new technological products. Many digital-supported products such as service robots, 24/7 self-service kiosks, and artificial intelligence support chatbots serve in the field of tourism (Bağcı ve İçöz, 2019). Considering the accommodation part of tourism in some departments of the hotel such as housekeeping, maintenance and security, extensive use of robots and artificial intelligence can lead to a significant increase in productivity, efficiency and reduce operational costs (Sugasri and Selvam, 2018). In other departments, such as front desk, where contact with guests is intensive, robots and artificial intelligence will be combined with human staff to enhance customer satisfaction and guest experience (Lukanova and Ilieva, 2019).

It is possible to examine the effective use of robots in the tourism sector in three groups: hospitality businesses, food and beverage businesses and travel businesses.

a. Robots in food and beverage businesses: In food and beverage businesses, it is seen that robots are used in the tasks of greeting customers, cooking and serving meals. While cooking robots undertake to prepare food to a certain standard, greeting robots are mainly responsible for receiving the customers, accompanying them to their places and introducing restaurant for customers. Service robots working in food and beverage businesses, on the other hand, are responsible for taking the food orders of the customers as waiters and delivering the meals to the customers (Yu et al. 2012). Robots are being used from seeding, spraying water and harvesting to cutting, processing and packaging of food products. Various robot systems are used in meat processing and automatic quality detection of the final product of bakery items (Iqbal et al., 2017).

b. Robots in travel businesses: The use of robots in travel businesses appears in different areas. Robots working at airports are involved in areas such as welcoming passengers, providing consultancy services, providing information, translating in different languages, carrying luggage, recommending duty-free products in shopping, and cleaning. In addition, robotic labor can be used for safety (İbiş, 2019). According to Bowen and Morosan (2018) by 2030, an increasing amount of travel products will be reserved and purchased by machines, without the need for human interaction, that represent the traveler and the travel industry company. The co-creation of the travel product will be created by machines and AI software representing the guest and the hospitality organization; both systems will understand their client's needs.

c. Robots in hospitality businesses: Robots can be in the position of providing direct service to guests or supporting employees in different parts of hotel businesses. Robotic receptionists, suitcase handlers, luggage

storage robots, room assistants, robots using vacuum cleaners are some of the examples of robot technologies seen in hotel businesses today. In addition, the existence of businesses that allow hotel guests to check in and out without the need for any employee is increasing day by day. Some hotel businesses have taken this a step further and have started to offer their guests the opportunity to check-in and check-out via mobile devices (İbiş, 2019). Service robots that work in housekeeping provide guests and staff with a variety of information and recommendations, deliver to the guest's various items, entertain children and adults, would be found at the hotels more and more often (Ivanov et al., 2017).

3. Methodology

3.1. Research method and design

Despite increasing interest in hospitality service robotics from researchers and practitioners alike (Murphy et al., 2017), applications of robotics in actual hospitality service settings remain relatively few and far between (Ivanov and Webster, 2019). Due to this, an exploratory qualitative approach was deemed suitable for this study. In accordance with the purpose of the research, case study pattern and holistic single case pattern (Yin, 2003) were preferred from qualitative research patterns as the method of inquiry. In holistic single case patterns, there is a single unit of analysis (an individual, an organization, a program, a school, etc.) (Yıldırım and Şimşek, 2008: 291).

The reason for choosing the case study design is that it is convenient to examine current situations based on people's opinions and in-depth knowledge of the subject. In addition, it is more convenient to reveal the essence of the researched subject and reflect the event as it is (Ozdemir, 2010; Tutar and Erdem, 2020). Studies conducted with case studies reveal the factors that affect the phenomenon hidden in the examined situation (Yin, 2014; Merriam and Tisdell, 2015).

3.2. Data collection and analysis procedure

In this study, which is based on the mixed data collection technique, the data obtained by using the semi-structured interview technique as the primary source, the data obtained by the literature review, the documents related to the business and the online applications were used as the secondary source. This was due to their ability to produce rich data from a limited number of cases and participants (Brewer, 2000). Data collection was carried out in June 2022.

To gain a better understanding of the service robotics currently in use, as well as the potential benefits and/or challenges of robotizing hospitality service encounters, data collection began with the semi-structured interview phase. Due to the theoretical focus of this research, semi-structured interview questions were created using Tuomi et al.' (2021) Roles of Service Robotics in Service Encounters Model. This model illustrates the roles of automation in five key areas (support, substitute, differentiate, improve, upskill) of service production and delivery. The questions were designed to explore the value of integrating service robots into service processes by identifying the most suitable tasks for automation in hospitality. They also highlighted the impact automation may have on hospitality employment as well as the impact on management and marketing.

In the analysis of the data, descriptive analysis technique was used. In the descriptive analysis process, a four-stage process was first followed: creating a framework for the analysis, processing the data according to the thematic framework, defining the findings, and interpreting the findings. In the process of processing the data, first, all interview transcript (approximately 3100 words of interview data) was printed. These were then fully read one by one, relevant or interesting sections were marked, notes were taken, and the data were deciphered (Huberman and Miles, 1997; Yıldırım and Şimşek, 2018). A thematic approach that built on a priori themes or categories, as used in previous literature, was adopted for data analysis (Creswell, 2007). In this study, the five key areas (support, substitute, differentiate, improve, upskill) of Tuomi et al.' (2021) Roles of Service Robotics in Service Encounters Model were taken as reference in the development of the interview questions. For this reason, the five key areas of the Model were taken as reference in the creation of the thematic framework for the analysis of the qualitative data converted into text as a result of the interview. Themes were determined to reveal the relationship and common aspects between the five key areas of Tuomi et al.' (2021) Model used to create interview questions.

In the process of processing the data, the data were then read, analyzed and categorized under 8 themes according to the thematic framework. Data that were not meaningful according to the created framework and were not valid due to misunderstandings were selected and excluded from the analysis (Yıldırım and Şimşek, 2018).

At the stage of defining the findings, the data, categorized according to the thematic framework, were defined and supported by quotations from the relevant statements expressed by the participant in the interview. At this stage, the whole data set was also carefully examined in order for the data under the themes to form a meaningful whole (internal consistency) and for all themes to explain the data obtained in the research in a meaningful way (external consistency). Thus, the representation ability of the data set according to the themes was evaluated. At this stage, another researcher experienced in qualitative data analysis was consulted to confirm whether the themes adequately reflected the data set. Then, the descriptive analysis results were explained, evaluated and interpreted together with the references in the literature (Creswell, 2014; Marshall and Rossman, 2006). In addition, direct participant statements that fully reflect the participant's views are included.

3.3. Research sample and general information

In this section, information about The Case Hotel Group, which was chosen as a case study in the research, is given and its general features are explained. In addition, the main reasons for the selection of the hotel group determined as the aforementioned case study are defined. After extensive research The Case multinational hospitality hotel group that owns, manages and franchises hotels, resorts and vacation properties was identified as the most appropriate sample to carry out this study due to their world-leading and innovative position addressing the global tourism market and the expert / senior executive being one of the most authoritative on behalf of the company. We also selected this hospitality company in an effort to represent front-of-house and back-of-house robots in various hospitality contexts, including hotels, restaurants, coffee shops, and bars.

It is the largest hospitality company in Europe, and the sixth largest hospitality company worldwide. The company operates in 5,300 locations in over 110 countries. Its total capacity is approximately 777,714 rooms. It owns and operates brands in many segments of hospitality: Luxury (8 brands), premium (10 brands), midscale (4 brands), and economy (7 brands). It also owns companies specialized in digital hospitality and event organization, such as onefinestay, D-Edge, ResDiary, John Paul, Potel & Chabot and Wojo. The company is headquartered in Issy-les-Moulineaux, France, and is a constituent of the CAC Next 20 index in the Paris stock exchange (Accor, 2022). As the hospitality company had several venues under several brands, the research findings reflect the applications and implications of many different hospitality businesses that cater to many different markets. This was because a purposeful or purposive sampling strategy targeting what Aguinis and Solarino (2019) call "elite informants" was adopted.

In this study we performed criterion sampling method, which is one of the purposeful sampling techniques (Patton, 2015; Yin, 2003), as a way to collect data. Patton (2015: 264) defines purposeful sampling: "The logic and power of purposeful sampling lie in selecting information-rich cases for in-depth study. Information-rich cases are those from which one can learn a great deal about issues of central importance to the purpose of the inquiry. Studying information-rich cases yields insights and in-depth understanding". Criterion sampling involves reviewing and studying 'all cases that meet some predetermined criterion of importance' (Patton, 2002: 238). The logic and power of criterion sampling lie in selecting those samples that satisfy certain specified criteria that help us to separate out the information rich samples. Also, it helps us to get more information from smaller number of samples (Mathstopia, 2022). The sample size for qualitative inquiry differs, and many researchers interpret sample size differently for this approach. Dworkin (2012) offers researchers 5-50 interviews to be enough for qualitative research, while (Patton, 2002) claims that there is no rule for the required sample size in such research design. Additively, in holistic single-case designs, there is a single unit of analysis (an individual, an organization, a program, a school, etc.) (Yıldırım and Şimşek, 2008). For the reasons stated above, the hotel group mentioned in this research was chosen as a case study.

In selecting interview participant, the key criteria were that informant was up to date with current state-of-the-art service robotics and had a comprehensive understanding of how and why the technology was used in their organization. When studying emergent phenomena, Bogner and Menz (2009) stress the importance of

targeting experts for their relevant interpretive knowledge, referred to as “know-why,” and their procedural knowledge or “know-how.” This is because of identifying key informant who can inform an inquiry through their knowledge, experience, and expertise (Patton, 2018). As illustrated in Table 1, Cluster Commercial Director of the Case Hotel Group was considered expert as the agents designing and/or overseeing the implementation of service robotics in hospitality.

Table 1. Demographic Characteristics of Interview Participant

Position	Cluster Commercial Director
Current Business	One of the brands affiliated with the hotel group
Experience (years)	20
Total Years of Management	17
Titles Held in Past Management Positions	1. Vice President 2. Regional Director of Business Development 3. Regional Director of Sales & Marketing 4. Director of Sales & Marketing
International Awards Won during his Management Career	1. Most creative marketing manager 2. The hotel/manager with the highest revenue growth

The following section illustrates the use of current state-of-the-art service robotics in hospitality service production and delivery. In accordance with previous research on the use of technology in service encounters (Bowen, 2016; Larivière et al., 2017; Tuomi et al., 2021), 3 principal roles of technology were observed: internal, external ve operational. In addition, 8 secondaries of these three roles were also found: **internal** (upskill and data collection), **external** (improve, differentiate and creative experiences & competition) and **operational** (substitute, support and supporting new business models). Three of them were found as new secondary/sub-roles. Quotes from in-depth interviews were used to illustrate the roles of automation in service operations.

4. Findings: Emerging Themes

The Cluster Commercial Director of the Case Hotel Group said, “*first of all, I would like to say that; If there was only one person staying at the hotel, it would be me and I would manage the robots*”, which is his general attitude to the current use of service robots in the hospitality sector.

Eight themes of the roles of service robotics in service encounters were explored based on the semi-structured interview – briefly described below in the form of direct quotations from participants:

4.1. General attitudes and behaviors towards the use of service robots in hospitality services

In this study, the following open-ended questions were asked to participant to measure his attitudes and behaviors towards the use of service robots in hospitality services:

Can you explain your approach to implementing service robots in your facilities affiliated to your hotel group, taking into account the advantages and disadvantages?

The participant stated that he had a positive view of the widespread use of service robots in the global tourism industry and noted that service robots would facilitate the work performed with their role supporting the basic functions carried out in the sector and even contribute to the quality at many points. In this regard, he highlighted the following by exemplifying:

It seems possible that simple, repetitive tasks that are not performed face-to-face with guests, especially those that do not require high-intensity interaction with guests, can be performed much more successfully by service robots

than by humans. At the same time, it also offers the opportunity to carry out such works, which are partially the source of low motivation, in a way that does not cause a decrease in organizational motivation.

Extending this view, he stated as a key advantage of service robots:

Furthermore, it seems inevitable that it will create a sweet competition with the employees. But I think that one of the biggest contributions of service robots to the global tourism industry will be to support the workforce in many ways, while also encouraging the restructuring of new approaches for the workforce to work with robots.

It should be noted that participant's quotation is closely linked to "supportive automation", which is another theme of roles of service robots examined in greater detail under a separate heading. Findings from global research (Ivanov et al., 2017; İbiş, 2019), suggest that when technology is used in tandem with human capabilities, it can support employees in different parts of hotel businesses, and effectively enhance service encounters (Bowen, 2016). Larivière et al. (2017) argue that, in general, technology has played two key roles in physical service encounters. One of this, it has supported service employees by providing them with more efficient data processing and analysis capabilities. In furtherance, Marinova et al., (2017) adds that this enables them to understand customer requirements better, thus improving job and customer satisfaction.

In accordance with previous research, this supportive automation was found in the highlights of the participants' views. The highlights of the participant's views about disadvantages of the use of service robots are given below, with the participant's own words:

One of the most important disadvantages of the use of service robots is that they can destroy the emotion that we capture thanks to people in service delivery. Because the most valuable component of the service offered in the sector is the employees and this feeling that is the essence of them. I see a very high probability that service robots will cause great harm to this feeling.

On the opposite side, in the statements of the participants, it is stated that it is a very important disadvantage that there is a gap between the capabilities of service robots and the service quality understanding of the sector. Participant stated the evaluation in question with the following statements:

Therefore, in the near future, due to the benefits offered by the service quality, the design of service robots based on the quality may appear as a disadvantage that should be carefully considered in the global tourism industry.

4.2. General opinions on the changes that the use of service robots will cause in the way of doing business

In the interview, the following open-ended question was asked to the participant to determine his opinions on the changes that the use of service robots will cause in the way of doing business in the global tourism sector.

In what ways are service robots currently transforming service production and delivery in hospitality service encounters?

The prominent opinions of the participant regarding this question are given below in his own words:

In the global tourism sector, we will experience limited changes in service units rather than a disruptive innovation in all areas at the same time. In other words, the change caused by the service robot used in room service in a hotel will first be transferred to that hotel chain and then to other stakeholder tourism service units.

Participant's quotations have shown that service robots will cause significant changes in the medium and long term, and that this change will be mostly at the micro level as of now. Despite previous research has extensively discussed the use of technology in services, based on these quotations, it can be interpreted that current global tourism industry on the use of robotics in service encounters is still in its infancy. Over time, these micro-scale changes will evolve to form a global ecosystem. This means that the way they do business will change on a global scale through various diffusion areas such as brand, service type or stakeholder network.

The concept of service encounters is defined as the way that services are produced and delivered to customers (Lin and Mattila, 2010; Voorhees et al., 2017). On the other hand, Surprenant and Solomon (1987) define service encounters as the "dyadic interaction between a customer and a service provider" (p. 87). In the context of hospitality service encounters. Ball et al. (2011) note that the sequence of service encounters generally includes

placing reservations, checking in, consuming auxiliary services, staying overnight, eating breakfast, and checking out.

The participant resonates findings from previous research that the use of service robots in hospitality service encounters improves operational efficiency (Iqbal et al., 2017), business performance, a new organizational structure and management Kuo et al. (2016) and reduces material movements and vehicle activity and process stages (Iqbal et al., 2017).

Furthermore, the participant shared the following idea that it is necessary to examine the types of service robots by dividing them into three. This classification reveals the level of development of the types of service robots that will be widely used in hospitality service encounters:

It is necessary to examine the subject of service robots by dividing them into three: humanoid robots/semi-humanoid robots, robotic systems that cooperate with humans, and drones. We will probably conduct the conversation about the first two more.

In addition, the participant added a few things about drone:

Currently, drones can provide services in almost every field in different ways. In the global tourism sector. They provide services in many areas such as the preparation of promotional images and videos, security, fault detection and entertainment. However, within the scope of our meeting, I think that we will make evaluations by considering service robots that can play a role in more fields and classical services.

The participant's expressions have shown that the use of service robots for much more flexible, much more mobile, and the use of these robots for rapid training approaches is much more appealing to the new generation employee profile. He added that he prefers to define the new generation as the Google or YouTube generation stating that the employee profile differs depending on the generation.

The opinions of the participant are given below in his descriptive expressions:

The employee profile differs depending on the generation. I prefer to define it as the Google or YouTube generation. This generation has changed employee dynamics very rapidly. Therefore, as hotel managers, we need to respond to this at the same speed. We can probably use service robots for much more flexible, much more mobile and faster education approaches. It can be much more active than a human or a recorded file. They may also take part in certain parts of the education, but not in the whole. For example, such as a briefing, answering questions, problem solving support, or a facility tour as part of orientation.

From the participants' statements, it seems inevitable that the way of doing business in the training of employees will change. Perhaps it would be useful to reconsider our definition of education, our design and, accordingly, the definition of career and competence. This answer, which is evaluated in terms of human resources, applies to many ways of doing business. For example, many jobs can be presented in different ways with the role of service robots, such as making a hotel promotion trip for guests who request, fulfilling the role of companion for guests in the 3rd age group, helping guests with questions and information about the destination.

4.3. Improve

The following open-ended question was asked to the participant to identify the benefits of using service robots in the global tourism ecosystem.

What are the benefits (process and quality control, cost savings, etc.) of using service robots on service operations, management, and marketing?

As pointed out by several authors (Ivanov et al., 2017; Ivanov and Webster, 2019; Noone and Coulter, 2012; Belanche et al., 2020), automating service processes may improve process management, quality control, demand prediction, and create cost savings. The participant stressed the importance of the benefits of using service robots in the global tourism ecosystem:

The most striking problem in the global tourism sector now and in the near future is quality personnel, or even just the personnel problem. The process that started with Covid 19 has differentiated the work and life perception of all employees. The industry did not have a strong response to this change in perception in terms of working

conditions, career maps or wage. I think this has raised the problem of qualified employees, and accordingly, the problem of service quality in the global tourism ecosystem to the top of the list.

Furthermore, the participant gave the following example regarding the solution of the problems described above:

For example, they can offer opportunities in many areas such as moving materials from warehouses to production areas and tracking their inventory digitally, performing stock controls in warehouses, performing cleaning controls in rooms, or conducting hygiene audits in restaurants. They can also detect and even repair some simple technical faults.

The participant's quotations reveal both the problem of qualified personnel and the inability to provide service quality at global standards. The most important result of these problems is that the probability of meeting quality standards is very low from the point of view of repeat customers. Consistent with previous technology research, this indicates that service robots can play a crucial role, especially in service areas such as process standardization and quality control. In all components of service processes that do not require face-to-face interaction with customers, service robots will be of critical value in ensuring global standards and replication.

He also defined this improvement as cost savings and income increase by articulating the following:

Such an improvement would also mean cost savings. For example, it will be a very valuable workhour saving for the workforce. Conversely, the support of a service robot that can continuously provide high standards in issues such as stock and warehouse management, material distribution and use will be invaluable in managing costs and increasing revenue.

Incidentally he expressed with the following quotes that service robots can provide another very important benefit for improving the service quality. Accordingly, he suggests that robots can play an active role in solving problems caused by the transitivity and dynamism between service processes. Thus, they can enhance service experience:

For example, they can take part in the transport of vacancies in the restaurant to the dishwashing room. While performing this service, they can take customer complaints or requests and forward them to customer services, and technical or hygiene-related problems by identifying them with their sensors or cameras and forwarding them to the technical service department.

It should be noted that his quotation is closely linked to designs based on transitivity between processes. On the contrary, the emergence of new processes, especially in terms of management of quality costs and increasing customer satisfaction, service robots may provide us with benefits. This implication is also consistent with the previous research suggests that service automation, and robotics provide vast opportunities to hospitality companies to improve their operations and productivity, deliver consistent product quality and transfer some of the service delivery processes to the customers (Ivanov et al., 2017; Sugasri and Selvam, 2018). Similarly, as points out by (Lukanova and Ilieva, 2019) in other departments, such as front desk, where contact with guests is intensive, robots and artificial intelligence will be combined with human staff to enhance customer satisfaction and guest experience.

4.4. Supporting new business model

The following open-ended question was asked to the participant to find out the changes brought about by the use of service robots on business models.

What kind of effects have the changes brought about by the use of service robots on your business model? (Service operations, management and marketing practices, etc.)

Findings from global research suggest that in a business environment where the level of competition and the rate of technological change are quite high, and customer preferences are constantly changing, businesses have to reinvent themselves and update their ways of doing business and processes (Tuomi et al., 2021).

The participant expert answers this question with the statement that "the global tourism industry is evolving towards business models that are essentially circular and sustainable as noted in the prior research. This quotation points to the degree in which service robots were used to automate service operations seemed dependent on the desired business model (Tuomi et al., 2021).

Delegating the most routine tasks to service robots allows businesses to increase their operational efficiency through more consistent, standardized service offerings (Tuomi et al., 2021). However, according to Huang and Rust (2018), it may also offer executives an opportunity to allow employees to focus on more complex tasks in service production and delivery, particularly tasks that require creativity, problem-solving, or empathy. The participant shed light on this issue by remarking the following:

For example, the United Nations' (2018) Sustainable Development Goals stress the importance of achieving sustainable economic growth through the provision of "decent work". In addition to technical issues such as energy, water, waste, socio-cultural and economically sustainable hotels are only possible with such business models. The increase in digitalization has brought great benefits to these issues that I have mentioned. Intelligent building and applications offered new opportunities in energy, water and waste management.

Further, he noted that it would be possible to have robots perform service processes that we cannot do with digital facilities in physical areas with the following statement:

For example, it would be great to have cute robots on the beach of the hotel that both support and inform the guests and collect the discarded garbage for environmental protection. Thus, on the other hand, it may be possible to prevent possible environmental pollution physically and to create a cooperation on this issue without disturbing the guests. Such service robots can also serve in general areas, floors and other technical areas.

The subject generally emphasized in the participant statements is related to the internal components of the business model. We can suggest that these developments will naturally cause to significant differences in key partners of the business model. For example, such an activation of the use of service robots will result in the addition of new units to your stakeholders, along with the change in the structure of the technical service department (employee qualifications and physical equipment). Another example: it will be inevitable to have a robotics company and a software company among your solution partners.

4.5. Support and data collection

Unlike previous research on the use of technology in service encounters (Bowen, 2016; Larivière et al., 2017; Tuomi et al., 2021), data collection found as a new technology role specific to service robotics is presented with the previous support theme under this section. The following open-ended question was asked to the participant. The question is aimed at determining whether the use of technology in tandem with human capabilities has effectively enhanced service encounters.

Can the use of automation in service production and distribution processes improve the service delivery of human resources in a supportive way?

According to (Bowen, 2016), it is proposed that when technology is used in tandem with human capabilities, it can effectively enhance service encounters. Research also reveals that service robots perhaps can be viewed as smart and autonomous tools that work together with employees, each playing to their strengths (Wirtz et al., 2018). For example, Lukanova and Ilieva (2019) suggest that robots and artificial intelligence can be combined with human staff to enhance customer satisfaction and guest experience. The participant views that support the previous research are given below, with the participant's own words:

It can be much more efficient for service robots to provide services not alone, but jointly with employees. This approach can bring together both the guest's request to receive service from the robot and the employee's contribution to the service quality at an optimal point.

I don't think it's possible for a robot to take some orders and manage the process alone until the end of the service with its technological capacity, aesthetic appearance and competence.

Consistent with previous technology research, his quotations attract attention that service robots worked particularly well when used to perform relatively simple, well-defined customer-facing tasks. These included guest-greeting, taking orders, dealing with payments, providing more information about products, managing restaurant queues, monitoring the preparation of the order, bringing it to the service area and returning the dirty dishes, and performing hotel customer check-ins. It should be noted that this participant's quotation is closely linked to them also performed well when completing repetitive operational back-end tasks that require precision.

Furthermore, it should be noted that this participant's quotations are closely linked to "data collection", which is a new theme unlike previous research. However, findings of the current research define data collection as a new theme, there is supporting evidence in the literature (Wirtz, et al., 2022) emphasizing that service robots can analyze large volumes of data, integrate internal and external information, recognize patterns and relate these to customer profiles. In addition, within minutes, these robots can propose best-fitting solutions and make recommendations.

Consistently, he pointed out the role of service robots in performing analytical tasks such as data collection, recording and transferring data for processing. As indicated in previous research (Tuomi et al., 2021), this allows for an unprecedented way to capture new types of data from service interactions, as well as provides a novel means to act on insights gained to improve service encounters.

As discussed herewith, we can conclude from the participant's statements that service robots can transfer or record many data for processing, such as service time, distance traveled, weight carried and so on. If legally possible, it can monitor and ultimately measure customers' satisfaction levels by analyzing their body language, tone of voice and facial expressions. This data can then be converted into useful information in the return of the same customer or in the services of similar customer groups. On the other hand, the service robot can subject the prepared orders to quality control in terms of color, size, service material type and quality, and even in terms of odor in the near future before taking them to the service area. If there is any standard deviation that will be the subject of a complaint, it can warn the relevant employee to correct it.

It can be suggested that in general, the technology seemed to work in harmony with employees; both added unique value to the service encounter. For example, the technology performed repetitive tasks with great precision while employees can have much more opportunity to focus on his customers, communication, and quality. Thus, the employee, who encounters fewer obstacles both physically and emotionally, can have the opportunity to provide much more successful and high-quality service with the help of the service robot data in the development of service quality.

Another important insight gained from his quotations pertains to the execution of quality control processes by robots. For example, it can ensure that all 1,000 Caesar salads are presented with the same appearance, size and appropriate serving material. Thus, the continuity of both the hotel business and the global food and beverage service standards is ensured.

Based on the examples shared by the participant, I can be concluded that we are at an early stage for service robots to play a role in all processes in hotel businesses. However, it would be very useful if the processes could be shared among the working and service robots in accordance with the roles that will increase the service quality. It will also offer opportunities to simplify, improve or completely replace these related processes.

Participant also emphasizing the importance of having hotels in very different segments under the same brand, he stated that it does not seem very possible today to create a single service robot concept for processes that are assumed to be globally homogeneous. He indicated as the reason for this situation that the processes of each segment are different from each other. We have also inferred from his expressions that in the mid-term and long-term period, it may be possible to see service robot applications with a depth that reaches customer-specific service.

4.6. *Substitutive*

The following open-ended question was asked to the participant. The question is aimed at learning expert opinions on the replacement of human resources by service robots in the medium or long term.

Can the use of service robots in service production and distribution processes replace human resources in the medium or long term?

As Larivière et al. (2017) suggest, technology may also replace employees altogether in service encounters. As a substitute for human staff, service robots could pose a psychological challenge to the conventional view of service, and leaders will have to accept and tackle these challenges (Xu et al., 2020). According to Rosenbaum and Wong (2015), the self-service systems noted previously, such as check-in kiosks at hotels or airports, are examples of this. In contrast to Larivière et al. (2017) and Xu et al. (2020), in their research Tuomi et al. (2021)

found that in some cases, service robots were used to carry out an entire service experience (i.e., the full sequences of service encounters). Examples of this included an autonomous bar manned by a virtual bartender and a coffee shop manned by a robot barista where ordering, serving, and taking payments were managed without any human involvement. They also added that there was a robotized hotel where customers could check-in and out, store their luggage, have their luggage taken to their room, order room service or taxis, and control the room through interacting with robots. But they concluded that although most service encounters were observed to be successful, it was evident that the more automated elements the service process included, the more chances there were of technical hiccups (Tuomi et al., 2021). According to their research findings, the payment system malfunctioned several times at the autonomous bar and the coffee shop is shown as an example of this situation.

This substitutive automation was observed to varying degrees in expert expressions. As elucidated by the participant:

Digitalization-based services and renewal of processes are spreading rapidly in the global tourism industry these days. Of course, this presents very important opportunities. For example, it opens enormous scope for speed, savings and greener action. However, as I have stated before, the use of service robots is not at this level. It is still the human element that makes the service we offer to guests privileged and what makes it special. Accordingly, I think that one of the last sectors to be affected by robots will be ours.

I think we are at a very early stage for robots to have face-to-face contact with guests. There are two main reasons for this. First one is the fact that the technological features that service robots can reach today are so weak that they cannot be compared with those who still work in face-to-face relations with guests. The second is that the level of readiness of the guests for such a contact is not very satisfactory in my opinion.

Similar to previous research (Lu et al., 2019), we attribute the finding of this research to the social worth of interacting with service robots as substitutes for human staff. Rolling out service robots not only fulfills the functional/ physical needs for labor but also supports the core of hospitality services, where “human touch” through interactions is at the heart of customer experience.

Participant also added that the subject can be viewed as follows:

Especially for the guest, face-to-face interaction with service robots will be a very new experience, so few guests open to such experiences can quickly adopt it. However, it seems possible that classical type guests, third age group or children may have various concerns in this sense and not be very enthusiastic about this experience. On the other hand, already, various robot-like mechanisms are performing some of the back-office work completely autonomously.

Based on the participant statements, it is possible to say, in summary, that for guest face-to-face situations, service robots can only replace employees in process components and partially in the mid-term period. Relatively soon for back offices, service robots will completely replace workers for many jobs.

In conclusion, the participant also added that “one day robots will be doing most of our work, but humans will definitely be around”.

4.7. Differentiate and creative experiences & competition

Unlike previous research on the use of technology in service encounters (Bowen, 2016; Larivière et al., 2017; Tuomi et al., 2021), creative experiences & competition found as a new technology role specific to service robotics is presented with the previous support theme under this section. The following open-ended question was asked to the participant to explore opportunities created by robots in terms of competitiveness of brands in the global tourism industry.

What opportunities does the use of service robots provide in terms of prominence and competitiveness of brands/chains affiliated with your group?

Service robots are still a relatively novel sight in service settings. As such, they provide an opportunity for businesses to stand out (Mest, 2017; Murphy et al., 2019). Previous research has shown clear variation in Automation used specifically for novelty (Tuomi et al., 2021). The participant stated the following:

Of course, brands with an interest in technology, X generation and at least the kind of guest profile that will not reject this experience will have positive effects on competitiveness. For example, if service robots are used within the accommodation facility to provide different experiences with gamification in various service areas for guests then it can have an impact on competitiveness.

As can be seen from the participant statements above-mentioned, another issue that sounds as a new theme can be added to the service robot's literature. We called this new theme as creative experiences & competition. It is generally accepted in previous research that cost and quality are needed but not sufficient for sustainable competitiveness, and it becomes important to be able to change with innovative approaches (Paksoy and Ersoy, 2016). From this point of view, it becomes very difficult for businesses that cannot keep up with change to be competitively successful (Omerzel, 2015). At this point, the role of service robots in developing creative experiences and gaining competitive advantage accordingly is important for businesses.

We can also attribute the finding of this research to developing creative designs/creative experiences for children. For instance, participant mentioned:

It may be interesting for service robots to play a role in the areas where children will spend time, and to prepare the environment and infrastructure in a way that will not only play but also provide education. Today, the words Entertainment and Education have been synthesized and evolved into a word called Edutainment, which means to provide education by adding fun to education or to learn while having fun. Creation of innovations in this context is also of great importance for the company to differentiate itself from its competitors.

Participant also highlighted the importance of data collection and interaction with external stakeholders (customers, suppliers, etc.) in developing creative and novel experiences for guests, consistent with (Tung and Law, 2017). As they stated that robots have the chance to provide a better and personalized service, especially with their capacity to process the data they obtain with the help of sensors and the opportunity to share this data. For example, participant mentioned:

They can be in constant contact with the family so that they do not have to worry about the safety of the child. They may even offer a basic service that will provide information to the family and business. For example, with their sensors and cameras, they can analyze which activities make children more excited and responsive. This information can both be made available to the family and used as data in the development of more effective children's Edutainment program.

Based on these discourses, the fact that they can collect dense, deep, fast and reliable data puts service robots in an important position at this point. For tech-savvy guests, service robots that can provide some basic services in their rooms can be offered upon request. Service robots with different functions for entertainment, for example, can play a supporting role in the gym or, if available, in the service vehicles serving within the accommodation facility.

The important thing here is that in order to contribute to the competitiveness, the contribution of service robots to service quality and how they can increase guest satisfaction should be explained effectively on the web page, social media and other channels through the examples we have just given. Service robots should be presented as part of the hotel's brand face, perhaps in a way that distinguishes them from other brands.

4.8. Upskill

The following open-ended question was asked to the participant to explore the changes that the increasing use of service robots will create in the role of employees.

How can the increased use of technology in meeting service needs and service delivery change the role of employees?

As discussed by D. Bowen (2016), the increasing use of technology in services may change the role of employees in service encounters. There is supporting references in the literature emphasizing that robots that can perform routine tasks effectively will also provide services that require high cognitive and analytical skills (e.g., financial services), at the same efficiency (Wirtz, et al., 2022). As well as improving service offerings, automation technologies were observed to change what it means to be an employee engaged in hospitality service encounters (Tuomi et al. 2021). Similarly, participant strongly indicate the significance of the increasing use of service robots may change the role of employees in service encounters. He emphasized the following:

In some cases, service robots may act in partnership with employees. The role of the employee may not be to make the espresso, but to serve and communicate with the guest. In a sense, this will result in the narrowing of the job descriptions of the employees.

Another example emphasized by the participant is the following:

Security is a service that should be provided without making guests feel it. I think it should be divided into two, personnel security and guest security. From this point of view, it may not be very convenient to use security robots instead of security guards in the lobby. However, service robots can replace security duties to prevent both work accidents and malicious attempts in all areas not seen by guests.

The most important insight gained from this quotation is that this will enable the role of security duties to evolve more towards observing guests more deeply and providing higher quality training if needed.

Participant underlined the importance of another issue that needs to be evaluated. In this context he said:

Another issue that needs to be evaluated may be the health services offered at the facility. Service robots can take the role of employees to a large extent in this sense. I think they can offer most of the basic health services. Of course, the most important issue is communication with the guest, as I have emphasized several times, service robots are not very suitable for playing the roles of employees in this sense. But they can support those roles.

For example, digital assistants are very useful, but physical work also needs to be done. At this point, service robots can do what digital assistants cannot. They can move files, classify documents or organize and control meeting rooms. Such assistants who don't eat, don't get sick, don't show up for work, and are free of whims are likely to be in high demand.

In conclusion, the obtained findings can be listed as follows;

- a. Today, service robots do not have enough aesthetics, functionality and adoption level to be used in areas where they can serve guests face to face.
- b. However, it is possible for them to do repetitive and simple tasks in the back offices. These jobs include warehouse control, hygiene control in various areas, room cleanliness control, technical controls and even some simple repairs. Service robots will not only provide better quality of work but also offer opportunities for time and cost savings. The biggest contribution of service robots in this field will be the sustainable provision of global standards.
- c. Service robots have the potential to undermine the emotional experience that connects employees with guests and is the core of service.
- d. The changes that service robots will cause in the global tourism sector in the medium term will take place at the micro level. However, in the long term, there will be developments that will affect the whole sector in a macro dimension and that will enable a significant part of the processes to evolve. For this to happen, their communication competencies that will enable them to be adopted by the guests will be of great value as well as the technological developments they demonstrate.
- e. It would be beneficial for service robots to provide services such as tours, education, security and health services for hotels with certain limitations.
- f. The role of service robots in data collection within legal limits will provide invaluable opportunities for both real-time data monitoring and analytical studies. With the processing of real-time data, new applications and new service designs will be possible to improve the service quality.
- g. Service robots will be able to play a supportive role by taking part in the same process as the employees in the medium term. In the long term, it seems possible to completely replace employees in some processes.
- h. The supporting role of service robots in the processes will create an opportunity for employees to focus on the more sensitive and complex parts of the work and will offer opportunities to improve service quality.
- i. Service robots are important for the transition to circular and sustainable business models, which are of great importance in the global tourism industry. With the benefits they will provide (time, cost, energy savings, etc.), they will be an important stakeholder for smart and sustainable business models. This development

will result in the inclusion of stakeholders such as robotic companies, software companies or solution partners for this field in the business models of the sector.

- j. The fact that service robots take an active role in the processes of presenting creative experiences and use it in promotion as one of the factors that differentiate it from others by businesses can have a positive effect on competitiveness. When process designs are made in which the effect of service robots on customer satisfaction can be visible and appropriate roles are given in this design, they can become an element that will contribute to competition.

5. Conclusion, Discussion and Theoretical Implications

The findings of this research contribute to the literature at three critical points in determining the role that service robots will play in the global tourism industry in the near and far future: First, revealing a new term definition and classification by giving a new perspective to the approaches in the literature regarding the development process of service robots. Second, making a new definition of the parameters that determine the qualifications of service robots, and making an evaluation that examines the interrelationships between these qualifications and the development process of service robots. Third, adding three new roles of service robotics in service encounters to the Tuomi et al.' (2021) Model.

Regarding the development process of service robots in the study; four terms are defined as mechanical-electronic (ME), electronic-autonomous (EA), mid-term autonomous-AI (AA-1) and long-term autonomous-AI (AA-2). These periods, take on the radar how the mutual relations of employees and service robots in business processes in the global tourism sector will change and quality developments of service robots. Definition of terms also significantly answers the basic question of what level and in what time period service robots will assume the role of employees in the global tourism industry.

On the other hand, the main features that will affect the differentiation of service robots during the four periods specified in the study have been defined and contributed to the literature. These qualities, which we define as appearance, functionality, interaction and trust, are also of critical importance in terms of revealing the role of service robots in the development processes of ME, EA, AA-1 and AA-2, which we define in the global tourism industry. Especially the qualifications we recommend for ME, EA and AA-1 periods are of great importance. However, with the progress of industry 4.0 and the definition of new industry periods, it can be stated that different qualifications are likely to be added to this list, especially in the AA-2 period, with new scientific studies.

One of the important contributions to the literature based on the findings is the addition of 3 new secondary roles/sub-dimensions to the secondary roles/sub-dimensions suggested by Tuomi et al. (2021): data collection, creative experiences & competition and supporting new business models. The principal and sub-dimensions of the proposed model are as follows:

INTERNAL

- a. **Upskill** (Changing service employees required skillsets and transforming existing roles)
- b. **Data Collection** (Use of data collected with sensors and cameras to improve service processes, within the limits of laws and guest acceptance)

EXTERNAL

- a. **Improve** (Utilizing resources more efficiently, allowing businesses to place a greater focus on improving service offerings)
- b. **Differentiate** (Offering service businesses a unique change to attract customer interest)
- c. **Creative Experiences & Competition** (Supporting businesses to increase their competitiveness through service robot-based promotion by being at the center of creative experiences)

OPERATIONAL

- a. **Substitute** (*Replacing human employees completely in a sequence of service encounters*)
- b. **Support** (*Dealing with routine tasks, freeing human employees to focus on more complex and dynamic situations*)

c. Supporting New Business Models (Taking a role in structuring processes and new stakeholders with digitalization in structuring circular or sustainable business models)

These new dimensions, which also support our approach to the development process of service robots and their role in the global tourism sector, which we have defined in our study, are of great importance. Service robots, whose data collection features have improved, will contribute significantly to increasing the competitiveness of the global tourism industry by offering creative experiences to customers. In addition, it can be predicted that service robots will be effective in the development of circular economy or sustainability-based business models, which are critical in the global tourism sector, especially in the AA-2 period.

The contribution of our study to the literature at these three important points is also valuable in terms of their integration. The increase in the qualifications of service robots, which play a central role in the definition of the development process of service robots in the global tourism sector, which we have defined in our study, is effective in the emergence of new dimensions that we have determined throughout the development process. On the other hand, these three points (development, quality and dimension integration) also form the basis of the functioning of the conceptual DRiTE (Development of Robotics in Tourism Ecosystem) Model that we presented for practitioners and hospitality services-related managers in this research. The new conceptual DRiTE Model of Development of Robotics in Tourism Ecosystem, which is created via critically analysis and then synthesis of knowledge from the literature and research findings.

5.1. Managerial implications

The conceptual framework that we established with the support of the literature regarding the development of service robots, in fact, is an important guide in terms of determining the main issues that hospitality services-related managers and practitioners should consider. Considering the nature, power, area and direction of the development, we think that the guidance of the DRiTE Model presented in this research will make an important contribution in order for hospitality services-related managers and practitioners to be successful in the use of service robots and to maximize their possible benefits.

Considering the research findings and then synthesizing these findings with the knowledge from the literature and, the new dimensions determined in addition to Tuomi et al.'s (2021) Model, a new conceptual DRiTE Model was created that takes into account both dimensions and their effects and how they will evolve in the process. The DRiTE Model (see Figure 1) of addressing the implications of this research, and offering insight for hospitality services-related executives into how to effectively research implications can be implement, is a conceptual model.

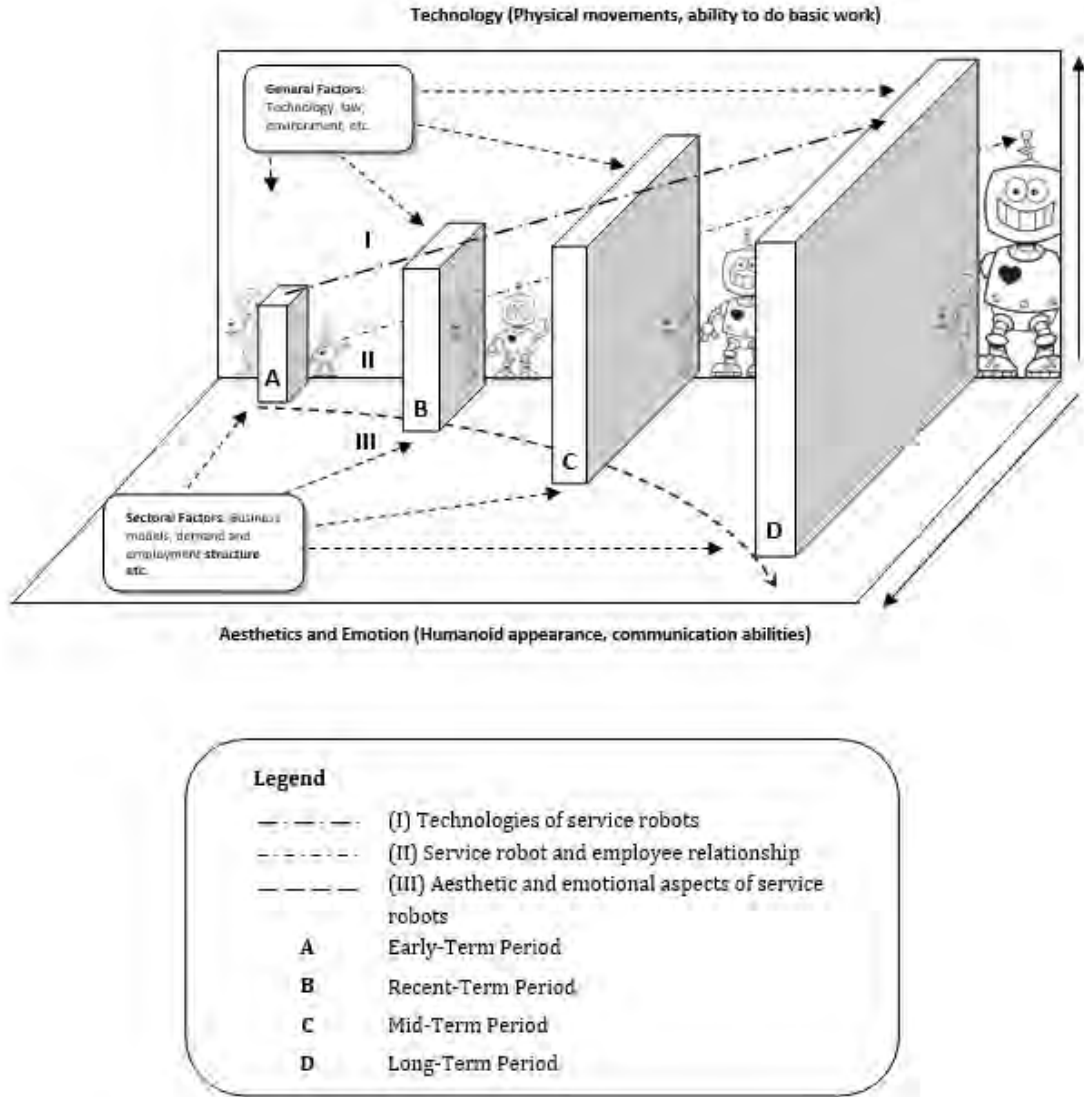


Figure 1: DRiTE (Development of Robotics in Tourism Ecosystem)

Source: Developed by the authors

Boxes in the form of DRiTE indicating periods (A, B, C, and D) are also drawn to grow over periods to indicate expansion of the global tourism industry. While the global tourism sector is growing in volume, the roles of service robots in the sector can be explained as follows in terms of the periods in DRiTE with the effect of technology and aesthetic appearance factors;

Early-Term Period (A)

The use of service robots is minimal and inefficient. Robots are in the early stages and not satisfactorily advanced for their technology, aesthetics, and communication capabilities. Therefore, while they are used in very low-level jobs in back offices, they are not used in face-to-face areas with guests.

Recent-Term Period (B)

With the increase in the technological capabilities of service robots to perform simple repetitive tasks, their use in back offices is increasing. Service robots are especially active in ensuring global standards in this period. Thanks to the improvements in their aesthetic appearance, they are used to support the employees in face-to-face areas and to attract the attention of the guests.

Mid-Term Period (C)

The technological features of service robots reach a level that can perform moderately complex tasks. For this reason, while doing a very important part of the work for the employees in the back offices, they start to take more roles than the employees with the development of their aesthetic structure in the face-to-face areas with the guests. They are starting to collect real-time data, partly within the limits set by the law and the level of reception of guests. This data is used in real time and for improvement practices. In this period, the roles of employees begin to change. Instead of basic tasks, they focus on more complex and service quality improvement efforts.

Long-Term Period (D)

Both the technological and aesthetic features of the service robots have reached a level that will meet the competencies of the employees and even exceed them in some features. A period in which most of the work in the global tourism industry is carried out by service robots. A small number of employees work on issues related to communication with the guest and system administration. In this period, when service robots work much more intensively than employees, they make a significant contribution to cyclical and sustainable business models in the global tourism industry. In this period of service robots in the global tourism industry, significant changes are taking place in business models in stakeholders, key partners and similar components. Service robots increase the chances of success of these business models with the opportunities they provide in time, energy, materials and similar issues.

The periods (A, B, C, and D) in the DRiTE model presented in the study provide important clues for managers and practitioners to configure their approaches to the use of service robots in the global tourism industry. By utilizing DRiTE, managers and practitioners can improve decision quality in the use of service robots in their own businesses, structuring service robots employee relations, and expanding the service areas and depth of service robots.

Considering the findings of our study and a review of the literature, it can be said that the use of service robots in the global tourism sector has passed relatively early-term period (A) and is in the recent-term period (B). Considering the current situation, managers and practitioners increase the use of service robots, especially in back-offices, in a way that provides global standards in technical, simple and repetitive processes. Today, service robots are mostly used in the specified density and depth to support employees.

The critical point is that managers and practitioners construct a holistic approach to realize the transformation that will be needed for the mid-term period (C) and the long-term period (D). The three new dimensions found in our study (data collection, creative experiences and competition, and supporting new business models) highlight the importance of both the timing and content of this transformation. Revealing the past and future of the service robots' roles in the global tourism industry, DRiTE sets a framework in which the proactive actions of managers and practitioners will be decisive for the (C) and (D) periods. From this point of view, the following suggestions are made for the actions of the managers and practitioners based on the findings of the study and the literature;

- a. **WHAT SHOULD BE DONE?** Necessary studies should be carried out in order to use the data collected by sensors and cameras within the limits of the laws and the acceptance of the guests, which is one of the new dimensions we have determined in our study, to improve the service processes. In this context, it is of great importance to answer the questions of which and in what amount of data will be collected, for what purpose the data will be used, and how much of the analysis will be done in real time and how much will be for another time. In this context, administrators and practitioners should monitor legal developments, technological developments and guest willingness-acceptance in data presentation-collection. For this purpose, it would be appropriate for enterprises to construct an ecosystem for the use of service robots. It should not be forgotten that in this ecosystem, where service robot manufacturers will be an important stakeholder, the IT unit for the enterprise, employees and guests will also be stakeholders. This preparation can be considered as the infrastructure preparation for the transformation we mentioned before.

HOW TO DO? Compliance with the legal requirements regarding the sensor, camera and microphone features of the service robots in use for data collection should be determined. Reassuring open

communication should be established with guests on this issue. By creating a digital infrastructure for data analysis, the employee(s) who will work for this purpose should be determined and trained.

- b. **WHAT SHOULD BE DONE?** One of the most important actions of managers and practitioners should be about new experiences and competition. For this purpose, the efficiency of the data collection dimension just mentioned is very important. Because, together with the quantity and quality of the data obtained, healthy outputs that will affect the efficiency of the analysis and the quality of the decision will be critical in this regard. In addition to the unit-based analyzes to be made by directing the data to the relevant processes, perspectives that will provide integration with a holistic approach should also be taken into consideration. As a result of the analysis of the collected data, it can be determined which experiences are more satisfying for which type of guest and how to create experiences that can provide higher satisfaction based on the streaming experience. Service robots will play an important role in guest satisfaction, both in the design of creative new experiences and as the focus of attraction themselves.

HOW TO DO? Working in partnership with the guest experience manager (unit) and the service robot manufacturer (stakeholder), physical service robots that guests will adopt should be used in new data-driven creative experience environments.

- c. **WHAT SHOULD BE DONE?** As can be seen in our DRiTE model, service robots will be working intensively in most of the processes in the global tourism sector in the (D) period. This period also refers to the period in which new business models will emerge, shaped by the opportunities and requirements provided by service robots. Therefore, the ecosystem structuring will offer opportunities for these new business models. Considering the importance of circular and sustainable business models in the present and future of the global tourism industry, new business models gain even more value. It can be stated that developments such as the digital surveillance economy in the global tourism ecosystem will increase the importance of service robots in new business models with the opportunities offered by Industry 4.0. In particular, the emphasis on the relationship between digitalization and sustainability can be considered as a sign that service robots will become more important in the global tourism ecosystem.

HOW TO DO? In the light of the developments in the global tourism sector, the business model in which service robots (qualities and opportunities) will be effective should be structured. Attention should be paid to structuring the components of the business model in accordance with service delivery based on service robots. For this purpose, new stakeholders should be identified in a framework where service robots will be the focus.

6. Limitation and future research

In this research we acknowledge several limitations that future research should address. First, service robots are still a relatively new phenomenon in hospitality service contexts. As such, the practical applications readily available to study are limited. To mitigate this issue, this research collected data from elite informant (Aguinis and Solarino, 2019) who is competent in evaluating the current approach and attitude towards the use of service robots in more than 5000 facilities providing hospitality services globally. In addition, he is an expert agent with unique extensive knowledge of current service robotics development and deployment in hospitality. However, in doing so, the time spent on interview was limited to an average of 2 hr. Although steps were taken to ensure sufficient research depth, more time spent in each location could have led to more specific insights.

Furthermore, expert agent's opinions were consulted within the purpose and scope of the research. Future research may take an employees' perspective and gain a complete understanding of employees' opinions on the roles of service robotics in service encounters. In addition, future research may conduct interview with customers to offer a broader view of the current effectiveness of service robots and revealed customer motivations for visiting establishments that make use of these robots.

Second, the proposed DRiTE model offers important clues for managers and practitioners to configure their approaches to the use of service robots in the global tourism industry. By utilizing DRiTE, managers and practitioners can improve decision quality in the use of service robots in their own businesses, structuring service robots' employee relations, and expanding the service areas and depth of service robots. The empirical

research is needed to test the presented DRiTE. It might be beneficial to analyze how effectively DRiTE could be put into practice in different segments of tourism industry for future research.

Declaration of Conflicting Interests

The authors of this article have equally contributed to this article, and they have no conflict of interest to declare, nor have they received any funding from any company. The research was carried out by obtaining the necessary permissions from the Case Hotel Group and the Dokuz Eylul University Ethics Committee.

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