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ORIGINAL RESEARCH

Hotel managers' perceptions towards the use of robots: a mixed-methods approach

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Abstract

Adopting a supply-side perspective, the paper analyses Bulgarian hotel managers' perceptions of service robots using a convergent mixed methods design. Structured quantitative data were collected from 79 managers using a questionnaire, while interviews were used for the collection of qualitative data from 20 managers. The findings indicate respondents feel that repetitive, dirty, dull, and dangerous tasks in hotels would be more appropriate for robots, while hotel managers would rather use employees for tasks that require social skills and emotional intelligence. The individual characteristics of respondents and the organisational characteristics of the hotels they currently worked in played little role in their perceptions of service robots. The managers considered that robots would decrease the quality of the service and were generally not ready to use robots. Additionally, the interviewees indicated that skilled and well-trained employees were more valuable and more adequate than robots for the hospitality and tourism industry. Theoretical and managerial implications are provided as well.

Keywords Robots · Supply-side perspective · Managers' perceptions · Automation of tasks · Impacts of service robots · Hotel industry · Bulgaria

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1 Introduction

1.1 Rationale

The automation and robotisation of services is not a new phenomenon (Huang and Rust 2018, 2020; Lu et al. 2020; Wirtz et al. 2018). Nearly four decades ago Collier (1983) discussed the forthcoming automation revolution in services, including in hotels and restaurants. Although the tourism and hospitality industry was quick to introduce vending machines and self-service kiosks, it started using service robots only recently due to their costs, limited technical capabilities, and the notion that tourism is a 'people's business'. In 2015 Henn na Hotel (http://www.h-n-h.jp/en) made history by opening the first "robotel" in the world in Nagasaki, Japan, and paved the way for service robots' entry into tourism and hospitality. As is the case of every innovation, the implementation of robots was difficult. In January 2019 Henn na Hotel announced that they had switched off more than half of their robots because they had created more work for the hotel employees and annoyed the guests (Bhimasta and Kuo 2019; Shead 2019). Nevertheless, the lessons learned from Henn na Hotel and other early users of robotic technologies helped the tourism and hospitality managers to get rid of the hype around service robots. Hotel managers may now have a more realistic view of what robots can do, in what way robots could be useful to their companies and customers, and understand how robots influence hotels' competitiveness, service quality, and profitability. That is why this paper is positioned in the domain of service robots in tourism and hospitality and looks at the perceptions of hotel managers regarding the potential use of service robots in their properties.

A robot is defined as an "actuated mechanism programmable in two or more axes with a degree of autonomy, moving within its environment, to perform intended tasks" (ISO 2012 n.p.). Depending on their intended use, robots are industrial and service robots. A service robot 'performs useful tasks for humans or equipment excluding industrial automation applications' (ISO 2012 n.p.). Service robots are not a curiosity anymore and enter many aspects of our life (Miller and Miller 2017; Nørskov 2016). The service industries recognise their potential for delivering an automated service to increase productivity, service capacity, provide consistent service quality, improve competitiveness, to cut costs, and improve financial results (Belanche et al. 2020; Ivanov and Webster 2019c; Naumov 2019; van Doorn et al. 2017; Wirtz 2019; Wirtz et al. 2018). The COVID-19 pandemic forced service companies to use robots for sanitation and physical distancing as well (Seyitoğlu and Ivanov 2020).

Tourism and hospitality companies started to use robots for various tasks such as the provision of information, cleaning, room service, delivering items, serving food and drinks, entertaining guests, etc. (Collins et al. 2017; Ivanov and Webster 2019f; Tuomi et al. 2020b). Service robots find their ways into hotels (Lukanova and Ilieva 2019; Nakanishi et al. 2020), restaurants (Berezina et al. 2019; Lee et al. 2018), bars (Foster et al. 2013), drone food delivery (Hwang et al. 2019), museums (Virto and López 2019), airports and other transport

stations (Quan and Kubota 2017; Shiomi et al. 2011). They serve as hosts and waiter staff at events as well (Ogle and Lamb 2019).

Academia was quick to respond to the needs of the business for more research in the domain of service robots in travel, tourism and hospitality (Gretzel and Murphy 2019; Ivanov et al. 2017, 2019; Murphy et al. 2017, 2019; Rosete et al. 2020; Tung and Law 2017; Tussyadiah 2020). Empirical studies on service robots in tourism are largely devoted to the demand-side perspective with an emphasis on customer attitudes towards and acceptance of robots (Ivanov et al. 2018a, b; Lin et al. 2019; Lu et al. 2019; Stock and Merkle 2017; Tussyadiah et al. 2017), customers' trust in robots (Park 2020; Tussyadiah et al. 2020), tasks perceived by tourists as appropriate for robotisation (Ivanov and Webster 2019a, b). Furthermore, researchers have focused on the customer evaluation of service robots (Tussyadiah and Park 2018), the impact of language styles in the service encounter (Choi et al. 2019), the effects of robotic service on guest evaluations of hotel brand experience (Chan and Tung 2019), heart-warming interaction between customers and robots (Nakanishi et al. 2020), the effect of service robot attributes on customers' expected rapport building with robots (Qiu et al. 2020). Empirical studies have also investigated the role of robots in the service recovery process (Ho et al. 2020), the nudging effect of robots on stimulating pro-environmental behaviour of tourists (Tussyadiah and Miller 2019), tourists' perceptions about the appearance of robots (Yu 2018, 2020; Yu and Ngan 2019), the impact of robot service on purchase intentions (Zhong et al. 2020) and robot use intentions (de Kervenoael et al. 2020), the impact of robotic chef anthropomorphism on food quality prediction (Zhu and Chang 2020). This research focus on tourists is logical because if customers do not want to be served by robots, if they resist, avoid, or do not wish to pay for robot-delivered services, then tourism and hospitality companies would find it challenging to introduce robots in their operations.

The supply-side (employees', managers' and owners') perspective of the use of service robots in tourism (Kuo et al. 2017; Lee et al. 2018; Li et al. 2019; Tuomi et al. 2019, 2020b; Xu et al. 2020) is a bit overlooked—a gap partially filled in by this paper. The perspective of owners and managers is important because they make decisions to introduce robots in their companies' operations. If they do not see the benefits of using robots in their companies, robots would not be used. In practice, owners and managers are the customers of the robot manufacturers and make purchase decisions. On the other hand, employees would be the ones who practically use service robots for cleaning, room service delivery, or other tasks. Their attitudes and perceptions would determine whether the company's investment in service robots would be profitable or not. If employees see robots as a threat to their jobs, they might sabotage the programme for introducing robots in the company. If employees see robots as a useful tool to liberate them from repetitive, dirty, dull, and dangerous tasks and make them more efficient and productive in the workplace, they might use robots effectively and efficiently, hence helping the company recover its investment in robots.

1.2 Aim and objectives

In the light of the above discussion, this paper adopts a supply-side perspective, focuses on Bulgarian hotel managers, and aims to evaluate their perceptions toward service robots. The specific objectives include: (a) to assess managers' perceptions regarding the advantages and disadvantages of service robots, compared to human employees; (b) to identify the tasks that are considered as suitable for robotisation; (c) to evaluate the expected impacts of service robots on hotel management's functional areas (operations, safety and security, marketing, human resource management, and financial management); (d) to assess hotel managers' readiness to implement service robots in the various departments in the hotels they manage; (e) to evaluate the role of respondents' and hotels' characteristics on managers' perceptions of service robots.

The Bulgarian hotel industry is an interesting empirical context due to several reasons. First, Bulgaria is an economy in transition. Much of the empirical research on service robots in tourism and hospitality so far has focused on developed economies, countries with large populations, and/or countries with traditions in robotics research and application, such as the USA (Lin et al. 2019; Lu et al. 2019; Park 2020), the UK (Tussyadiah and Miller 2019; Tussyadiah and Park, 2018), Japan (Nakanishi et al. 2020; Shiomi et al. 2011), Taiwan (Kuo et al. 2017; Lee et al. 2018), and China (Li et al. 2019), among others, while studies on transitioning and developing economies are more scarce (Dogan and Vatan 2019; Ivanov et al. 2018a, b). Second, tourism plays an important role in the economy of the country—10.3% of Bulgaria's GDP is generated by tourism (WTTC 2020). Hence, hotel managers' decisions to use robots in addition to or instead of human labour may have significant implications on employment in the country. Third, although Bulgaria is a member of the European Union, it has low labour costs compared to Western European countries. The average salaries in tourism and hospitality are around 350 euros per month (NSI 2020c), which makes robots financially uncompetitive compared to employees. Fourth, Bulgaria faces a huge demographic crisis—the population dropped by 8.6% during the last decade from 7606551 in 2008 to 6951482 in 2019 (NSI 2020a) due to emigration and low birth rates, hence the supply of labour decreased. At the same time, the tourism sector boomed—the number of beds in accommodation establishments increased by 23.5%—from 276,586 in 2008 to 341,506 in 2019 (NSI 2020b), thus the demand for labour increased. While Bulgaria has started to attract foreign employees in its tourism sector (e.g. from Ukraine, Moldova, Armenia, etc.), the country cannot compete with Spain, Italy, France, Germany, UK, or Greece in attracting foreign labour due to the low salaries. Hence, some hoteliers have started to implement automation technologies (e.g. chatbots, self-service kiosks, robots) as a way to decrease the labour needs in their companies. For instance, in November 2019 Best Western Premier Sofia Airport hotel (https://www.hotelpremiersofia.com/) introduced the first room service robot in the country. Hotel Aqua Bourgas (http://burgas.aquahotels.com/en/) introduced a digital receptionist on its website. Central Hostel Varna (http://www.hostel-varna.com/en) is a completely self-service accommodation establishment; access to the property is provided via a self-check-in kiosk.

The rest of the paper is organised as follows. The next section reviews service robot literature in a tourism/hospitality context from a supply-side perspective. Section 3 elaborates on the research methodology. Section 4 presents the findings. Finally, Sect. 5 summarises the paper's contribution, discusses the theoretical and managerial implications, addresses the limitations, provides suggestions to future research, and concludes the paper.

2 Literature review

Adoption and subsequent implementation of robots in tourism and hospitality are complicated (Dogan and Vatan 2019; Kuo et al. 2017; Lee et al. 2018). To make an informed decision, owners and managers need a clear perspective of service robots' advantages and disadvantages relative to human employees. Understanding robots' potential applications and impacts on their companies' functional areas (i.e. operations, safety and security, marketing, human resource management, and financial management) is critical.

Prior studies (e.g. Dogan and Vatan 2019; Ivanov 2019; Ivanov and Webster 2019c) have indicated various *advantages* and *disadvantages* of service robots compared to human employees. The following advantages have been outlined in the literature: robots' ability to work 24/7, the ability to implement their work correctly and on time, easy expansion of the scope of their tasks through software and hardware upgrades, provision of predictable service quality. Moreover, robots do not get bored and can perform the same tasks numerous times without complaints, and they do not go on strikes or get ill. Some of their disadvantages include: robots can work in structured situations only, and they cannot implement tasks they were not programmed/trained for or lack the respective hardware. For instance, a robot such as Pepper, intended for social interactions with humans, cannot be used for room service delivery because it lacks a container for the items and has limited mobility. Robots also lack creativity and personal approach in their interactions with guests and employees, since they are emotionless (Dogan and Vatan 2019) and may be perceived as a threat by customers, employees and labour unions (Kazandzhieva and Filipova 2019; Li et al. 2019), which may hinder their implementation by tourism and hospitality companies. Nevertheless, the advances in artificial intelligence and robotics will improve the technical capabilities of service robots, will decrease and even eliminate some of their disadvantages, and will strengthen their advantages compared to employees. Coupled with dropping prices, the shift in the balance towards the advantages of service robots will stimulate their wider implementation in the industry.

Robots have various potential *directions for application* in tourism and hospitality. The robotisation of services is implemented on tasks level—e.g. moving items, providing information, printing a document (e.g. a voucher, a cash receipt), taking a selfie with a guest, performing a preprogrammed dance, vacuuming the carpet, polishing the floor, disinfecting the premises, flipping burgers, etc. In that context, the literature indicates that robots are mostly suitable for repetitive, dirty, dull, and dangerous tasks, which few people want to do. For example, Ivanov

and Webster (2019a) found that tourism industry professionals considered as most suitable for robotisation tasks related to information provision, housekeeping, cleaning, garbage collection, luggage carrying, and processing documents. Tasks that involved the subordination of a human to a robot, either physically or emotionally, were not considered as appropriate for robotisation—e.g. babysitting, hairdressing, dancing with guests, or robot-delivered massages.

The implementation of service robots in a hospitality company would have significant *impacts* on its business. From a human resource management point of view, each job position consists of various tasks, some of which are more suitable for automation than others. Hence, the use of robots may change the composition of tasks performed by each job position (Osawa et al. 2017). In practice, the implementation of service robots would have simultaneously a substitution and an enhancement effect on tourism and hospitality jobs (Ivanov and Webster 2019e). Through the substitution effect, service robots automate most of the tasks composing a job position leading to the elimination of the whole job position. Through the enhancement effect, robots do not replace the employees, but help them perform better (be more effective, efficient, and productive) on their job position. In that sense, automation and robotisation may help hotels provide more decent work for their employees (Tuomi et al. 2020a). Within the context of the technology acceptance models (Davis 1989; Venkatesh and Davis 2000), the enhancement effect may improve robots' job relevance and perceived usefulness, and stimulate their implementation in the tourism and hospitality industry. The balance between the substitution and enhancement effects depends on the specific tasks that constitute a particular job position and will be specific in each company. Nevertheless, employees may be afraid for their jobs and perceive robots as a threat (Li et al. 2019), although studies have shown that the hotel managers envision robots as support for employees rather than as their substitutes (Dogan and Vatan 2019). Furthermore, employees would need to have different roles in regard to the robotised service encounters in their companies such as coordinator, enabler, differentiator, innovator, and educator (Tuomi et al. 2019), which would require training to learn new knowledge and skills to utilise the full potential of service robots in their work.

From an operations perspective, robots increase the service capacity of the company, allowing it to serve more guests with the same number of human employees (Ivanov 2019). It also makes the planning of operations easier because of the predictable service performance of robots. At the same time, the use of mobile robots (e.g. for cleaning or room service delivery) requires that hotels have robot-friendly facilities that allow robots' mobility which may require some additional investment in the building (Ivanov and Webster 2017; Tan et al. 2016). Moreover, hotels need to ensure proper robot repair/maintenance is provided either by hiring trained personnel or by outsourcing it to another company. Furthermore, hotels may face a vendor lock-in situation when they rely on one particular robot supplier/manufacturer and cannot switch to another (Farrell and Klemperer 2007) due to the incompatibility of the technologies of the suppliers. This means that hoteliers will not be able to renew their robots often and may use outdated models. Leasing robots (robot-as-a-service) will eliminate some of these operational disadvantages because the robot owner will

take care of the maintenance, software updates, and model renewals (Ivanov and Webster 2019d, e).

From a marketing perspective, robots can be used to create experiences for customers (Choi et al. 2020; Qiu et al. 2020; Tung and Law 2017). Through providing a unique and memorable experience (Chan and Tung 2019) the use of robots in hotels may enable the revisit intention and positive word of mouth of guests through posting in social media and hotel review sites (Choi et al. 2020). However, guests do not need to select the property just because of the robots—location, service value, hotel design, prices, etc., are determining factors for customers' hotels choice as well (Yadegaridehkordi et al. 2018).

From a financial perspective, robots make sense if they improve the financial performance of the company by reducing operational costs and/or generating additional revenues (Ivanov and Webster 2019d). Costs can be decreased directly through the elimination of some job positions, or indirectly by enhancing employees and allowing them to perform more effectively and efficiently. The additional revenues can be a result of extensive growth (i.e. through additional room service sales delivered by a robot), intensive growth (i.e. higher prices for robotic experiences for tourists), or they can be generated indirectly (i.e. by automating tasks and freeing time for employees to focus on more revenue-generating activities). As investment in service robots requires significant financial resources (purchase/rent, staff training, operating costs, insurances, electricity, repair/maintenance, etc.), companies need to implement a thorough cost–benefit analysis before deciding to invest in robots. They need to consider the non-financial costs and benefits discussed above as well because they may outweigh the financial ones. For example, from a safety and security perspective, the COVID-19 pandemic showed that robots can be used for UV disinfection of facilities, and for providing the necessary physical distancing between customers and service employees (Seyitoğlu and Ivanov 2020), which may stimulate their adoption in the future (Zeng et al. 2020).

This paper looks that the role of the individual (gender, age, work experience) and organisational characteristics (hotel capacity, category, location, chain affiliation, predominant traveller type) in shaping hotel managers' perceptions towards service robots in line with previous studies. The UTAUT framework (Unified Theory of Acceptance and Use of Technology) by Venkatesh et al. (2003) considers gender, age, and experience as individual characteristics that moderate the relationships between performance expectancy, effort expectancy, social influence and the facilitating conditions, on the one side, and the behavioural intentions and use behaviour, on the other. Studies have found that these individual characteristics played a role in the acceptance of service robots. For example, Loffredo and Tavakkoli (2016) showed that males and younger respondents were more receptive to robots than females and older respondents. In the Technology-Organisation-Environment framework by Tornatzky and Fleischer (1990), the organisation's characteristics (e.g. size, management structure, degree of centralisation, slack resources, etc.) form the organisational context of technological innovation decision making. According to that framework, larger hotels and higher category hotels may have more available resources that they could invest in service robots. Furthermore, following the institutional theory by DiMaggio and Powell (1983), hoteliers may use robots because of

coercive pressure by franchisors or customers. That is why chain affiliation and the predominant traveller type in a hotel (business or leisure) may play a role in shaping hotel managers' perceptions.

3 Methodology

3.1 Research design

Data were collected from December 2018 to April 2019. The study adopted mixed methods research because it allows for the collection of both structured quantitative data through a questionnaire and in-depth qualitative data through interviews. Furthermore, mixed methods research compensates for the disadvantages of questionnaires and interviews when they are used as individual instruments for data collection (Khoo-Lattimore et al. 2019). This study followed the convergent (parallel) mixed methods design to reach the aims (Creswell 2012). First, the researchers gathered quantitative and qualitative data, then analysed the datasets separately, compared the results of the quantitative and qualitative datasets to interpret them and indicate whether the results supported or contradicted each other. Finally, the comparison of the two datasets enabled the convergence of the different datasets (Creswell 2012).

3.2 Questionnaire

The research population included hotel managers in Bulgaria. A combination of convenience and self-selection sampling was applied due to the lack of publicly available and comprehensive database with the contact details of hotels and hotel managers in the country. The authors developed their database with emails of 1150 hotel managers. The emails were collected from the websites of hotels, the industry contacts of the authors, and during a hospitality career fair held in Varna. An online questionnaire was developed and the link to it was distributed to the emails of potential respondents. Additionally, the link was posted online in closed social media groups of hotel managers in the country. Their membership ranged from 200 to 4185 members. This procedure helped give just eligible respondents access to the questionnaire.

The questionnaire included several blocks of questions. The first block collected data about the demographic characteristics of respondents and the hotels they currently worked for. The second block asked whether robots or employees would be more suitable for a set of tasks adopted from Ivanov and Webster (2019a, b) based on a 5-point scale, from 1-Robots are much more appropriate than human employees to 5-Human employees are much more appropriate than robots. The third block included questions about the perceived advantages and disadvantages of robots compared to employees and the customer experience they would be used to create, on a 5-point level of agreement scale. The list of the statements was adapted from Ivanov et al. (2018a) and expanded by the authors. The fourth block evaluated respondents'

perceptions about the impacts of robots on the functional areas of the hotel (operations, safety and security, human resource management, marketing, and finance) on a 5-point level of agreement scale. The final block asked about the intentions and the timeframe to introduce robots in various hotel departments (Reception, F&B, Housekeeping, Meetings and events, Gardening, and Security). Reverse coding was used for some of the statements in the questionnaire. The final sample included 79 managers. Their characteristics are presented in Table 1. The Kolmogorov–Smirnov test revealed that the distribution of respondents' answers was statistically different from normal. That is why the authors adopted nonparametric tests for hypothesis testing. The Mann–Whitney U test was used to evaluate the role of gender, chain affiliate of the hotel and predominant traveller type on the variation of respondents' answers, while Kruskal–Wallis χ^2-test was adopted to assess the role of age, work experience, hotel capacity, category and location on hotel managers' perceptions.

3.3 Interviews

Qualitative data were collected through face-to-face semi-structured interviews with hotel managers. Due to the reasons discussed in Sect. 3.2, a combination of non-probability convenience and purposive sampling was applied. The interviewees were recruited during a hospitality career fair in Varna and through the industry contacts of the authors. The authors contacted respondents with diverse demographic characteristics and job positions. First, the research participants were informed about the research aims and structure. After they voluntarily agreed to participate in the study, the interviews were conducted. The individual interviews ranged between 20 and 30 min. The interviews were listened to and noted with the participants' permission. The interviews were later transcribed to a word file for data analysis. The data were analysed through content analysis with three main phases: reduction, displaying, and conclusion verification (Miles and Huberman 1994). Initially, the relevant raw data were filtered, then participants' statements that matched the research objectives were determined. Finally, the themes and sub-themes were developed independently and agreed upon by three coders who have experience in qualitative research methods. To check the reliability of the coding, two other researchers not related to this research project and the data collection process were asked to match the statements with the identified themes and subthemes. The kappa analysis revealed that there was substantial agreement ($\kappa = 0.667$) between them (Landis and Koch 1977). The sample of the interviews included 20 managers. Their characteristics are presented in Table 2.

The qualitative and quantitative part of the survey included different respondents—hotel managers completed the questionnaire or were interviewed. Therefore, the results from the interviews can complement the quantitative findings and check their validity and reliability. Studies stress that mixed methods increase data validity and reliability and strengthen the findings (Johnson and Onwuegbuzie 2004).

Table 1 Sample's characteristics (questionnaire) (n = 79)

Characteristic	Number of respondents	Percent
Gender		
Female	58	73.4
Male	21	26.6
Age		
18–30	18	22.8
31–40	26	32.9
41–50	24	30.4
51 +	11	13.9
Work experience		
Up to 5 years	18	22.8
6–10	24	30.4
11–15	18	22.8
16–20	7	8.9
More than 20	12	15.2
Job position		
GM	40	50.6
Front office/reservations manager	16	20.3
Marketing manager	7	8.9
F&B manager	3	3.8
MICE manager	3	3.8
Other	10	12.7
Hotel category		
1–3 stars	24	30.4
4 stars	41	51.9
5 stars	14	17.7
Hotel size		
Up to 50 rooms	24	30.4
51–100 rooms	23	29.1
101–150 rooms	12	15.2
151 or more rooms	20	25.3
Hotel location		
Urban	29	36.7
Seaside	34	43.0
Mountain	12	15.2
Countryside	4	5.1
Predominant type of guests		
Business	22	27.8
Leisure	57	72.2
Chain affiliation		
Affiliated	19	24.1
Independent	60	75.9
Total	79	100.0

Table 2 Sample's characteristics (interviews)

Participant	Gender	Age	Education level	Position	Years of experience	Location of the hotel
P1	Female	44	Master	Food and Beverage Manager	11	Seaside
P2	Female	45	Bachelor	Front Office Manager	15	Seaside
P3	Female	46	Master	General Manager	18	Mountain
P4	Female	43	Master	Marketing and Sales Manager	12	Urban area
P5	Male	31	Master	Food and Beverage Manager	20	Urban area
P6	Female	28	High school	Front Office Supervisor	7	Rural/Countryside
P7	Female	45	Master	Marketing and Sales Manager	16	Seaside
P8	Female	39	Master	General Manager	20+	Seaside
P9	Male	49	Doctorate	General Manager	20+	Seaside
P10	Male	56	Bachelor	Food and Beverage Manager	18	Seaside
P11	Female	45	Master	Executive Chef	15	Seaside
P12	Male	46	Master	Food and Beverage Manager	11	Seaside
P13	Male	32	High school	General Manager	6	Seaside
P14	Male	47	Bachelor	Executive Chef	12	Seaside
P15	Male	37	Bachelor	General Manager	15	Seaside
P16	Female	48	Master	General Manager	17	Seaside
P17	Male	33	Master	Marketing and Sales	14	Seaside
P18	Female	36	Master	Head of Waiters	9	Seaside
P19	Male	35	Bachelor	General Manager	13	Seaside
P20	Male	42	Doctorate	Front Office Manager	11	Seaside

4 Findings

4.1 General perceptions of managers towards service robots

Table 3 presents the quantitative results of hotel managers' perceptions of service robots. In general, they considered that robots had an advantage over human employees regarding data processing skills such as the provision of information in more languages than humans ($\bar{x}=3.99$, $\sigma=1.000$), calculations ($\bar{x}=3.78$, $\sigma=0.938$), speed of work ($\bar{x}=3.49$, $\sigma=0.949$), protection of personal data ($\bar{x}=3.33$, $\sigma=0.993$), and fewer mistakes ($\bar{x}=3.19$, $\sigma=1.043$). Respondents were sceptical regarding the social skills of robots such as their capabilities to provide personalised service to guests ($\bar{x}=2.44$, $\sigma=1.073$), handling complaints ($\bar{x}=2.47$, $\sigma=1.087$), friendliness ($\bar{x}=2.57$, $\sigma=1.032$), and politeness ($\bar{x}=2.72$, $\sigma=1.178$). Furthermore, they perceived robots' inability to implement a guest's special requests that go beyond their

Table 3 General perceptions of service robots (n = 79)

Directions of robot application in hotels	Mean	Standard deviation	Mann–Whitney *U* test	Kruskal–Wallis χ^2-test	
			Gender	Age	Work experience
Advantages					
Robots will handle complaints easier than human employees	2.47	1.087	476	0.142	0.100
Robots will protect the guests' personal data better than human employees	3.33	0.993	482.5	2.142	3.606
Service robots are able to deliver more personalized service to guests	2.44	1.073	399.5	2.997	4.861
Robots will make fewer mistakes than human employees	3.19	1.043	363.5*	6.029	7.067
Robots will be faster than human employees	3.49	0.949	415	1.573	1.179
Robots will deal with calculations better than human employees	3.78	0.938	419.5	3.364	1.446
Robots will provide more accurate information than human employees	3.10	1.153	444	5.738	7.367
Robots will be able to provide information in more languages than human employees	3.99	1.000	508.5	6.225	2.236
Robots will be friendlier than human employees	2.57	1.032	479.5	1.358	1.055
Robots will be more polite than human employees	2.72	1.178	451.5	2.492	2.856
Disadvantages					
Robots will consume too much electricity (r)	3.00	0.926	436.5	3.690	5.410
Robots will malfunction during service (r)	2.68	0.922	486.5	0.421	6.400
Robots will misunderstand a question/order (r)	2.62	0.900	390	2.013	4.366
Robots can't implement special requests/they work only in a preprogrammed frame (r)	2.08	0.874	449	4.088	4.294
Robots can't understand a guest's emotions (r)	2.30	1.247	445	0.829	9.127
Experience					
Being served by robots will be an interesting experience	3.14	1.130	412	0.737	3.192
Being served by robots will be a memorable experience	3.08	1.084	374	2.524	1.319
Being served by robots will be a pleasurable experience	2.75	1.123	344.5*	0.610	2.486
Being served by robots will be an exciting experience	3.11	1.056	432	0.170	0.501

(1) Coding: 1—completely disagree, 5—completely agree; (2) (r)—reverse coding; (3) levels of significance: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

programming ($\bar{x}=2.08$, $\sigma=0.874$), and the lack of understanding of guests' emotions ($\bar{x}=2.30$, $\sigma=1.247$) as the biggest disadvantages of robots to employees. Considering that hospitableness is the core of hospitality services and social skills are a key source of it (Tasci and Semrad 2016), the lack of social skills in robots would be an obstacle in their implementation by the hotel industry (Qiu et al. 2020).

Hotel managers seemed homogeneous in their responses—the Mann–Whitney *U* test and Kruskal–Wallis χ^2-test did not reveal significant differences based on gender, age, or work experience. Generally, males were more receptive towards robots, similar to previous studies (Loffredo and Tavakkoli 2016; Ivanov et al. 2018a), but for only two statements the differences were statistically significant: 'Robots will make fewer mistakes than human employees' ($U=363.5$, $p<0.05$) and 'Being served by robots will be a pleasurable experience' ($U=344.5$, $p<0.05$).

The findings from the interviews confirmed the quantitative results of the questionnaire. For example, as robot advantages over human employees, interviewees mentioned that "*Robots will be faster, more efficient and precise…*" [P4], they "*can work any time*" [P6] and "*Being served by robots will be an exciting experience for the guests*" and it would provide a competitive advantage to the hotel [P13]. At the same time, the interviewees acknowledged that "*Robots cannot understand human emotions…differentiate the right and wrong… carry out special requests…*" [P8], and "*It is difficult for them to understand people's desires…*" [P14]. Unlike robots "*People have an adequate judgment and approach to the diverse situations*" [P19]. High installation and maintenance costs [P2, P3, P4, P6, P10], mistakes by robots [P7, P10, and P14], and difficulties in communicating and understanding guests [P3] were identified as disadvantages of using robots in hotels as well. Interviewees thought that well trained and skilled employees were more valuable than robots and believed that employees are more adequate for the hospitality and tourism industry because the industry is mostly related to service and attitude which are significant in terms of guest satisfaction and experience. For instance, P5 stated that "*In my opinion, in the hotel business the most important thing is the service and attitude towards the guests. The guest wants to be special. He or she has invested a great amount of money to go somewhere where they can indulge and relax… Human is much more adequate because the robot cannot take many factors into account*". Another participant also said that "*Tourist service is an experience. Guests want to remember not only the place they visit but also the people and hotel staff they run into… The attention and attitude that employees give to the guests will not be the same if robots take their places*" [P6]. Therefore, "*Social robots are intended for short interactions*" [P18].

4.2 Directions of robot application in hotels

Table 4 presents the results of the directions of robot application in hotels. Findings indicate that robots were perceived as more appropriate for housekeeping tasks such as cleaning the common areas of the hotel ($\bar{x}=2.54$, $\sigma=1.259$), taking customer orders for new towels, linen, etc. ($\bar{x}=2.80$, $\sigma=1.255$) or laundry ($\bar{x}=2.85$, $\sigma=1.282$), delivering new towels, linen, etc. ($\bar{x}=2.89$, $\sigma=1.301$)

Table 4 Directions of robot application in hotels (n = 79)

Directions of robot application in hotels	Mean	Standard deviation	Mann–Whitney *U* test			Kruskal–Wallis χ^2-test				
			Gender	Chain affiliation	Traveller type	Age	Work experience	Hotel capacity	Hotel category	Hotel location
Reception										
Welcoming/greeting a guest	4.16	1.234	550.5	518.5	470	2.156	2.384	4.761	2.289	2.396
Check-in	3.82	1.258	606	540	504	1.372	2.498	2.671	3.223	0.610
Check-out	3.87	1.148	539	455.5	540	1.394	2.738	0.485	0.161	0.968
Issuing payment documents	2.85	1.312	390.5*	457	571	0.444	0.690	2.444	0.166	1.325
Providing information about hotel facilities	3.14	1.278	565	444.5	520	1.721	12.951*	6.264	3.640	3.919
Providing information about the destination	3.29	1.211	531	416.5	611	3.515	4.957	6.736	1.815	0.303
Guiding to the room	3.97	1.219	588.5	559	583	3.804	2.793	0.165	0.810	1.448
Concierge services (ordering tickets, taxis)	3.24	1.398	426.5*	446	619.5	2.010	0.443	9.565*	3.160	2.888
Processing cash payments	3.24	1.283	457	462	472	0.487	0.838	0.838	0.476	6.041
Processing card payments	2.66	1.348	307***	501	524.5	0.588	2.153	5.691	0.214	1.309
Accompanying the guest when leaving the hotel	4.15	1.051	584.5	538.5	562.5	3.312	5.269	1.780	1.574	1.579
Restaurant										
Welcoming/greeting a guest in the restaurant	4.14	1.185	576.5	534.5	492	0.396	2.090	6.217	3.680	1.433
Guiding guests to the table in the restaurant	4.05	1.142	591.5	560	563	2.763	2.455	1.457	0.965	0.405
Taking orders	3.58	1.247	422*	522	597	1.179	1.557	4.389	3.636	0590
Serving food	4.08	1.152	576.5	457	614.5	2.383	3.489	8.020*	4.378	2.008
Serving drinks	4.00	1.098	504.5	484.5	596	3.751	3.131	3.035	1.413	1.120
Provision of information about the menu	3.53	1.329	504.5	513.5	619	2.331	4.785	3.652	2.163	1.429

Table 4 (continued)

Directions of robot application in hotels	Mean	Standard deviation	Mann–Whitney *U* test			Kruskal–Wallis χ^2-test				
			Gender	Chain affiliation	Traveller type	Age	Work experience	Hotel capacity	Hotel category	Hotel location
Cooking food	3.96	1.149	410*	463	603.5	3.129	1.464	4.426	3.754	0.455
Preparing drinks	3.56	1.268	472	538	485	1.181	2.926	8.042*	2.653	0.916
Cleaning the table	3.14	1.430	456.5	499	612	2.446	4.704	5.818	2.481	1.414
Room service delivery	3.62	1.254	561	487.5	567	1.944	5.214	4.412	3.880	1.007
Housekeeping										
Cleaning the common areas of the hotel	2.54	1.259	575.5	446.5	515.5	1.022	3.060	8.627*	2.190	2.879
Cleaning the room	3.13	1.408	449	435.5	610	2.360	1.037	4.383	1.199	1.304
Taking customer orders for laundry	2.85	1.282	388*	476.5	613.5	0.458	7.173	8.430*	0.775	0.408
Delivering ready laundry	2.76	1.313	533	449.5	544	3.346	6.116	10.108*	2.103	4.621
Taking customer orders for new towels, linen, etc.	2.80	1.255	435*	520.5	582	2.543	4.894	8.173*	2.162	1.848
Delivering new towels, linen, etc.	2.89	1.301	542.5	479	621.5	2.813	7.454	5.627	1.846	6.326
Other										
Participation in entertainment programs	4.18	0.950	530.5	499	615.5	2.251	4.014	0.418	1.119	1.749
Serve as guards/security	3.39	1.344	459	365.5*	624	3.739	3.254	2.909	0.719	3.703
Provide massages	4.43	0.915	573	495	610	3.222	1.946	3.027	1.215	1.224
Provide gardening services	2.91	1.370	578	487.5	598	3.550	4.664	10.941*	1.772	3.684

(1) Coding: 1—robots are much more appropriate than human employees, 5—human employees are much more appropriate than robots; (2) levels of significance: ***$p < 0.001$, **$p < 0.01$, *$p < 0.05$

or ready laundry ($\bar{x} = 2.76$, $\sigma = 1.313$). They were also considered as appropriate for processing card payments ($\bar{x} = 2.66$, $\sigma = 1.348$), issuing payment documents ($\bar{x} = 2.85$, $\sigma = 1.312$), and for gardening services ($\bar{x} = 2.91$, $\sigma = 1.370$). For all other tasks, hotel managers considered that employees were slightly or significantly more appropriate, especially for tasks such as massages ($\bar{x} = 4.43$, $\sigma = 4.43$), entertainment ($\bar{x} = 4.18$, $\sigma = 0.950$), welcoming/greeting a guest at the reception ($\bar{x} = 4.16$, $\sigma = 1.234$) or in the hotel's restaurant ($\bar{x} = 4.14$, $\sigma = 1.185$), and accompanying the guest when leaving the hotel ($\bar{x} = 4.15$, $\sigma = 1.051$). These results echo the findings of Ivanov and Webster (2019a, b) regarding customers' perceived appropriateness of robot application in travel, tourism, and hospitality companies. Surprisingly, information provision tasks were considered as slightly more appropriate for employees than robots, although they can be easily automated. A possible explanation might be that hotel managers considered that the provision of tourist information should be delivered in a less structured and more emotional way. However, our data do not allow us to confirm or disconfirm this conjecture, which might be subject to future research.

Looking at Table 4, we see that the grouping factors have no or marginal impact on respondents' answers. Again males were more receptive to robots compared to females for tasks such as processing card payments, issuing payment documents, taking orders for laundry, new towels, linen, etc., taking orders, and cooking food in a restaurant. Unexpectedly, the managers of largest hotels (over 150 rooms) were a bit more sceptical towards robots and considered that some of the tasks were more appropriate for human employees than the managers of smaller properties (up to 50 rooms and between 51–100 rooms): e.g., concierge services, serving food in a restaurant, preparing drinks, cleaning of common areas, taking order for laundry, new towels, linen and delivering them (all $p < 0.05$). A possible explanation might be that the managers of the largest hotels considered that the use of robots would deteriorate the perceived service quality and would form an image of commodification of hotel services. A fast forward look at Table 5 confirms this notion—the managers of the largest properties had the lowest level of agreement with the statement that 'Using robots will improve the service quality of the hotel' and the difference with the responses of other managers was significant ($\chi^2 = 8.861$, $p < 0.05$). Therefore, focusing on employees was likely a strategy to humanise the service experience and avoid the image of service commodification.

The results from the interviews supported the quantitative findings. For example, robots were considered suitable for washing and cleaning dishes in the restaurants, taking orders, cleaning tables and floors [P12], issuing various documents and ordering taxis [P16], supporting staff at the reception during group arrivals, provision of information, distribution of promotional materials [P9], or for marketing support [P6], which would free time for the employees to concentrate on their guests [P19] and allow them to "*focus on more difficult tasks*" [P8]. Hence, in general, hotel managers perceived robots as appropriate for repetitive, dirty, dull and dangerous tasks, which employees avoid, hence, enhancing rather than replacing human employees (Dogan and Vatan 2019; Ivanov and Webster 2019d, e).

Table 5 Impacts of service robots (n = 79)

Directions of robot application in hotels	Mean	Standard deviation	Mann–Whitney *U* test			Kruskal–Wallis χ^2-test				
			Gender	Chain affiliation	Traveller type	Age	Work experience	Hotel capacity	Hotel category	Hotel location
Finance										
Robots will reduce operating costs	3.44	0.977	345.5	322*	429.5	9.426*	9.080	3.223	1.069	3.094
Robots will improve hotel's occupancy rate	2.76	0.942	486	415.5	360.5	4.718	4.996	2.642	5.998*	4.713
Robots will allow the hotel to charge higher prices	2.76	0.911	516.5	440	441	2.186	2.559	5.364	5.328	4.848
Robots will increase the revenue of the hotel	2.96	0.985	313**	327*	401.5	7.227	10.059*	1.920	2.336	4.788
Robots will improve the profitability of the hotel	3.17	0.993	222***	434.5	499.5	2.675	4.478	7.739	1.781	1.288
Operations										
Robots will make the operational process easier	3.33	0.904	363*	365	439.5	12.168**	12.135*	0.170	0.931	1.015
Using robots will allow the hotel to serve more guests	3.29	1.106	421.5	335.5*	437.5	2.619	3.122	2.111	1.361	2.255
The introduction of robots in our hotel will require that we make changes to our facilities	3.68	1.161	465.5	386.5	475.5	0.213	3.113	2.517	0.694	0.208

Table 5 (continued)

Directions of robot application in hotels	Mean	Standard deviation	Mann–Whitney *U* test			Kruskal–Wallis χ^2-test				
			Gender	Chain affiliation	Traveller type	Age	Work experience	Hotel capacity	Hotel category	Hotel location
Safety and security										
The usage of robotic services will guarantee better safety and security of guests	2.79	0.978	308**	381.5	444.5	3.791	4.588	2.648	0.088	3.382
The usage of robotic services will guarantee better safety and security of employees	3.04	0.971	249.5***	375	498.5	5.089	9.352	13.277**	2.681	3.593
Marketing										
Robots will improve guests' experience	2.85	1.044	361.5*	468	389.5	1.447	1.903	4.782	3.389	1.682
Customers will choose the hotel just because of the robotic technologies	2.46	0.855	483	418	497	0.633	1.214	2.875	3.982	2.990
Using robots will have positive impact on hotel's image	3.06	0.918	420	376.5	483	0.783	1.106	3.194	4.619	0.611
Using robots will improve the service quality of the hotel	3.06	1.047	346.5*	449.5	489	2.189	2.652	8.861*	0.916	0.809
Human resource management										
Implementation of robotic technologies will be easily accepted by the employees	2.83	0.949	442	474.5	489.5	2.572	2.888	4.376	2.887	5.562

Table 5 (continued)

Directions of robot application in hotels	Mean	Standard deviation	Mann–Whitney *U* test			Kruskal–Wallis χ^2-test				
			Gender	Chain affiliation	Traveller type	Age	Work experience	Hotel capacity	Hotel category	Hotel location
Using robots would require significant training of employees	3.53	1.034	504.5	472	411	1.813	3.393	2.130	2.023	1.746
The introduction of robots will require human employees to learn new skills	3.75	0.960	407	477	437.5	0.765	1.040	1.358	0.337	2.885
If robots are used in our hotel, many colleagues will lose their jobs (r)	2.72	1.136	507.5	462	476	2.493	2.647	0.365	0.450	5.347
If robots are used in our hotel, I will lose my job (r)	3.72	0.988	490.5	390.5	378.5	4.978	3.083	0.854	8.151	1.969

(1) Coding: 1—completely disagree, 5—completely agree; (2) (r)—reverse coding; (3) levels of significance: ***p < 0.001, **p < 0.01, *p < 0.05

4.3 Impacts of service robots

Table 5 reveals respondents' perceptions about the impacts of the service robots on the functional areas in hotel management—operations, safety and security, marketing, human resource management, and finance. The biggest potential impacts hotel managers see in operations—robots would make the operational processes easier ($\bar{x}=3.33$, $\sigma=0.904$) and will increase the service capacity of hotels allowing them to serve more guests ($\bar{x}=3.29$, $\sigma=1.106$), but they would require the redesign hospitality facilities to allow for robot's mobility ($\bar{x}=3.68$, $\sigma=1.161$) (Ivanov and Webster 2017). From a human resource management perspective, the implementation of robots would require significant training of employees ($\bar{x}=3.53$, $\sigma=1.034$) and they may need to learn new skills too ($\bar{x}=3.75$, $\sigma=0.960$). The use of robots may lead to job losses ($\bar{x}=2.72$, reverse coding, $\sigma=1.136$), but managers were not generally afraid about being replaced ($\bar{x}=3.72$, reverse coding, $\sigma=0.988$). The marketing benefits were not very evident to the hotel managers and they gave mostly neutral responses, but they largely agreed that customers would not choose a hotel just because of the robotic technologies it used ($\bar{x}=2.46$, $\sigma=0.855$). Similarly, the respondents were not sure about the impacts of robotic technologies regarding the safety and security of guests ($\bar{x}=2.79$, $\sigma=0.978$) and employees ($\bar{x}=3.04$, $\sigma=0.971$), but the COVID-19 pandemic might change their perceptions, especially considering that service robots can be a useful tool for physical distancing (Seyitoğlu and Ivanov 2020). Finally, from a financial perspective, respondents acknowledged that robots would reduce the operating costs of the hotel ($\bar{x}=3.44$, $\sigma=0.977$) and improve profitability ($\bar{x}=3.17$, $\sigma=0.993$), but were sceptical toward the improvement of occupancy rate ($\bar{x}=2.76$, $\sigma=0.942$) and the ability of the hotel to charge higher prices ($\bar{x}=2.76$, $\sigma=0.911$). Therefore, findings indicate that the impact of robots on hotels' bottom line would be through cost reduction, not through higher revenues, prices, or occupancy rates.

The responses of hotel managers were largely homogeneous and only a few notable differences were identified. As with the initial findings, males were more optimistic than females about the impacts of robots on revenues ($U=313$, $p<0.01$), profitability ($U=222$, $p<0.001$), the safety and security of guests ($U=308$, $p<0.01$) and employees ($U=249.5$, $p<0.001$), and service quality ($U=346.5$, $p<0.05$). Furthermore, the managers of the largest properties were more conservative than the managers of the smallest hotels about the impact of robots on the safety and security of employees ($\chi^2=13.277$, $p<0.001$).

Qualitative results were in line with the quantitative results. From an operations perspective, robots would be used for "*fast service during peak moments…Fast check-in and checkout of the guests*" [P3] meaning that "*Employees will be able to serve more guests thanks to robots*" [P1] and they "*will be able to do more tasks, take extra responsibilities and will save time*" [P6]. The use of robots to help operations in peak service periods was mentioned by P4 and P16 as well. Concerning marketing, "*the use of robots will improve the quality of service of the hotel*" [P19] and "*may attract more visitors*" [P2]. However, from a financial perspective "*buying and maintaining a single robot is most likely to cost more than hiring a single*

human" [P8]. Therefore, the financial costs of service robots might be a hindrance to their implementation by the hotel industry (Ivanov and Webster 2018).

Most of the respondents' comments referred to the human resource management impacts of robots. For example, the introduction of robots would make it "*hard for a great number of employees…Use of robots will require additional training courses for the employees*" [P13], but hoteliers had a "*limited ability to conduct extra courses to teach all hotel employees to work properly with robotic technologies*" [P20]. Additionally, the use of robots requires that companies hire skilled employees to operate them which would push costs up. As P8 put it: "*There is no need to mention that in order these robots to function properly, we need to hire skilled people again to maintain them. The more skilled the specialist, the higher salary*". Nevertheless, the respondents were not afraid of substitution because a "*well-trained worker cannot be replaced*" [P18], "*in our hotel, we rely on human service, so robots are not such a big threat*" [P3], and a "*well-educated and skilled individual is more valuable than a technological advancement*" [P9]. Moreover, as P10 commented:

> "In this regard, a well-trained employee with good qualifications could in no way be replaced by a robot. I have guests who have returned to a particular hotel precisely because of the hotels' employees and of their attitude. There are customers who come back to certain restaurants because of their chefs and waiters. The attitude is everything in the hotel business" [P10].

Finally, one respondent commented that robots cannot substitute human employees but would rather compensate for the lack of employees: "*Robots will replace the lacking workforce … automation services will be indispensable in places where there are no longer qualified personnel*" [P4]. These findings support the claim of Ivanov and Webster (2019c) and Webster and Ivanov (2020) that in the near future automation technologies would rather compensate for the unborn children and the lack of sufficient and skilled employees willing to take hospitality jobs, but some substitution effect and replacement of employee by automation technologies is inevitable, although it would be at a different rate for different tasks and job positions (Ivanov 2020).

4.4 Intention to implement service robots

Pertinent to the fourth objective, respondents were asked about their intentions to introduce service robots in various hotel departments within different timeframes. The results are presented in Table 6. The findings show that none of the hotels had service robots. This reflects the reality because the first service robot in a hotel in Bulgaria was introduced in November 2019 by Best Western Premier Sofia Airport hotel—about 6 months after the end of data collection. The overwhelming majority of respondents did not intend to introduce robots or consider it as an option in at least 5 years. Only a small number of respondents reported they might introduce robots in less than a year.

The interview results were completely in line with the findings from the questionnaire. Most interviewees (13 of them) reported they did not intend to implement

Table 6 Intention to introduce service robots

Directions of robot application in hotels	Hotel departments											
	Reception		Restaurant		Housekeeping		Gardening		Security		Meetings and events	
	N	%	N	%	N	%	N	%	N	%	N	%
We intend to introduce within 1 years	3	3.8	4	5.2	1	1.3	4	5.3	4	5.3	3	3.8
We intend to introduce within 2–3 years	8	10.3	4	5.2	7	9.2	7	9.3	3	3.9	4	5.1
We intend to introduce within 4–5 years	5	6.4	5	6.5	6	7.9	7	9.3	4	5.3	4	5.1
We intend to introduce in more than 5 years	13	16.7	16	20.8	16	21.1	16	21.3	13	17.1	16	20.3
We do not intend to introduce robots	49	62.8	48	62.3	46	60.5	41	54.7	52	68.4	52	65.8
Total	78	100.0	77	100.0	76	100.0	75	100.0	76	100.0	79	100.0

$\chi^2 = 9.894$, df = 20, p = 0.970

robotic technology in their hotels due to various reasons—some reported insufficient financial resources [P12, P15, P16, P20] or serving predominantly elderly tourists [P3, P6] as barriers for robot implementation. Specifically, P6 mentioned that "*robots would be of great use in restaurants and households but not in our hotel due to the types of visitors that stay*" [P6]. Other interviewees mentioned that they did not intend to implement robots in their operations because they rely on and prefer human employees [P1, P2, P4, P9, P17] in their hotels. Moreover, they believe that for the tourism and hospitality industry employees were better than robots as the industry was based on human-human interactions while "*robotic technologies could not be as effective as people*" [P9]. Additionally, P2 said: "*No, I would not like to implement robotic technologies in my hotel, because I think that the best service is delivered to the guests by humans*" [P2].

5 Conclusion

5.1 Contribution

This paper contributes to the literature by analysing hotel managers' perceptions of service robots. More specifically, the paper identifies the managers' perceptions regarding the advantages and disadvantages of service robots, their readiness to implement service robots, the tasks considered as appropriate for robotisation, the expected impacts of service robots on hotel management's functional areas, and the role of respondents' and hotels' characteristics on managers' perceptions of service robots. From a methodological perspective, the application of convergent mixed methods design allowed the triangulation of findings and deeper insights into the subject. From a managerial perspective, the results may help hotel managers in terms of implementing service robots in their operations.

5.2 Theoretical implication

From a theoretical perspective, the findings indicate that some of the tasks in hotels would be more appropriate for robots, while others—for human employees (Table 4). Results show that the robots were perceived as appropriate for repetitive, dirty, dull, and dangerous tasks (e.g. cleaning the common areas of the hotel, delivering laundry, gardening, issuing payment document, processing card payments), which human employees avoid, or for tasks that put the human in a superior position over a robot (e.g. taking customer orders for laundry, new towels, linen). On the other hand, hotel managers would rather use humans for tasks that require social skills and emotional intelligence (welcoming/greeting customers, guiding the guest to the room/table), for tasks which would put a human in a subordinate position to a robot if a robot performed them (e.g. massage), or for tasks related to food and drinks (e.g. preparing and serving food and drinks). In this regard, the findings confirm previous studies (Dogan and Vatan 2019; Ivanov and Webster 2019a) about the scope of tasks that hospitality employees consider as appropriate for robotisation.

Moreover, the findings mirror the results of demand-side studies that show that information provision, documentation and payments, and housekeeping activities are acceptable for robotisation, while body-related tasks are not (Ivanov et al. 2018a). Therefore, if hoteliers decide to robotise these activities, they may face little resistance by guests.

Furthermore, the findings showed that the demographic characteristics of respondents (age, work experience) played little role in their perceptions of service robots, the tasks they could be assigned to perform, and robots' potential impacts on hotel's business (Tables 3, 4, and 5). Gender was found to be shaping perceptions towards robots—males were more receptive to service robots compared to female managers thus confirming prior studies (Loffredo and Tavakkoli 2016; Ivanov et al. 2018a). The characteristics of the hotel where the managers were working (chain affiliation, the predominant type of served guests, category, location, and size) had little role in shaping managers' perceptions with one notable exception. The managers of the largest properties were a bit more sceptical toward the application of robots for some tasks than the managers of smaller hotels. They considered that robots would decrease the quality of the service they provide; hence, the preference towards human employees instead of robots in the largest hotels was a way to humanise the customer experience and avoid perceptions of the commodification of their product. Therefore, overall, the findings do not support the role of the organisational factors identified in the Technology–Organisation–Environment framework (Tornatzky and Fleischer 1990) and the institutional theory (DiMaggio and Powell 1983) in shaping managers' perceptions towards service robots, although respondents' answers varied by the hotel size for some directions of robot application (Table 4) and impacts of robots (Table 5).

Additionally, the interviewees indicated that skilled and well trained human employees were more valuable than robots and believed that human employees were more adequate for the hospitality and tourism industry because the industry was mostly related to customer service, employee attitude and behaviour (Qiu et al. 2020) which were perceived as important factors for high guest satisfaction and memorable customer experience (Kim et al. 2012). However, as there are different types of tourists, there may be some tourists who search for safety and security and some other tourists who are eager to experience robotics. For example, after the current pandemic (COVID-19) people may desire to have physically distant service which may be difficult to deliver by human employees. Thus, robotics may increasingly gain importance in terms of providing physically distant hospitality and tourism services (Seyitoğlu and Ivanov 2020).

Finally, the hotel managers perceived that the balance between the enhancement and the substitution effects of robots on tourism and hospitality jobs (Dogan and Vatan 2019; Ivanov and Webster 2019d, e) was definitely on the side of the enhancement effect. Respondents considered that robots will not substitute them, but will help the employees be more effective, efficient, and productive. In that sense, the findings did not provide support to the fears that robots would replace human employees in tourism and hospitality (Li et al. 2019). However, the improvement of the technical capabilities of robots in the future will increase the substitution potential of robots, leading to the replacement rather than the enhancement of tourism

and hospitality employees. The demographic crisis that developed economies face (Webster and Ivanov 2020) and the increased acceptance of service robots by customers will further stimulate the implementation of service robots by tourism and hospitality companies.

5.3 Managerial implications

This study provides significant implications for hotel managers in terms of using robots in their services. First, as mentioned in Sect. 5.2, robots were considered more appropriate for repetitive, dirty, dull, and dangerous tasks. The use of robots for dirty and dangerous tasks (e.g. cleaning the floors, disinfection) ensures human employees' health and, accordingly, the number of workplace accidents may decrease. Furthermore, the use of robots for repetitive and dull tasks would not only improve the operational efficiency of the hotel but would also create a better working climate for employees who consider such tasks as not psychologically rewarding and will save their time for other tasks (Tuomi et al. 2020a). Since the robots are helpful in repetitive and less complex tasks, human employees may be able to spend more time to provide personalised services to guests (Larivière et al. 2017). Furthermore, thanks to robotics, employees may have the opportunity to focus on guest communication which has the potential to strengthen the guest's relationship (Qiu et al. 2020). In this respect, robotics may enhance the satisfaction of employees which is significant in terms of service quality and guest satisfaction. Moreover, as Lee et al. (2020) point out, service providers should not expect robots to perform very complex services such as handling customer complaints and serving VIP guests because they are more effective for less complex, routine, and repeated tasks. Therefore, although robots may perform some tasks in hotels, this does not mean that they would replace all human jobs in hotel operations. However, technological progress in the field of robotics may decrease the gap between robots and human employees in terms of social skills, thus making robots appropriate for tasks which hoteliers currently consider as reserved for humans, and expand the areas of their application in hotels (Qiu et al. 2020; Tung and Au 2018).

The major potential impacts hotel managers see in operations are that robots would make the operational processes easier and will increase the service capacity of hotels allowing them to serve more guests, but they would require redesign hospitality facilities to allow for robot's mobility (Ivanov and Webster 2017). Overall, findings show that the impact of robots on hotels' bottom line would be through cost reduction, not through higher revenues, prices, or occupancy rates. Therefore, robotics companies that sell service robots to the hospitality industry would need to create strong business cases, measure and emphasise in their business proposals to hoteliers the cost savings that their robots would deliver, but without overpromises and hype. Once in operation, robots have to match the expectations of hoteliers and the promises of robot manufacturers and sellers, and really decrease the costs of hotels, because otherwise they would be turned off (like in Henn na Hotel) and hoteliers, being the customers of robotics companies, would be dissatisfied. On the other hand, the respondents in this study were somewhat sceptical regarding the

marketing benefits of robots but acknowledged the need for staff training to learn new skills. Therefore, robotics companies have to provide initial and periodic training to hotel employees to allow them to use their robots safely, effectively, and efficiently. Additionally, robotics companies have to be proactive; they must develop and present cases of successful implementation of robots in hotels, and elaborate on how robots contributed to customer satisfaction and the overall guest experience (Qiu et al. 2020; Tung and Au 2018; Tung and Law 2017). In that way, the positive examples may shift the perceptions of hotel managers because they would see the marketing potential of robots. They may also advise hoteliers on the potential use of robots in their properties.

Finally, hotel managers must have a realistic view of the advantages and disadvantages of robots compared to human employees and implement a comprehensive cost–benefit analysis about the impacts of robot use in their properties (Ivanov and Webster 2018). This analysis must cover not only the financial aspects of the business, but it has to be more holistic and encompass operations, marketing, human resource management, and safety and security as well. Such analysis allows hoteliers to take an informed decision about the implementation of robots. The actual decision has to be justified, not based on hype, fashion, or copying competitors' actions (mimetic pressure in the institutional theory by DiMaggio and Powell 1983).

5.4 Limitations and future research directions

Although this study provides valuable findings related to the use of robotics in hotels from the perspective of hotel managers, it is necessary to mention some of its limitations. First, the sample size is small—despite the authors' efforts, only 99 hotel managers (79 managers for the quantitative study and 20 managers for the qualitative study) participated in the research. Probably the hotel managers that responded to the questionnaire and the interviews had greater knowledge and more positive perceptions towards robots compared to those who did not respond. Previous studies that researched Bulgarian hotel managers reported similar low response rates (Ivanov et al. 2014, 2015; Ivanova and Ivanov 2015). Second, the authors used non-probability sampling due to the lack of a publicly available and comprehensive list of contact details of hotels in the country that would have allowed probability sampling. Therefore, the findings cannot be generalised beyond that empirical context. Third, as a direct consequence of the non-probability sampling, the managers of the seaside hotels were overrepresented in the interviews but not in the sample from the questionnaire. Fourth, the question 'Robots may misunderstand a question/order' might have been double-barrelled. Although for a robot it does not matter whether the sentence is a question or an order—in both cases it is a piece of information that needs to be understood and the necessary actions to be taken, it is possible that the respondents had different views about a robot misunderstanding a question compared to a robot misunderstanding an order. Finally, the data were collected before the COVID-19 outbreak. Thus, the perceptions of hotel managers toward the use of service robots may have changed, especially towards the questions related to safety and security, but this should be subject to future research.

The tourism and hospitality literature desperately needs an in-depth economic analysis of the real-life cases of robot applications by hotels, restaurants, airports, and other travel, tourism, and hospitality companies. Future research needs to delve into the actual financial and non-financial costs and benefits that robots create for companies and illuminate the economic feasibility of the use of robots in the tourism and hospitality context. Moreover, research can focus on the role of COVID-19 pandemic on the use of robots by tourism and hospitality companies. Furthermore, research can shed light on the actual substitution and enhancement effects experienced by companies that introduced service robots. Finally, research can investigate the collaboration between human employees and robots in the delivery of tourism and hospitality services.

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References

Belanche D, Casaló LV, Flavián C, Schepers J (2020) Service robot implementation: a theoretical framework and research agenda. Serv Ind J 40(3–4):203–225

Berezina K, Ciftci O, Cobanoglu C (2019) Robots, artificial intelligence, and service automation in restaurants. In: Ivanov S, Webster C (eds) Robots, artificial intelligence, and service automation in travel, tourism and hospitality. Emerald Publishing Limited, Bingley, pp 185–219

Bhimasta RA, Kuo PY (2019) What causes the adoption failure of service robots? A case of Henn-na Hotel in Japan. In: Adjunct proceedings of the 2019 ACM international joint conference on pervasive and ubiquitous computing and proceedings of the 2019 ACM international symposium on wearable computers, pp 1107–1112. https://dl.acm.org/doi/abs/10.1145/3341162.3350843

Chan APH, Tung VWS (2019) Examining the effects of robotic service on brand experience: the moderating role of hotel segment. J Travel Tour Mark 36(4):458–468

Choi S, Liu SQ, Mattila AS (2019) "How may I help you?" Says a robot: examining language styles in the service encounter. Int J Hosp Manag 82:32–38

Choi Y, Oh M, Choi M, Kim S (2020) Exploring the influence of culture on tourist experiences with robots in service delivery environment. Curr Issues Tour. https://doi.org/10.1080/13683500.2020.1735318

Collier DA (1983) The service sector revolution: the automation of services. Long Range Plan 16(6):10–20

Collins GR, Cobanoglu C, Bilgihan A, Berezina K (2017) Automation and robotics in the hospitality industry, Chapter 12. In: Hospitality information technology: learning how to use it, 8th edn. Kendall/Hunt Publishing Co., Dubuque, pp 413–449

Creswell JW (2012) Educational research. planning, conducting, and evaluating quantitative and qualitative research, 4th edn. Pearson Education, Boston

Davis FD (1989) Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Q 13(3):319–340

de Kervenoael R, Hasan R, Schwob A, Goh E (2020) Leveraging human-robot interaction in hospitality services: incorporating the role of perceived value, empathy, and information sharing into visitors' intentions to use social robots. Tour Manag 78:104042

DiMaggio J, Powell W (1983) The iron cage revisited: institutional isomorphism and collective rationality in organizational fields. Am Sociol Rev 48(2):147–160

Dogan S, Vatan A (2019) Hotel managers' thoughts towards new technologies and service robots' at hotels: a qualitative study in Turkey. In: Cobanoglu C, Cavusoglu M, Corbaci A (eds) Advances in global business and economics, vol 2. ANAHEI Publishing, Sarasorta, pp 382–399

Farrell J, Klemperer P (2007) Coordination and lock-in: competition with switching costs and network effects. In: Armstrong M, Porter R (eds) Handbook of industrial organization, vol 3. Elsevier, Amsterdam, pp 1967–2072

Foster ME, Gaschler A, Giuliani M (2013) How can I help you? Comparing engagement classification strategies for a robot bartender. In: Proceedings of the 15th ACM on International conference on multimodal interaction. ACM, pp 255–262

Gretzel U, Murphy J (2019) Making sense of robots: consumer discourse on robots in tourism and hospitality service settings. In: Ivanov S, Webster C (eds) Robots, artificial intelligence, and service automation in travel, tourism and hospitality. Emerald Publishing Limited, Bingley, pp 93–104

Ho TH, Tojib D, Tsarenko Y (2020) Human staff vs. service robot vs. fellow customer: does it matter who helps your customer following a service failure incident? Int J Hosp Manag 87:102501

Huang MH, Rust RT (2018) Artificial intelligence in service. J Serv Res 21(2):155–172

Huang MH, Rust RT (2020) Engaged to a robot? The role of AI in service. J Serv Res. https://doi.org/10.1177/1094670520902266

Hwang J, Kim H, Kim W (2019) Investigating motivated consumer innovativeness in the context of drone food delivery services. J Hosp Tour Manag 38:102–110

ISO (2012) ISO 8373:2012. Robots and robotic devices—vocabulary. Retrieved on Sept 8, 2019 from https://www.iso.org/obp/ui/#iso:std:iso:8373:ed-2:v1:en

Ivanov S (2019) Ultimate transformation: how will automation technologies disrupt the travel, tourism and hospitality industries? Zeitschrift für Tourismuswissenschaft 11(1):25–43

Ivanov S (2020) The impact of automation on tourism and hospitality jobs. Inf Technol Tour. https://doi.org/10.1007/s40558-020-00175-1

Ivanov S, Webster C (2017) Designing robot-friendly hospitality facilities. In: Proceedings of the scientific conference "tourism, innovations, strategies", 13–14 October 2017, Bourgas, pp 74–81

Ivanov S, Webster C (2018) Adoption of robots, artificial intelligence and service automation by travel, tourism and hospitality companies—a cost–benefit analysis. In: In Marinov V, Vodenska M, Assenova M, Dogramadjieva E (eds) Traditions and innovations in contemporary tourism. Cambridge Scholars Publishing, Cambridge, pp 190–203

Ivanov S, Webster C (2019a) What should robots do? A comparative analysis of industry professionals, educators and tourists. In: Pesonen J, Neidhardt J (eds) Information and communication technologies in tourism 2019, proceedings of the international conference in Nicosia, Cyprus, 30.01–01.02.2019, pp 249–262

Ivanov S, and Webster C (2019b) Perceived appropriateness and intention to use service robots in tourism. In: Pesonen J, Neidhardt J (eds) Information and communication technologies in tourism 2019, proceedings of the international conference in Nicosia, Cyprus, 30.01–01.02.2019, pp 237–248

Ivanov S, Webster C (2019c) Conceptual framework of the use of robots, artificial intelligence and service automation in travel, tourism, and hospitality companies. In: Ivanov S, Webster C (eds) Robots, artificial intelligence and service automation in travel, tourism and hospitality. Emerald Publishing, Bingley, pp 7–37

Ivanov S, Webster C (2019d) Economic fundamentals of the use of robots, artificial intelligence and service automation in travel, tourism and hospitality. In: Ivanov S, Webster C (eds) Robots, artificial intelligence and service automation in travel, tourism and hospitality. Emerald Publishing, Bingley, pp 39–55

Ivanov S, Webster C (2019e) Robots in tourism: a research agenda for tourism economics. Tour Econ. https://doi.org/10.1177/1354816619879583

Ivanov S, Webster C (eds) (2019f) Robots, artificial intelligence and service automation in travel, tourism and hospitality. Emerald Publishing, Bingley

Ivanov S, Ivanova M, Iankova K (2014) Sustainable tourism practices of accommodation establishments in Bulgaria: an exploratory study. Tourismos 9(2):175–205

Ivanov S, Stoilova E, Illum SF (2015) Conflicts between accommodation establishments and travel agencies. Tour Hosp Res 15(1):54–70
Ivanov SH, Webster C, Berezina K (2017) Adoption of robots and service automation by tourism and hospitality companies. Revista Turismo Desenvolvimento 27/28:1501–1517
Ivanov S, Webster C, Garenko A (2018a) Young Russian adults' attitudes towards the potential use of robots in hotels. Technol Soc 55:24–32. https://doi.org/10.1016/j.techsoc.2018.06.004
Ivanov S, Webster C, Seyyedi P (2018b) Consumers' attitudes towards the introduction of robots in accommodation establishments. Tourism 63(3):302–317
Ivanov S, Gretzel U, Berezina K, Sigala M, Webster C (2019) Progress on robotics in hospitality and tourism: a review of the literature. J Hosp Tour Technol 10(4):489–521. https://doi.org/10.1108/JHTT-08-2018-0087
Ivanova M, Ivanov S (2015) Affiliation to hotel chains: hotels' perspective. Tour Manag Perspect 16:148–162
Johnson RB, Onwuegbuzie AJ (2004) Mixed methods research: a research paradigm whose time has come. Educ Res 33(7):14–26. https://doi.org/10.3102/0013189X033007014
Kazandzhieva V, Filipova H (2019) Customer attitudes toward robots in travel, tourism, and hospitality: a conceptual framework. In: Ivanov S, Webster C (eds) Robots, artificial intelligence, and service automation in travel, tourism and hospitality. Emerald Publishing Limited, Bingley, pp 79–92
Khoo-Lattimore C, Mura P, Yung R (2019) The time has come: a systematic literature review of mixed methods research in tourism. Curr Issues Tour 22(13):1531–1550
Kim JH, Ritchie JB, McCormick B (2012) Development of a scale to measure memorable tourism experiences. J Travel Res 51(1):12–25
Kuo C-M, Chen L-C, Tseng C-Y (2017) Investigating an innovative service with hospitality robots. Int J Contemp Hosp Manag 29(5):1305–1321
Landis JR, Koch GG (1977) The measurement of observer agreement for categorical data. Biometrics 33(1):159–174. https://doi.org/10.2307/2529310
Larivière B, Bowen D, Andreassen TW, Kunz W, Sirianni NJ, Voss C, Wünderlich NV, De Keyser A (2017) "Service Encounter 2.0": an investigation into the roles of technology, employees and customers. J Bus Res 79:238–246. https://doi.org/10.1016/j.jbusres.2017.03.008
Lee WH, Lin CW, Shih KH (2018) A technology acceptance model for the perception of restaurant service robots for trust, interactivity, and output quality. Int J Mobile Commun 16(4):361–376
Lee WJ, Kwag SI, Ko YD (2020) Optimal capacity and operation design of a robot logistics system for the hotel industry. Tour Manag 76:103971
Li JJ, Bonn MA, Ye BH (2019) Hotel employee's artificial intelligence and robotics awareness and its impact on turnover intention: the moderating roles of perceived organizational support and competitive psychological climate. Tour Manag 73:172–181
Lin H, Chi OH, Gursoy D (2019) Antecedents of customers' acceptance of artificially intelligent robotic device use in hospitality services. J Hosp Mark Manag 29:1–20
Loffredo D, Tavakkoli A (2016) What are European Union public attitudes towards robots. Syst Cybern Inform 14(1):11–19
Lu L, Cai R, Gursoy D (2019) Developing and validating a service robot integration willingness scale. Int J Hosp Manag 80:36–51
Lu VN, Wirtz J, Kunz WH, Paluch S, Gruber T, Martins A, Patterson PG (2020) Service robots, customers and service employees: what can we learn from the academic literature and where are the gaps? J Serv Theory Pract. https://doi.org/10.1108/JSTP-04-2019-0088
Lukanova G, Ilieva G (2019) Robots, artificial intelligence, and service automation in hotels. In: Ivanov S, Webster C (eds) Robots, artificial intelligence, and service automation in travel, tourism and hospitality. Emerald Publishing Limited, Bingley, pp 157–183
Miles BM, Huberman AM (1994) Qualitative data analysis, 2nd edn. Sage Publications, Thousand Oaks
Miller MR, Miller R (2017) Robots and robotics: principles, systems, and industrial applications. McGraw-Hill Education, New York
Murphy J, Hofacker C, Gretzel U (2017) Dawning of the age of robots in hospitality and tourism: challenges for teaching and research. Eur J Tour Res 15:104–111
Murphy J, Gretzel U, Pesonen J (2019) Marketing robot services in hospitality and tourism: the role of anthropomorphism. J Travel Tour Mark 36(7):784–795
Nakanishi J, Kuramoto I, Baba J, Ogawa K, Yoshikawa Y, Ishiguro H (2020) Continuous hospitality with social robots at a hotel. SN Appl Sci 2(3):1–13

National Statistics Institute /NSI/ (2020a) Population by settlements and sex. https://infostat.nsi.bg/infostat/pages/reports/query.jsf?x_2=1089
National Statistics Institute /NSI/ (2020b) Accommodation establishments. https://infostat.nsi.bg/infostat/pages/reports/query.jsf?x_2=1258
National Statistics Institute /NSI/ (2020c) Average annual wages and salaries of the employees under labour contract by economic activities (A38) and sex (2008–2018). https://infostat.nsi.bg/infostat/pages/reports/result.jsf?x_2=568
Naumov N (2019) The impact of robots, artificial intelligence, and service automation on service quality and service experience in hospitality. In: Ivanov S, Webster C (eds) Robots, artificial intelligence and service automation in travel, tourism and hospitality. Emerald Publishing, Bingley, pp 123–133
Nørskov M (2016) Social robots: boundaries, potential, challenges. Routledge, London
Ogle A, Lamb D (2019) The role of robots, artificial intelligence, and service automation in events. In: Ivanov S, Webster C (eds) Robots, artificial intelligence, and service automation in travel, tourism and hospitality. Emerald Publishing Limited, Bingley, pp 255–269
Osawa H, Ema A, Hattori H, Akiya N, Kanzaki N, Kubo A, Koyama T, Ichise R (2017) Analysis of robot hotel: reconstruction of works with robots. In: 2017 26th IEEE international symposium on robot and human interactive communication (RO-MAN). IEEE, pp 219–223
Park S (2020) Multifaceted trust in tourism service robots. Ann Tour Res 81:102888
Qiu H, Li M, Shu B, Bai B (2020) Enhancing hospitality experience with service robots: the mediating role of rapport building. J Hosp Mark Manag 29(3):247–268
Quan W, Kubota N (2017) Evolutionary people tracking for robot partner of information service in public areas. In: International conference on intelligent robotics and applications. Springer, Cham, pp 703–714
Rosete A, Soares B, Salvadorinho J, Reis J, Amorim M (2020) Service robots in the hospitality industry: an exploratory literature review. In: International conference on exploring services science. Springer, Cham, pp 174–186
Seyitoğlu F, Ivanov S (2020) Service robots as a tool for physical distancing in tourism. Curr Issues Tour **(in press)**
Shead S (2019) World's first robot hotel fires half of its robots. Forbes. https://www.forbes.com/sites/samshead/2019/01/16/worlds-first-robot-hotel-fires-half-of-its-robots/#78bf9dfde1b1
Shiomi M, Sakamoto D, Kanda T, Ishi CT, Ishiguro H, Hagita N (2011) Field trial of a networked robot at a train station. Int J Soc Robot 3(1):27–40
Stock RM, Merkle M (2017) A service robot acceptance model: user acceptance of humanoid robots during service encounters. In: Proceedings of the 2017 IEEE international conference on pervasive computing and communications workshops (PerCom workshops), 13–17 March 2017, Kona. https://doi.org/10.1109/percomw.2017.7917585
Tan N, Mohan RE, Watanabe A (2016) Toward a framework for robot-inclusive environments. Autom Constr 69:68–78
Tasci D, Semrad J (2016) Developing a scale of hospitableness: a tale of two worlds. Int J Hosp Manag 53:30–41. https://doi.org/10.1016/j.ijhm.2015.11.006
Tornatzky LG, Fleischer M (1990) The process of technological innovation. Lexington Books, Lexington
Tung V, Au N (2018) Exploring customer experiences with robotics in hospitality. Int J Contemp Hosp Manag 30(7):2680–2697. https://doi.org/10.1108/IJCHM-06-2017-0322
Tung VWS, Law R (2017) The potential for tourism and hospitality experience research in human–robot interactions. Int J Contemp Hosp Manag 29(10):2498–2513
Tuomi A, Tussyadiah I, Stienmetz J (2019) Service robots and the changing roles of employees in restaurants: a cross cultural study. e-Rev Tour Res 17(5):662–673
Tuomi A, Tussyadiah I, Ling EC, Miller G, Lee G (2020a) x=(tourism_work) y=(sdg8) while y= true: automate (x). Ann Tour Res 84:102978
Tuomi A, Tussyadiah IP, Stienmetz J (2020b) Applications and implications of service robots in hospitality. Cornell Hosp Q. https://doi.org/10.1177/1938965520923961
Tussyadiah I (2020) A review of research into automation in tourism: launching the Annals of Tourism Research Curated Collection on Artificial Intelligence and Robotics in Tourism. Ann Tour Res 81:102883
Tussyadiah I, Miller G (2019) Nudged by a robot: responses to agency and feedback. Ann Tour Res 78:102752
Tussyadiah IP, Park S (2018) Consumer evaluation of hotel service robots. In: Stangl B, Pesonen J (eds) Information and communication technologies in tourism 2018. Springer, Cham, pp 308–320

Tussyadiah IP, Zach FK, Wang J (2017) Attitudes toward autonomous on demand mobility system: the case of self-driving taxi. In: Schegg R, Strangl B (eds) Information and communication technologies in tourism 2017. Proceedings of the international conference in Rome, January 24–26, 2017. Springer, Cham, pp 755–766

Tussyadiah IP, Zach FJ, Wang J (2020) Do travelers trust intelligent service robots? Ann Tour Res 81(C):102886

van Doorn J, Mende M, Noble SM, Hulland J, Ostrom AL, Grewal D, Petersen JA (2017) Domo Arigato Mr. Roboto emergence of automated social presence in organizational frontlines and customers' service experiences. J Serv Res 20(1):43–58

Venkatesh V, Davis FD (2000) A theoretical extension of the technology acceptance model: four longitudinal field studies. Manag Sci 46(2):186–204

Venkatesh V, Morris M, Davis G, Davis F (2003) User acceptance of information technology: toward a unified view. MIS Q 27(3):425–478

Virto N, López M (2019) Robots, artificial intelligence, and service automation to the core: remastering experiences at museums. In: Ivanov S, Webster C (eds) Robots, artificial intelligence, and service automation in travel, tourism and hospitality. Emerald Publishing Limited, Bingley, pp 239–253

Webster C, Ivanov S (2020) Demographic change as a driver for tourism automation. J Tour Futures. https://doi.org/10.1108/JTF-10-2019-0109

Wirtz J (2019) Organizational ambidexterity: cost-effective service excellence, service robots, and artificial intelligence. Organ Dyn. https://doi.org/10.1016/j.orgdyn.2019.04.005

Wirtz J, Patterson P, Kunz W, Gruber T, Lu VN, Paluch S, Martins A (2018) Brave new world: service robots in the frontline. J Serv Manag 29(5):907–931

World Travel and Tourism Council /WTTC/ (2020) Bulgaria 2020 annual research: key highlights. https://wttc.org/Research/Economic-Impact

Xu S, Stienmetz J, Ashton M (2020) How will service robots redefine leadership in hotel management? A Delphi approach. Int J Contemp Hosp Manag 32(6):2217–2237

Yadegaridehkordi E, Nilashi M, Nasir MHNBM, Ibrahim O (2018) Predicting determinants of hotel success and development using structural equation modelling (SEM)-ANFIS method. Tour Manag 66:364–386

Yu CE (2018) Humanlike robot and human staff in service: age and gender differences in perceiving smiling behaviors. In: Proceedings of the 7th international conference on industrial technology and management (ICITM). IEEE, pp 99–103

Yu CE (2020) Humanlike robots as employees in the hotel industry: thematic content analysis of online reviews. J Hosp Mark Manag 29(1):22–38

Yu CE, Ngan HFB (2019) The power of head tilts: gender and cultural differences of perceived human vs human-like robot smile in service. Tour Rev 74(3):428–442

Zeng Z, Chen PJ, Lew AA (2020) From high-touch to high-tech: COVID-19 drives robotics adoption. Tour Geogr **(in press)**

Zhong L, Sun S, Law R, Zhang X (2020) Impact of robot hotel service on consumers' purchase intention: a control experiment. Asia Pac J Tour Res. https://doi.org/10.1080/10941665.2020.1726421

Zhu DH, Chang YP (2020) Robot with humanoid hands cooks food better? Effect of robotic chef anthropomorphism on food quality prediction. Int J Contemp Hosp Manag. https://doi.org/10.1108/IJCHM-10-2019-0904