

## Research Article

# Robots in Tourism and Hospitality: The Perception of Future Professionals

**Teresa Palrão** <sup>1,2</sup> **Rosa I. Rodrigues** <sup>3,4</sup> **Arlindo Madeira** <sup>5,6</sup> **Alexandra S. Mendes** <sup>7</sup>  
and **Sofia Lopes** <sup>5,8</sup>

<sup>1</sup>CiTUR, Estoril Higher Institute for Tourism and Hotel Studies, Estoril, Portugal

<sup>2</sup>ISCE—Instituto Superior de Lisboa e Vale do Tejo, 2620-379 Ramada, Portugal

<sup>3</sup>Instituto Superior de Gestão, Business & Economics School, Lisbon, Portugal

<sup>4</sup>CEFAGE—Center for Advanced Studies in Management and Economics, Évora, Portugal

<sup>5</sup>Faculty of Social Sciences and Technology, Universidade Europeia, Lisbon, Portugal

<sup>6</sup>ESCAD—Escola Superior de Ciências da Administração, IPLUSO, Lisbon, Portugal

<sup>7</sup>CiTUR, Polytechnic of Leiria, Peniche, Portugal

<sup>8</sup>Faculty of Economics and Business Sciences, Universidade Lusíada de Lisboa, Lisbon, Portugal

Correspondence should be addressed to Alexandra S. Mendes; alexandra.mendes@ipleiria.pt

Received 16 September 2022; Revised 24 November 2022; Accepted 3 April 2023; Published 26 May 2023

Academic Editor: Zheng Yan

Copyright © 2023 Teresa Palrão et al. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

This research is aimed at analyzing the perception of future tourism professionals about the presence of robots in the hospitality industry. It was based on data obtained from undergraduate and master students in tourism and hospitality, through a questionnaire that sought to assess their perceptions regarding hospitality, novelty, culture, robot performance management in the tourism industry, and their willingness to work in a partially robotized environment in the future. The analysis of the perceptions of future tourism and hospitality professionals was performed based on a structural equation model and revealed that perceptions of novelty and performance management have a significantly positive impact on the willingness of participants to work in a partially robot environment in the future. When the intention to use robots in the future is included in the model, this positive effect decreases. The current existing research on the application of artificial intelligence in hospitality and tourism has, mainly, focused on the customer or the hotelier, making it important to understand how generations of future employees in hospitality and tourism view the use of this type of technology, anticipating any future less favorable situations.

## 1. Introduction

The uncertain and challenging economic environment that has characterized the last two years has led the hospitality industry to make radical changes, which have become a turning point for the tourism industry [1]. These transformations have helped to elevate the travel experience and improve customer service models, with several tourism and hospitality businesses starting to implement the use of robots in many frontline services (e.g., waiters and concierges) [2].

Nowadays, the use of service robots already has several practical examples, including the fully robotized Henn-Na Hotel in Japan and the Hilton Hotel, which uses the Connie robot as a concierge [3]. Service robots are being implemented in many front office tasks and include those from waiter robots in restaurants to robotic concierges in hotels and are increasingly being used in the hospitality and tourism sectors to simultaneously provide the customer with improved services while reducing costs [4]. According to the International Federation of Robotics [5], the sales of

service robots increased by 37% in 2021 worldwide, but in the hospitality industry, in particular, this growth was of 85%.

Technological innovation has gained new momentum because the introduction of service robots not only reduces operating costs but also makes it possible to offer customers better services [6, 7]. Another frequent reason for the implementation of service robots relates to the improvement of customers' hospitality experience, namely, the consistency of service or the reduction of waiting times [8].

While technology can contribute to the management of the hotel and/or specific hotel sections, one must be selective in the innovations, and only those that add value to the organization and offer experiences that meet guests' expectations should be incorporated [9]. Seyitoğlu and Ivanov [10] state that the COVID-19 pandemic, despite the catastrophic economic effects, has given technology an important role, namely, to ensure social distancing, but also as a way to reduce costs, proving to be an opportunity to redefine business models. In this context, Tussyadiah [11] refers to the existence of three different realities: (a) hotels with exclusive use of robots, (b) hotels where the work is performed by robots and humans, and (c) hotels where all the work is performed exclusively by humans.

A partially robotized work environment brings added advantages to organizations that adopt this type of technology as the human-robot integration in a collaborative way, and the development of a good relationship between staff and technology has proven to be growing and advantageous [12]. Individuals attribute different types of emotion towards interacting with a human teammate or a robot teammate, and this interaction is influenced by their culture [13]. There are substantial differences between the use of day-to-day technology and the technology under discussion in this research study, and there is a need for workers to be empowered with digital technologies through identified and targeted training for collaborative work with service robots, which can make future workers more receptive to this challenge [14].

Social robotics, meanwhile, is a field of technology that is still in its preliminary stages, although there are already robots that interact simply and clearly with customers to perform specific tasks. However, the acceptance of robots is, strongly, influenced by customers' perceptions of their similarities with humans [4]. Yet, it appears that most of the literature mainly focuses on the acceptance of existing robotic technology and does not explore the full potential of artificial intelligence (AI) in the hospitality and tourism sectors [15].

The intelligent robot has been defined as a technology that, with its own ability to perceive the environment, and through independent thinking, can perform actions befitting the context in which it is brought in [16, 17]. There are three elements that distinguish intelligent robots from ordinary robots, namely, sensory, motion, and thinking aspects. Language and information processing can play an important role, making it possible to assign human characteristics without considering them as neither fully real nor fully inanimate entities [18]. According to Tussyadiah [11], the appli-

cation of intelligent automation in tourism can be understood as the implementation of an integrated system of next-generation technologies that include artificial intelligence, robotics, and the Internet of Things, to autonomously perform service tasks within tourism environments. The purpose of the current research is to analyze the perception of future tourism professionals about the use of robots in the hospitality industry and to describe the factors that may influence this perception.

Previous research has shown that the intention to use robots is correlated with trust in this type of technology [19]. The advantages and disadvantages of robots have a positive impact on raising awareness about the usefulness of robots while intentions can positively contribute to enhancing human-robot collaboration [20] while negative attitudes towards technology in general seem to affect the propensity to use service robots [11]. The main objective of this research is to identify the factors that may affect the willingness to work in the hospitality industry in a partially robotized environment, considering the intention to use robots as a mediating variable.

The intention to use robots in the future, the perception of novelty, and the awareness that robots can both guide and manage performance in the hospitality industry all contribute positively to the intention of students in the hospitality and tourism sectors to work in partially robotic environments, while their culture and perception of hospitality contribute negatively to this intention.

This research is organized as follows: a state-of-the-art approach, where the use of robots in the hotel industry, partially robotized environments, the novelty associated with their use, their use in performance management in the hotel industry, the cultural background, and hospitality are explored, which allowed the rationalization of the hypotheses under study; there follows a description of the data and methods applied; the next chapter presents the main results and analyses in accordance with previous studies; finally, the conclusions are provided, with practical implications, limitations, and recommendations for future research.

## 2. Literature Review

*2.1. The Use of Robots in the Hospitality Industry.* In a world characterized by uncertainty and constant change, where technology is increasingly more prevalent, organizations need to define strategies to become more innovative and competitive, and the hospitality industry is no exception [21]. However, the inclusion of artificial intelligence in this industry is no longer new since it has been more than three decades since Collier [22] brought to the attention of academics the importance of including robotics in their lectures.

According to Tung and Law [23], the adoption of robotic technology has been growing significantly in various professional areas (e.g., airports, cruise ships, restaurants, travel agencies, and events) and the use of robots in the hospitality sector has been a constant, in recent years [15]. Belanche et al. [4] reported that sales of professional service robots have had an annual growth rate of more than 30%. Without

TABLE 1: Research on the use of robots in the hospitality industry.

Author(s)	Main results
Andrew	The use of service robots should be encouraged because, as opposed to the costs associated with traditional resources, which are likely to increase over time, robotic technology costs are expected to decrease in the following years [24].
Melis	The intention to use robotic technology is largely influenced by the perceived usefulness and benefits inherent in its use [25].
Wanner and Herkommer	Service robots, in the hospitality industry, are mostly used for performing physical tasks, and the great potential of AI for performing tourism operations remains overlooked [26].
Werthner and Klein	The robotic technology used in the tourism and hospitality sector focuses essentially on back-office activities and contributes little or nothing to stimulate customer-robot interaction [27].
Kawarazaki et al.	Service robots still lack the skills to establish a friendly relationship with humans (e.g., kindness and friendliness), although there is a growing effort on the part of their programmers for communication to occur through natural language, gestures, and more humanized expressions [28].
Melis et al.	Service automation triggers a major ethical dilemma with hotel managers: (a) should they replace their employees with robots to make more profit? (b) Or should they use technology to improve the working conditions of their employees and, consequently, the offer of the services provided? [29].
Melissen et al.	Hospitality is largely dependent on human resources, and it is this heavy dependence that makes this sector increasingly attractive for the introduction of service robots that offer innovative, fast, and effective experiences [30].
Ivanov and Webster	The perception of human-robot interaction is not only influenced by the characteristics of the robot but also by the situational context and the characteristics of the customer, since this perception is strongly influenced by sociocultural factors [31].
Rosete et al.	The use of service robots has diminished the affective experience as they cannot mimic humans in terms of emotions nor are they advanced enough to perform social activities, leaving guests frustrated [32].
Belanche et al.	Human likeness contributes positively to increasing customer affinity with service robots, which in turn is a strong predictor of their success in the hospitality industry [4].
Khalique et al.	The introduction of AI, in particular robots, brings numerous benefits at the hospitality level, namely, in terms of cost reduction, accuracy, and speed in the service provided [33].

Source: elaborated by the authors.

being exhaustive on this subject, Table 1 lists the main authors whose research has focused on this theme.

Murphy et al. [34] argue that humanoid robots play an increasingly important role in hospitality and tourism services because anthropomorphic characteristics are a critical factor for customers to accept them. De Kervenoael et al. [35] further report that social robots are increasingly present in tourism settings and hospitality services. However, customer attitudes regarding the use of service robots in the hospitality sector are still unclear, incomplete, and limited because interaction between humans and robots in real-life situations is still scarce. Therefore, most of the current research focuses on theory and seeks to understand customer expectations of robotic services [36]. The use of AI and robotics in the tourism and hospitality sector is a complex issue since robots must integrate functions associated

with cartography, navigation, collision avoidance, obstacle avoidance, image recognition, object manipulation, and social interaction capabilities that match consumers' needs and make their experiences more unique [31]. Using robotics in the tourism sector, besides decreasing human contact, may also lead to technical problems for which there is no solution yet [37].

Specialists predict that, by the year 2030, robots will make up about 25% of the hotel industry's "workforce," performing tasks that were previously performed solely by humans [38]. To optimize the benefits arising from AI, it is essential to understand what different stakeholders think about the positive and negative impacts of using AI, both in industry and in society, in general [11]. The uncertainty still prevails as to whether, in the future, technological advances supported by robotics can replace human warmth

and express emotions that meet customers' expectations [32]. Considering the aforementioned, it can be seen that the hotel industry still has a long and challenging journey ahead of it because, if on the one hand this disruptive paradigm shift stimulates the emergence of successful hotel businesses, on the other hand, it can contribute to the disappearance of others [39].

*2.2. Partially Robotized Environment.* The massification of technology use in daily life makes the demand for technology in hotels a trend, and even before the COVID-19 pandemic, communication with guests was already largely done using smart mobile devices, since providing services in a personalized way and in real time is one of the great advantages of technology use [40]. Since the hospitality industry is still associated with long working hours [41], robots can replace or complement human labor and assist in the performance of tasks of greater or lesser complexity [42].

In the hospitality industry, the success of a robot depends largely on the combination of hardware, functionality, and ability to comply with standards and thus should be able to respond to the required function, adding value to the operator and the customer [43]. The activities performed by hospitality professionals are divided into front-of-house and back-of-house functions, and in both, the technological aspect plays an important role. Procedures related to activities, dynamics, norms, and behaviors can be performed by humans and robots, and this interaction is strongly influenced by technological advancement [44]. However, it should be noted that while the use of robots in hospitality can ensure physical distance between hosts and guests, their use may reduce the feeling of hospitality as they lessen the interaction between human employees and the tourist [10].

For Ivkov et al. [15], students have a clear sense of the importance of those business features that make competition more severe and therefore may have the intention to implement service robots based on accuracy, consistency, and unparalleled service. Thus, the first hypothesis (H1) of this research was outlined:

H1. Intention to use robots in the future positively influences willingness to work in a partially robotized environment.

*2.3. Novelty Associated with the Use of Robots.* Robots represent an opportunity for companies to reduce costs, in the long term, to relieve the workload associated with hospitality professionals, and to act as a form of entertainment involving new technologies [45], and the use of service robots and AI to provide services that meet human needs is becoming more and more popular among hospitality and tourism businesses [46]. In this context, Blöcher and Alt [9] reported that tasks that are more repetitive, routinized, and structured and that do not require any kind of training and/or expertise can be performed more effectively while using AI and robotics.

According to Kim et al. [47], robots are a novelty for guests, which generates enthusiasm and publicity for hotels seeking to build an innovative brand image. The COVID-19 pandemic revealed the importance of judging and discriminating the more important types of interpersonal inter-

action from the less important ones, and the approach using AI contributed to increase customer satisfaction on many levels, while the novelty factor and perceived benefits were also found to positively affect the intention of future professionals to use robotic technology in their professional activity [15, 48, 49]. All these studies provided the basis for the formulation of the following hypotheses (H2 and H3):

H2. The willingness to work in a partially robotized environment is influenced by the novelty associated with the use of robots in the hospitality industry.

H3. The intention to use robots in the future mediates the relationship that exists between the novelty associated with the use of robots in the hospitality industry and the willingness to work in partially robotized environment.

*2.4. The Use of Robots in Managing Performance in the Hospitality Industry.* According to Tuomi et al. [39], in high-contact customer environments, service robots tend to outperform humans in the execution of standardized tasks due to their mechanical and analytical nature, with the advantage of not having to deal with problems of punctuality, accountability, disagreements, complaints, and poor service delivery by staff. These factors, combined with the accuracy and efficiency of robotic technology, can increase customers' willingness to try the services provided by AI [50]. An efficient management of resources and the minimization of some operational costs can increase profits and reduce the prices applied to the consumer [6] while, simultaneously, it allows to respond to guests' needs, practically instantaneously [51].

There is evidence that in some cases, service robots have not yet reached the desired technological maturity to proficiently replace humans, as they cannot effectively communicate with customers or create empathy with them, so some guests do not yet accept being "served" by robotic devices, feeling the need for human contact in intangible and personalized services, which requires a deeper understanding of the effect of human-robot interaction [21]. According to these authors, the creation of personal profiles that ensure that guests' preferences are remembered if there is a repeat stay and the development of loyalty programs could contribute to the personalization of service delivery based on spending and/or booking patterns.

The rejection of the use of service robots is still shared by some professionals in hospitality-related functions, considering the study conducted by Mildred Tapfuma and Musavengane [52], which revealed that 96% of respondents feel that the introduction of robotic machines in service delivery makes their jobs redundant and, therefore, do not agree with its implementation. On the other hand, it is found that students attending courses related to the area of hospitality and tourism consider that the services provided to customers can be improved, in terms of accuracy, speed, and consistency, if they are performed by robots, which influences their intention to use them in the future [15]. Considering all this supporting information, the following hypotheses (H4 and H5) were derived:

H4. The use of robots to manage performance in the hospitality industry positively influences the willingness to work in a partially robotized environment.

H5. The relationship between using robots to manage performance in the hospitality industry and the willingness

to work in a partially robotized environment is mediated by the intention to use robots in the future.

**2.5. Cultural Background.** A particular country's cultural context can play an important part in understanding the level of acceptance of various stakeholders and their willingness to use service robots [53]. According to Yilmaz and Tasci [54], the social interaction that takes place between the hotel employee and the tourist depends on cultural aspects. Human and intangible resources are more difficult to imitate and, therefore, can serve as a stronger source of competitive advantage [55].

Tuomi et al. [56] additionally state that a country's culture affects perceptions about robot adoption, which may affect how technology-mediated service is accepted, as the uncertainty aversion towards unknowable situations differs from country to country. Therefore, it is found that Japanese tend to have a positive attitude towards the adoption of service robots that makes it easier to introduce robots in hotels [57]. In Portugal, the implementation of AI and robotic technology in hospitality industry has been increasing, but the opinion on this topic is still very diversified and far from consensual [58]. Under these assumptions, the sixth hypothesis (H6) of the present study was outlined:

H6. The culture of a country influences the intention to use robots in the future.

**2.6. Hospitality in the Hotel Industry.** The rapid evolution of technology affects all areas of personal life, and people are increasingly influenced by and dependent on digital media for carrying out everyday activities, be they professional, social, and/or leisure [59]. The presence of robots in tourism businesses represents a challenge relative to how traditional hospitality is viewed, since there are several studies showing that human employees should not be completely replaced by service robots [28, 29, 32].

Most robots are used to provide information (e.g., menus in restaurants and description of works of art) and/or to deliver items (e.g., room service in hotels and food/drink in restaurants), as they cannot yet mimic humans in affective and emotional terms [32]. Hospitality largely depends on the direct interaction that occurs between customers and staff, and robots lack social skills that allow them to communicate with people following human behavioral patterns [58]. Resistance to the introduction of service robots by hospitality employees is inevitable; although service robots in their current state of development are less skilled than human employees, the latter may perceive robots as a threat to their jobs [60].

Bowen and Morosan [38] allude that it is difficult to maintain hospitality when machines replace employees. When tourists interact predominantly with robots, they lose human contact and social support, which can trigger high levels of anxiety and loneliness [31]. However, there are repetitive, boring, and dangerous tasks that can be performed by robotic technology, because, in addition to protecting workers' health, they eliminate human errors arising from the monotony associated with the execution of these tasks [11].

Therefore, the perception of future professionals in this activity sector seems to differ according to whether the robots are fully or partially used [8]. Although there is little research on this topic, tourism and hospitality students believe that hospitality depends on the interaction between guests and employees, so customers may refuse to use technology because of the lack of meaningful interaction [15]. Considering all of the above, the following hypothesis (H7) was therefore derived:

H7. Students' perceptions of hospitality have impact on their intentions to use robots in the future.

### 3. Materials and Methods

Considering that the general objective of this research is to analyze the perception of future hospitality and tourism professionals on the use of robots in the hospitality industry, outlining the factors that may influence this perception, the following detailed approach was adopted.

**3.1. Data.** To test the hypotheses of this study, a four-section questionnaire was applied and distributed face-to-face on paper to a nonprobability sample of undergraduate and master's students in the hospitality and tourism field in May 2022 in the classroom context. This commonly used technique consists of using a convenience sample resulting in greater operational ease and low sampling cost [61]. The study included 358 higher education students who attend bachelor's or master's programs related to tourism and/or hospitality (94% of those are undergraduate students), aged between 18 and 41 years, 70% of which are female. Among the respondents, 41% were in their first year at the time of application of the questionnaire, with the predominant course being tourism (44%), followed by hotel management (29%). Regarding the geographical dispersion of the sample, the participants study in the Metropolitan Area of Lisbon and in the western region of Portugal. No fixed response time was given, incentives were not provided for questionnaire completion, and students were asked for consent. The fourth section included questions directed to characterize the sample.

To measure the independent variables (IV), a questionnaire was developed. The first section focused on students' perceptions of (a) hospitality [33], (b) novelty [47], (c) performance management [39], and (d) country culture [31]. The second section included items that allowed ascertaining the participants' perception of the intention to use robots in the future, which is the moderating variable of the model under study [8]. The third section focused on the dependent variable (DV) and was intended to ascertain the students' willingness to work in a partially robotic environment [55]. All answers, in sections one to three, were given using a five-point Likert-type scale ranging from 1 (strongly disagree) to 5 (strongly agree).

**3.2. Data Analysis Method.** The research was operationalized using a quantitative methodology, based on a hypothetic-deductive approach that sought to analyze the relationship between the variables under study. To evaluate the internal structure of the measurement instrument, an exploratory factor analysis was performed, which, through principal component analysis with varimax rotation, resulted in a

simplified structure that made data interpretation much more accessible. The methodology used to test the hypotheses was structural equation modeling (SEM), and the software used was IBM SPSS AMOS, version 28.

The extraction of the components was based on the criteria postulated by Furr [62], namely, (a) eigenvalues greater than one, (b) scree plot analysis, and (c) percentage of variance explained. The initial questionnaire was composed of 40 questions, but the items with item-factor correlations lower than 0.400, with a difference lower than 0.200 between them or that saturated in more than one component, were eliminated.

The final version of the questionnaire is composed of 21 items: (a) hospitality with five items (e.g., “Robots’ ability to interact is very limited.”), (b) novelty with four items (e.g., “The use of robots allows offering customers a futuristic experience.”), (c) performance management with four items (e.g., “The functionality of robots justifies their use in some tasks.”), and (d) country culture with three items (e.g., “The functionality of robots justifies their use in some tasks.”). Four items were used to determine the participants’ perception of their intention to use robots in the future (e.g., “In the near future, I consider using robots to gain competitive advantage.”). The DV was assessed through a single item. According to Dolbier et al. [63], this format is the most suitable when a quick and easy-to-interpret response is desired. Although this type of scale is often criticized due to the impossibility to calculate its psychometric indicators, Littman et al. [64] argued that its use has advantages over scales consisting of several items, as it allows obtaining more effective results.

The Kaiser-Meyer-Olkin indicator ( $KMO = 0.85$ ) and Bartlett’s test of sphericity ( $\chi^2_{(190)} = 1964.27, p < 0.001$ ) were also calculated, which showed that there were no identity problems in the data and that the correlations between the items were sufficient and adequate. Through the factor matrix analysis, it was possible to verify that the four components obtained explain 50.82% of the variance, a value considered satisfactory [65].

To confirm the results obtained in the exploratory study, a confirmatory factor analysis was performed whose values revealed that the manifest variables adequately represent the number of constructs obtained. The structural model analysis was based on the cutoffs recommended in the literature [65, 66], whose values demonstrate that the model fits the sample under study ( $\chi^2_{(98)} = 1.687, p < 0.001, CFI = 0.948, GFI = 0.945, RMSR = 0.054, RMSEA = 0.044, LO90 = 0.032, \text{ and } HI90 = 0.055$ ).

Reliability was analyzed through Cronbach’s alpha coefficient, whose results revealed an adequate internal consistency for all variables under study, with values ranging between 0.70 and 0.72 [62]. To assess the measurement quality of the instrument, the composite reliability (CR) and the average variance extracted (AVE) were calculated, which showed adequate values (Table 2), since they are higher than 0.60 [67]. Convergent and discriminant validities were calculated according to the procedures recommended by Fornell and Larcker [68]. The results revealed that the discriminant validities of the IV exhibited average shared variance (ASV) and maximum shared variance (MSV) values that were below the AVE score [65].

TABLE 2: Composite reliability and convergent and discriminant validities.

Variables	CR	AVE	MSV	ASV
Hospitality	0.86	0.70	0.34	0.17
Novelty	0.85	0.61	0.19	0.16
Performance management	0.84	0.75	0.56	0.25
Country’s culture	0.83	0.84	0.65	0.34

Note: CR = composite reliability; AVE = average variance extracted; MSV = maximum shared variance; ASV = average shared variance. Source: elaborated by the authors.

## 4. Results and Discussion

*4.1. Results.* A path analysis was performed as a way to verify the adjustment of the proposed model to the sample, which, through a structural model found on theory [32, 51, 57], allowed the description of all existing relationships between the constructs involved in this research (Figure 1).

The results demonstrated that, after covariation of the errors indicated by the AMOS modification indices, the model proved to be fitted to the data ( $\chi^2_{(7)} = 1.053, p < 0.001, CFI = 0.983, GFI = 0.970, RMSR = 0.023, RMSEA = 0.012, LO90 = 0.047, \text{ and } HI90 = 0.067$ ). Any model can be improved by analyzing the modification indices and consequently establishing the trajectories suggested by those indices as long as the modifications are supported by theory [69].

Considering the hypotheses under analysis in this research, the next point is their analysis according to the proposed model.

Data analysis revealed that the intention to use robots in the future positively influenced the willingness that tourism students have to work in a partially robotic environment (H1;  $\beta = 0.134, t = 2.292, p < 0.001$ ).

Students’ perceptions of the novelty associated with the use of robots in the hospitality industry have been found to have a significantly positive impact on their willingness to work in a partially robotic environment in the future (H2;  $\beta = 0.163, t = 3.042, p < 0.05$ ).

The intention to use robots in the future mediates the relationship that exists between the novelty associated with the use of robots in the hospitality industry and the willingness to work in a partially robotized environment. When the mediator variable is included in the model, the effect decreases, although it remains significant (H3;  $\beta = 0.127, t = 2.296, p < 0.05$ ).

The perception about the use of robots to manage performance in the hotel industry also has a significantly positive impact on the willingness that tourism students have to work in a partially robotic environment in the future (H4;  $\beta = 0.430, t = 8.081, p < 0.001$ ).

The relationship between using robots to manage performance in the hospitality industry and the willingness to work in a partially robotized environment is mediated by the intention to use robots in the future. When the mediator variable is included in the model, the effect decreases, although it remains significant (H5;  $\beta = 0.370, t = 2.292$ ,

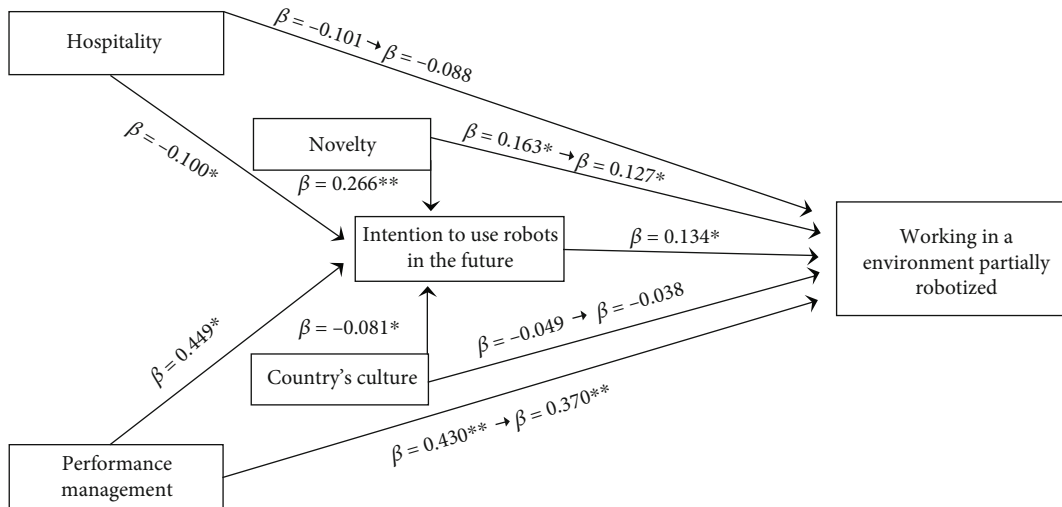


FIGURE 1: Mediation model. Source: elaborated by the authors.

TABLE 3: Mediation of the intention to use robots in the future in the relationship between the IV and the willingness to work in a partially robotized environment.

Predictor variables	Willingness to work in a partially robotized environment ( $\beta$ )
Hospitality	-0.101
Novelty	0.163*
Country's culture	-0.049
Performance management	0.430**
Adjusted $R^2$	0.304
$F_{(4,353)}$	39.917**
Hospitality	-0.088
Novelty	0.127*
Country's culture	-0.038
Performance management	0.370**
Intention to use robots in the future	0.134*
Adjusted $R^2$	0.312
$F_{(5,352)}$	33.370**

\* $p < 0.05$ ; \*\* $p < 0.001$ . Source: elaborated by the authors.

$p < 0.001$ ). Therefore, a partial mediation is present, which translates into an indirect effect of the perceived novelty associated with the use of robots and the use of robots to manage performance in the hospitality industry on participants' willingness to work in a partially robotized environment, and this effect is significant for both variables (perception about the novelty associated with the use of robots: Sobel  $Z = 2.114$ ,  $p < 0.05$ ; perception about the use of robots to manage performance in the hotel industry: Sobel  $Z = 0.876$ ,  $p < 0.05$ ) [70].

It was also observed that, although the country's culture and the hospitality negatively influence the willingness of

participants to work in a partially robot environment, this impact is not statistically significant (Table 3).

This research concluded that the cultural values of the participants have a negative impact on the intention to use robots in the future (H6;  $\beta = -0.081$ ,  $t = -1.621$ ,  $p < 0.05$ ).

Finally, it was found that students' perception of hospitality has a negative impact on the intention to use robots in the future (H7;  $\beta = -0.100$ ,  $t = -1.996$ ,  $p < 0.05$ ). On the other hand, the novelty associated with the use of robots in the hotel industry ( $\beta = 0.266$ ,  $t = 5.483$ ,  $p < 0.001$ ) and the use of robots to manage performance ( $\beta = 0.449$ ,  $t = 9.328$ ,  $p < 0.001$ ) in this sector positively influence the intention to use robots in the future (Table 4).

**4.2. Discussion.** The main objective of this study consists in analyzing the perception of future tourism and hospitality professionals about the use of robots in the hospitality industry, describing the factors that may influence this perception. The discussion of the results will be based on the hypotheses formulated.

Data analysis revealed that the intention to use robots in the future positively influences the desire to work in a partially robotic environment, which allowed us to validate the first hypothesis formulated. The results are similar to those found by Benckendorff et al. [71], which found that the hospitality and tourism industries are also being affected by advances in artificial intelligence and robotics. These findings may be due to the precarious conditions faced by professionals in the hospitality industry, namely, overtime, split hours, low wages, and routine tasks, considering that robots can easily perform monotonous tasks and help in reducing excessive overtime work [72]. Following this idea, Baum [41] argues that robots can replace or complement human labor and help perform tasks of greater or lesser complexity, although it is still premature to predict whether service robots bring competitive advantages to the tourism and hospitality sector [21]. The impact of service robots on service employees includes advantages like reduced routine work and enhanced productivity, or disadvantages such as

TABLE 4: Impact of the IV on the intention to use robots in the future.

Predictor variables	Intention to use robots in the future ( $\beta$ )
Hospitality	-0.100*
Novelty	0.266**
Country's culture	-0.081*
Performance management	0.449**
Adjusted $R^2$	0.430
$F_{(4,353)}$	68.322**

\* $p < 0.05$ ; \*\* $p < 0.001$ . Source: elaborated by the authors.

loss of autonomy and job insecurity [73, 74]. Nevertheless, it was considered relevant to know whether the intention of future tourism professionals to use robots in the future can influence their willingness to work in a partially robotized environment, since so far, studies have only been carried out with tourists [42].

This research revealed that the desire to work in a partially robotic environment is influenced by the novelty associated with the use of robots in the hospitality industry, which allowed to validate the second hypothesis of the study and can be explained by the fact that students realize that service robots can help them in routine jobs that will be part of their professional future. These results are consistent with those presented by Blöcher and Alt [9] which have demonstrated that the novelty that service robots represent can make repetitive and routine tasks easier to perform and increase employee satisfaction in a work context. Similarly, Ivkov et al. [15] reveal that future professionals consider that the novelty associated with robotic technology can minimize the high amount of workload they are exposed to on an everyday basis.

The results obtained allowed the confirmation of the third hypothesis, namely, the fact that the intention to use robots in the future mediates the relationship between the novelty associated with the use of robots in the hotel industry and the willingness to work in a partially robotized environment. Nevertheless, it appears that there is an indirect effect of perception on the novelty associated with the use of robots, since there is a difference between the intention to use robots in the future and the desire to work in a partially robotic environment. In this context, Kim et al. [47] refer that, although the novelty associated with robots is valued by future professionals, the importance associated with the interpersonal relationships they establish with guests continues to be considered more important [75, 76]. Research developed by Drexler and Lapré [21], before the COVID-19 pandemic, already mentions that many customers refuse to interact with robots, as they feel the need for human contact.

The fourth hypothesis, which stated that the use of robots to manage performance in the hospitality industry positively influences the intention to use them in the future, was supported by the analysis conducted in this research, which can be explained by the benefits perceived by those

upcoming professionals in their future activity. This result is in line with the research developed by Belanche et al. [6] that reinforce the idea that with the use of service robots, operating costs can be minimized, which allows lower prices to be applied to customers and, thus, more efficient management of resources. On the other hand, Seyitoğlu and Ivanov [55] argue that there is still a need to adapt service robots to customers, as this is the only way to manage their performance because even though new technologies are designed to solve problems and bring benefits to human life, and the intelligent use of an emerging technology offers new possibilities to improve human life, even when they function properly, it should be cautioned that inappropriate use may cause losses from incorrect actions [77].

Intention to use robots in the future was found to positively influence future tourism professionals' desire to work in a partially robotized environment, but when perception about performance management is included in the model with mediating status, the effect decreases, although it remains significant. These results confirm that the fifth hypothesis of this research is in line with Drexler and Lapré's study [21], and according to which, service robots cannot establish effective communication with customers, because there is still a long way to go before they can interact harmoniously with humans. It was also found that although the participants in the study consider that the services performed by robots are faster and more accurate, the interaction and proximity with customers continue to be an asset to guarantee their loyalty, as mentioned in previous studies [15, 75].

These results may be due to the type of culture that prevails in the country under study, since according to Hofstede's dimensions [78], Portugal has high values of femininity [79] and collectivism [80]. Therefore, interpersonal relationships are valued in exchange for loyalty [81], which is in line with the sixth hypothesis tested in this research, according to which the participants' cultural background negatively influences the intention to use robots in the future, although this impact is not statistically significant, not allowing the validation of this hypothesis. This can be explained because Portugal has strong cultural values based on hospitality, reinforced by centuries of embracing people from other origins, and thus, the Portuguese value personal and relational interactions, which may hinder the acceptance of robots.

Finally, it was found that students' perception of hospitality has a negative impact on their intentions to use robots in the future, and these results may be due to the students' perception that hospitality is largely influenced by the interaction that occurs between guests and staff, and with the introduction of service robots, this interaction ceases to exist, in line with the seventh hypothesis formulated. According to the other research, robotic technology does not replace the tasks performed by humans; it only complements them [75, 82]. Although the results obtained in this study do not support the hypothesis because they are not statistically significant, they concur with research who allude that hospitality depends on the interaction that takes place between guests and employees [15].



Bearing in mind the hypotheses analyzed, it can be concluded that the widespread adoption of advanced technology may have human resource implications, because human-robot interaction in a professional context requires customized policies and strategies [21].

## 5. Conclusions

The main objective of this research was to study the perception of future tourism and hospitality professionals about the presence of robots in the hotel industry and to determine the factors that most contribute to influence their opinion on this topic. According to Ivanov and Webster [31], the adoption of service robots is an increasingly close reality, which allowed to respond to the specific objectives initially formulated, as it was observed that (a) the intention to use robots in the future positively influenced the will that the tourism students have to work in a partially robotic environment; (b) students' perceptions of novelty associated with the use of robots in the hotel industry have a significantly positive impact on their willingness to work in a partially robotic environment in the future; (c) the intention to use robots in the future mediates the relationship between the novelty associated with the use of robots in the hotel industry and the desire to work in a partially robotic environment; (d) awareness of the use of robots to guide performance in the hospitality industry has a significantly positive impact on the willingness of future tourism professionals to work in a partially robotic environment in the future; (e) the relationship between the use of robots to manage performance in the hospitality industry and the willingness to work in a partially robotic environment is mediated by the intention to use robots in the future; (f) the country's culture negatively influences the intention to use robots in the future; and (g) students' perceptions of hospitality have a negative impact on their intentions to use robots in the future. It is important to mention that each of the specific objectives mentioned gave rise to a research hypothesis, and it was found that, except for the last two (H6 and H7), all the others were corroborated from the results obtained.

There are several authors [15, 21, 55] who argue that service robots still need to be improved to increase efficiency in tasks where it is important to use emotions. On the other hand, there is evidence that a wide range of service robots has been used to perform tasks at different technical levels, namely, guides, receptionists, porters, cooks, room attendants, housekeeping, and waiters, among others [21, 83]. This is where the management of novelty and robot performance clearly overlaps with the human factor; that is, the results revealed that the perception of innovation and performance management has a significantly positive impact on participants' willingness to work in an environment partially robotic [9].

It is important to build a solid foundation of trust based on facts by not allowing the general attitude towards the use of robots to be influenced by fictional information coming from the media [84]. Undoubtedly, the future is already here, and thus, instead of fearing changes, it is necessary to

face technological advances in an informed and conscious way, since it can be an asset to alleviate the demands associated with the workload of professionals in the hotel sector.

*5.1. Practical Implications.* The research outcomes reveal several practical implications, both for future professionals, for those responsible for defining training curricula, for hospitality and tourism lecturers, and for employers and hotel businesses. The need for future professionals, currently students, to adapt to the inclusion of robots in the hospitality industry is urgent, and this adaptation should be anticipated in higher education schools. This process may begin, by introducing relational and technical modules that prepare students for a "new hospitality." Thus, it is essential to arouse the interest of those responsible for higher education institutions to invest in real robots that would allow students a close contact in practical classes, leading them to recognize their potential.

Employers in the hospitality industry should demonstrate a willingness to strengthen the commitment between the use of human labor and the use of robots in hospitality. This compromise should focus on the possibility of an improvement in service quality, always expressing the importance of the training for future hoteliers, as the perceived threat that future hospitality professionals currently feel may cause a decrease in investment in their further training. Future professionals must become aware of the advantages of using robots, in a complementary way, allowing them to evolve and develop skills that allow them to increase productivity while reducing the number of routine tasks. If employers can succeed in conveying this message, future professionals will not feel their autonomy compromised in their prospective jobs. The hotel industry must be prepared to present robots to new professionals as facilitator tools and not as competing elements, promoting motivation for work. This motivation may be due, for example, to the fact that professionals can control the technology, just as they control a vacuum cleaner at the same time as it facilitates a task [31].

The process of adapting to this new reality must be progressive to be successful, and environments must not be fully robotized, or predictably, success will be occasional. This research contributes to reducing the gap in the literature on the use of robots in the hospitality industry from the point of view of students and future professionals in this area, since most of the research has been conducted with tourists.

It is important that both professionals and academics are aware of the fact that robots represent one of the most effective forms of hospitality technology and that their presence will help ensure higher levels of guest satisfaction. Thus, this study contributes to promote reflection on the advantages of internal automation, particularly with regard to mobilizing staff members to perform other tasks that require human contact. Many functions will be able to be performed with a higher level of precision since technology can perform functions uninterruptedly, which is not possible by humans.

*5.2. Limitations and Future Research.* As a relatively new and still developing topic, it is crucial to scientifically monitor future changes and trends. Considering that it involves

potential impacts related to individuals (human resources) research should be people and emotion-focused. Further studies can clarify and anticipate problems related to the application of this type of technology in the tourism industry, avoiding not-so-good consequences for both staff and customers.

A limitation of this research is related to the fact that only students from higher education institutions in two Portuguese regions were used: Lisbon and in the western region of Portugal. Although the institutions receive students from all over the country, as well as international students, the analysis would have been more robust if the questionnaires had been applied in higher education institutions more diversified geographically. The fact that a convenience sample was used brings with it the disadvantage of making it impossible to make inferences at the population level. It is also considered relevant to compare the perception of students from different countries on the use of robots in the hotel industry to understand whether different culture backgrounds influence this perception.

Resistance to change from the more experienced generation can be mitigated by using the younger generations, as their propensity for technology, related to artificial intelligence, is almost natural. This means that the perceptions from younger generations can assist in the creation of codes of ethics and of conduct, combined with the human resources from the hospitality industry, to reduce any adverse impacts.

## Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

## Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

## Acknowledgments

This work is financed by the national funds through Foundation for Science and Technology (FCT), IP, within the scope of the reference project (UIDB/04470/2020).

## References

- [1] C. D. de la Lastra, *Cenário de crise: as primeiras oportunidades para os gestores nas Áreas de hotelaria & turismo com formaçãõ de qualidade | Ambitur*, Ambitur, 2020, Available: <https://www.ambitur.pt/cenario-de-crise-as-primeiras-oportunidades-para-os-gestores-nas-areas-de-hotelaria-turismo-com-formacao-de-qualidade/>.
- [2] S. Park, "Multifaceted trust in tourism service robots," *Annals of Tourism Research*, vol. 81, article 102888, 2020.
- [3] L. Chan, L. Hogaboam, R. Cao, L. Chan, L. Hogaboam, and R. Cao, "Artificial intelligence in tourism and hospitality," in *Applied Artificial Intelligence in Business*, pp. 213–229, Springer, 2022.
- [4] D. Belanche, L. V. Casalo, and C. Flavián, "Frontline robots in tourism and hospitality: service enhancement or cost reduction?," *Electronic Markets*, vol. 31, no. 3, pp. 477–492, 2021.
- [5] International Federation of Robotics, "Executive summary world robotics 2022- service robots," 2022. Available: [https://ifr.org/img/worldrobotics/Executive\\_Summary\\_WR\\_Service\\_Robots\\_2022.pdf](https://ifr.org/img/worldrobotics/Executive_Summary_WR_Service_Robots_2022.pdf).
- [6] D. Belanche, L. V. Casalo, C. Flavián, and J. Schepers, "Service robot implementation: a theoretical framework and research agenda," *The Service Industries Journal*, vol. 40, no. 3-4, pp. 203–225, 2020.
- [7] N. Naumov, "The impact of robots, artificial intelligence, and service automation on service quality and service experience in hospitality," in *Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality*, S. Ivanov and C. Webster, Eds., pp. 123–133, Emerald Publishing Limited, 2019.
- [8] H. Qiu, M. Li, B. Shu, and B. Bai, "Enhancing hospitality experience with service robots: the mediating role of rapport building," *Journal of Hospitality Marketing & Management*, vol. 29, no. 3, pp. 247–268, 2020.
- [9] K. Blöcher and R. Alt, "AI and robotics in the European restaurant sector: assessing potentials for process innovation in a high-contact service industry," *Electronic Markets*, vol. 31, no. 3, pp. 529–551, 2021.
- [10] F. Seyitoğlu and S. Ivanov, "A conceptual framework of the service delivery system design for hospitality firms in the (post-)viral world: the role of service robots," *International Journal of Hospitality Management*, vol. 91, article 102661, 2020.
- [11] I. Tussyadiah, "A review of research into automation in tourism: launching the annals of tourism research curated collection on artificial intelligence and robotics in tourism," *Annals of Tourism Research*, vol. 81, article 102883, 2020.
- [12] V. Di Pasquale, V. De Simone, V. Giubileo, and S. Miranda, "A taxonomy of factors influencing worker's performance in human-robot collaboration," *IET Collaborative Intelligent Manufacturing*, vol. 5, no. 1, article e12069, 2023.
- [13] F. Correia, S. Christeson, S. F. Mascarenhas, A. Paiva, and M. Fraune, "I know I am, but what are you? How culture and self-categorization affect emotions toward robots," *Proceedings of the ACM on Human-Computer Interaction*, vol. 6, no. CSCW2, pp. 1–19, 2022.
- [14] C. Lloyd and J. Payne, "Digital skills in context: working with robots in lower-skilled jobs," *Economic and Industrial Democracy*, 2022.
- [15] M. Ivkov, I. Blešić, B. Dudić, G. Pajtinková Bartáková, and Z. Dudić, "Are future professionals willing to implement service robots? Attitudes of hospitality and tourism students towards service robotization," *Electronics*, vol. 9, no. 9, p. 1442, 2020.
- [16] W. L. Rongshen Lai and W. Yongming, "Review of research on the key technologies, application fields and development trends of intelligent robots," in *Intelligent Robotics and Applications*, Springer International Publishing, 2018.
- [17] M. O. Riedl, "Human-centered artificial intelligence and machine learning," *Human Behavior and Emerging Technologies*, vol. 1, no. 1, pp. 33–36, 2019.
- [18] Y. Tong, F. Wang, and W. Wang, "Fairies in the box: children's perception and interaction towards voice assistants," *Human Behavior and Emerging Technologies*, vol. 2022, article 1273814, 8 pages, 2022.

- [19] I. Giorgi, F. A. Tiroto, O. Hagen et al., "Friendly but faulty: a pilot study on the perceived trust of older adults in a social robot," *IEEE Access*, vol. 10, pp. 92084–92096, 2022.
- [20] M. O. Parvez, H. Arasli, A. Oztüren, R. N. Lodhi, and V. Ongsakul, "Antecedents of human-robot collaboration: theoretical extension of the technology acceptance model," *Journal of Hospitality and Tourism Technology*, vol. 13, no. 2, pp. 240–263, 2022.
- [21] N. Drexler and V. Beckman Lapré, "For better or for worse: shaping the hospitality industry through robotics and artificial intelligence," *Research in Hospitality Management*, vol. 9, no. 2, pp. 117–120, 2019.
- [22] D. A. Collier, "The service sector revolution: the automation of services," *Long Range Planning*, vol. 16, no. 6, pp. 10–20, 1983.
- [23] V. W. S. Tung and R. Law, "The potential for tourism and hospitality experience research in human-robot interactions," *International Journal of Contemporary Hospitality Management*, vol. 29, no. 10, pp. 2498–2513, 2017.
- [24] W. P. Andrew, "Hospitality education and the technological revolution," *Hospitality Education and Research Journal*, vol. 8, no. 2, pp. 15–21, 1984.
- [25] A. Melis, *Corporate Governance in Europe: An Empirical Analysis of the Italian Case among Non Financial Listed Companies*, Elsevier, 1998.
- [26] M. C. Wanner and T. F. Herkommer, "Off-line programming for the aircraft cleaning robot "SKYWASH"," *Proceedings of IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS'94)*, vol. 3, pp. 1972–1979, 1994.
- [27] H. Werthner and S. Klein, *Information Technology and Tourism: A Challenging Relationship*, Springer-Verlag Wien, 1999.
- [28] N. Kawarazaki, I. Hoya, K. Nishihara, and T. Yoshidome, "7 cooperative welfare robot system using hand gesture instructions," in *Advances in Rehabilitation Robotics*, pp. 143–153, Springer Berlin Heidelberg, Berlin, Heidelberg, 2004.
- [29] A. Melis, S. Carta, and S. Del Rio, "CSR and integrated triple bottom line reporting in Italy: case study evidence," in *Corporate Social Responsibility*, Edward Elgar Publishing, 2009.
- [30] F. Melissen, J.-P. Van der Rest, S. Josephi, and R. Blomme, *Hospitality Experience*, Routledge, 2019.
- [31] S. Ivanov and C. Webster, "Perceived appropriateness and intention to use service robots in tourism," in *Information and Communication Technologies in Tourism 2019*, J. P. Cham and J. Neidhardt, Eds., pp. 237–248, Springer International Publishing, 2019.
- [32] A. Rosete, B. Soares, J. Salvadorinho, J. Reis, and M. Amorim, *Service Robots in the Hospitality Industry: An Exploratory Literature Review*, Springer, 2020.
- [33] A. Khaliq, A. Waqas, Q. A. Nisar, S. Haider, and Z. Asghar, "Application of AI and robotics in hospitality sector: a resource gain and resource loss perspective," *Technology in Society*, vol. 68, article 101807, 2022.
- [34] J. Murphy, U. Gretzel, and J. Pesonen, "Marketing robot services in hospitality and tourism: the role of anthropomorphism," *Journal of Travel & Tourism Marketing*, vol. 36, no. 7, pp. 784–795, 2019.
- [35] R. de Kervenoael, R. Hasan, A. Schwob, and E. Goh, "Leveraging human-robot interaction in hospitality services: Incorporating the role of perceived value, empathy, and information sharing into visitors' intentions to use social robots," *Tourism Management*, vol. 78, article 104042, 2020.
- [36] V. Kazandzhieva and H. Filipova, "Customer attitudes toward robots in travel, tourism, and hospitality: a conceptual framework," in *Robots, Artificial Intelligence, and Service Automation in Travel, Tourism and Hospitality*, Emerald Publishing Limited, 2019.
- [37] N. Samala, B. S. Katkam, R. S. Bellamkonda, and R. V. Rodriguez, "Impact of AI and robotics in the tourism sector: a critical insight," *Journal of Tourism Futures*, vol. 8, no. 1, pp. 73–87, 2022.
- [38] J. Bowen and C. Morosan, "Beware hospitality industry: the robots are coming," *Worldwide Hospitality and Tourism Themes*, vol. 10, no. 6, pp. 726–733, 2018.
- [39] A. Tuomi, I. P. Tussyadiah, and J. Stienmetz, "Applications and implications of service robots in hospitality," *Cornell Hospitality Quarterly*, vol. 62, no. 2, pp. 232–247, 2021.
- [40] D. Buhalis and M. Foerste, "SoCoMo marketing for travel and tourism: empowering co-creation of value," *Journal of Destination Marketing & Management*, vol. 4, no. 3, pp. 151–161, 2015.
- [41] T. Baum, "Hospitality employment 2033: a backcasting perspective (invited paper for 'luminaries' special issue of International Journal of Hospitality Management)," *International Journal of Hospitality Management*, vol. 76, pp. 45–52, 2019.
- [42] P. Christou, A. Simillidou, and M. C. Stylianou, "Tourists' perceptions regarding the use of anthropomorphic robots in tourism and hospitality," *International Journal of Contemporary Hospitality Management*, vol. 32, no. 11, pp. 3665–3683, 2020.
- [43] C.-M. Kuo, L.-C. Chen, and C.-Y. Tseng, "Investigating an innovative service with hospitality robots," *International Journal of Contemporary Hospitality Management*, vol. 29, no. 5, pp. 1305–1321, 2017.
- [44] M. D. M. A. Almeida, "Robots, inteligencia artificial y realidad virtual: una aproximación en el sector del turismo," *Cuadernos de Turismo*, vol. 1, no. 44, pp. 13–26, 2019.
- [45] T. Allman, "BBC News. China restaurant introduces robot waiters," 2014, Available: <https://www.bbc.com/news/av/world-asia-30460737>.
- [46] L. Lu, R. Cai, and D. Gursoy, "Developing and validating a service robot integration willingness scale," *International Journal of Hospitality Management*, vol. 80, pp. 36–51, 2019.
- [47] S. H. Kim, S. R. Yoo, and H. M. Jeon, "The role of experiential value, novelty, and satisfaction in robot barista coffee shop in South Korea: COVID-19 crisis and beyond," *Service Business*, vol. 16, pp. 771–790, 2022.
- [48] Z. Yan, R. Gaspar, and T. Zhu, "How humans behave with emerging technologies during the COVID-19 pandemic?," *Human Behavior and Emerging Technologies*, vol. 3, no. 1, pp. 5–7, 2021.
- [49] Z. Yan, "Unprecedented Pandemic, Unprecedented Shift, and Unprecedented Opportunity," *Human Behavior and Emerging Technologies*, vol. 2, no. 2, pp. 110–112, 2020.
- [50] D. Gursoy, O. H. Chi, L. Lu, and R. Nunkoo, "Consumers acceptance of artificially intelligent (AI) device use in service delivery," *International Journal of Information Management*, vol. 49, pp. 157–169, 2019.
- [51] D. Buhalis and I. Moldavska, "Voice assistants in hospitality: using artificial intelligence for customer service," *Journal of Hospitality and Tourism Technology*, vol. 13, no. 3, pp. 386–403, 2022.
- [52] M. Mildred Tapfuma and R. Musavengane, "COVID-19 and employee-customer relationship: hotel frontline employee

- perceptions,” *Journal of Human Resources in Hospitality & Tourism*, vol. 21, no. 1, pp. 31–56, 2022.
- [53] K. F. MacDorman, S. K. Vasudevan, and C.-C. Ho, “Does Japan really have robot mania? Comparing attitudes by implicit and explicit measures,” *AI & Society*, vol. 23, no. 4, pp. 485–510, 2009.
- [54] S. S. Yilmaz and A. D. A. Tasci, “Circumstantial impact of contact on social distance,” *Journal of Tourism and Cultural Change*, vol. 13, no. 2, pp. 115–131, 2015.
- [55] F. Seyitoğlu and S. Ivanov, “Service robots as a tool for physical distancing in tourism,” *Current Issues in Tourism*, vol. 24, no. 12, pp. 1631–1634, 2021.
- [56] A. Tuomi, I. Tussyadiah, and J. Stienmetz, “Service robots and the changing roles of employees in restaurants: a cross cultural study,” *E-review of Tourism Research*, vol. 17, no. 5, 2020.
- [57] Y. Choi, M. Oh, M. Choi, and S. Kim, “Exploring the influence of culture on tourist experiences with robots in service delivery environment,” *Current Issues in Tourism*, vol. 24, no. 5, pp. 717–733, 2021.
- [58] M. Martins and C. Costa, “Are the Portuguese ready for the future of tourism? A technology acceptance model application for the use of robots in tourism,” *Revista Turismo & Desenvolvimento*, vol. 36, no. 2, pp. 39–54, 2021.
- [59] S. Lew, G. W.-H. Tan, X.-M. Loh, J.-J. Hew, and K.-B. Ooi, “The disruptive mobile wallet in the hospitality industry: an extended mobile technology acceptance model,” *Technology in Society*, vol. 63, article 101430, 2020.
- [60] P. K. McClure, ““You’re Fired,” “You’re fired,” says the robot,” *Social Science Computer Review*, vol. 36, no. 2, pp. 139–156, 2018.
- [61] G. Sharma, “Pros and cons of different sampling techniques,” *International Journal of Applied Research*, vol. 3, no. 7, pp. 749–752, 2017.
- [62] R. M. Furr, *Psychometrics: An Introduction*, SAGE publications, 2021.
- [63] C. L. Dolbier, J. A. Webster, K. T. McCalister, M. W. Mallon, and M. A. Steinhardt, “Reliability and validity of a single-item measure of job satisfaction,” *American Journal of Health Promotion*, vol. 19, no. 3, pp. 194–198, 2005.
- [64] A. J. Littman, E. White, J. A. Satia, D. J. Bowen, and A. R. Kristal, “Reliability and validity of 2 single-item measures of psychosocial stress,” *Epidemiology*, vol. 17, no. 4, pp. 398–403, 2006.
- [65] J. F. Hair, W. C. Black, B. J. Babin, R. E. Anderson, and R. Tatham, *Multivariate Data Analysis*, Pearson Prentice Hall, 2010.
- [66] Y. Xia and Y. Yang, “The influence of number of categories and threshold values on fit indices in structural equation modeling with ordered categorical data,” *Multivariate Behavioral Research*, vol. 53, no. 5, pp. 731–755, 2018.
- [67] F. Valentini and B. F. Damásio, “Variância média extraída e confiabilidade composta: indicadores de precisão,” *Psicologia: Teoria e Pesquisa*, vol. 32, no. 2, 2016.
- [68] C. Fornell and D. F. Larcker, “Evaluating structural equation models with unobservable variables and measurement error,” *Journal of Marketing Research*, vol. 18, no. 1, pp. 39–50, 1981.
- [69] J. Marôco, “Análise de equações estruturais: fundamentos teóricos, software e aplicações. Portugal: ReportNumber,” 2014, Recuperado de <https://books.google.com.br>.
- [70] K. J. Preacher and G. J. Leonardelli, “Calculation for the Sobel Test: An Interactive Calculation Tool for Mediation Tests [Online software],” 2010, <http://www.people.ku.edu/~preacher/sobel/sobel.htm>.
- [71] P. J. Benckendorff, Z. Xiang, and P. J. Sheldon, *Tourism Information Technology*, Cabi, 2019.
- [72] F. L. M. Ismail, A. Ismai, N. A. Abd Wahab, and L. A. Latiff, “Job satisfaction and work-life quality among employees of hotel industry in Malaysia,” *International Journal of Civil Engineering and Technology*, vol. 10, no. 4, pp. 2285–2293, 2019.
- [73] F. Fusté-Forné and T. Jamal, “Co-creating new directions for service robots in hospitality and tourism,” *Tourism and Hospitality*, vol. 2, no. 1, pp. 43–61, 2021.
- [74] A. N. Stamate, G. Sauvé, and P. L. Denis, “The rise of the machines and how they impact workers’ psychological health: an empirical study,” *Human Behavior and Emerging Technologies*, vol. 3, no. 5, pp. 942–955, 2021.
- [75] I. Carvalho, S. Lopes, A. Madeira, T. Palrão, and A. S. Mendes, “Robot coworkers: the vision of future hoteliers,” *Human Behavior and Emerging Technologies*, vol. 2022, article 8567289, 13 pages, 2022.
- [76] J.-C. Giger, N. Piçarra, P. Alves-Oliveira, R. Oliveira, and P. Arriaga, “Humanization of robots: is it really such a good idea?,” *Human Behavior and Emerging Technologies*, vol. 1, no. 2, pp. 111–123, 2019.
- [77] Y. Xue, “A review on intelligent wearables: uses and risks,” *Human Behavior and Emerging Technologies*, vol. 1, no. 4, pp. 287–294, 2019.
- [78] G. Hofstede, “Dimensionalizing cultures: the Hofstede model in context,” *Online Readings in Psychology and Culture*, vol. 2, no. 1, p. 2307, 2011.
- [79] K. Gannouni and L. Ramboarison-Lalao, “Examining gender effects on leadership among future managers: comparing Hofstede’s masculine vs. feminine countries,” *Management International/International Management/Gestión Internacional*, vol. 23, pp. 42–51, 2019.
- [80] E.-M. Sent and A. L. J. Kroese, “Commemorating Geert Hofstede, a pioneer in the study of culture and institutions,” *Journal of Institutional Economics*, vol. 18, no. 1, pp. 15–27, 2022.
- [81] H. Kharouf, H. Sekhon, S. M. Fazal-e-Hasan, E. Hickman, and G. Mortimer, “The role of effective communication and trustworthiness in determining guests’ loyalty,” *Journal of Hospitality Marketing & Management*, vol. 28, no. 2, pp. 240–262, 2019.
- [82] H. Osawa, A. Ema, H. Hattori et al., “What is real risk and benefit on work with robots?: From the analysis of a robot hotel,” in *Proceedings of the Companion of the 2017 ACM/IEEE International Conference on Human-Robot Interaction*, pp. 241–242, Vienna, Austria, 2017.
- [83] S. H. Ivanov and C. Webster, “Designing robot-friendly hospitality facilities,” in *Proceedings of the Scientific Conference “Tourism. Innovations. Strategies”*, pp. 13–14, Bourgas, Bulgaria, 2017.
- [84] N. Savela, T. Turja, R. Latikka, and A. Oksanen, “Media effects on the perceptions of robots,” *Human Behavior and Emerging Technologies*, vol. 3, no. 5, pp. 989–1003, 2021.