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Attitude towards service robots in tourism and hospitality services settings – The effect of multidimensional anthropomorphism and technology readiness

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Abstract

The use of technology in tourism is increasing day by day. Service robots are now on the agenda. The success of developments that envisage a new experience for consumer tourists depends on the accurate prediction of tourists' possible attitudes and behaviors and the influencing antecedents. This study examined consumer tourists' attitudes and usage intentions towards service robots on the multidimensional basis of anthropomorphism and technological readiness (TR). A survey was conducted with 1018 tourists in Türkiye face-to-face and using QR codes. Findings showed that attitude towards service robots (AR) mediated the relationship between anthropomorphism, technological readiness and intention to use (IS). Participating tourists anthropomorphically focused on the physical appearance of the robots rather than their functions and internal structures. Service robot experience is still limited in the tourism industry. Therefore, the empirical results obtained are guiding theory and practice in terms of academic studies and tourism service providers.

KEYWORDS

anthropomorphism, intention to use, service robots, technology readiness, tourism and hospitality

1 | INTRODUCTION

Service robots, widely recognized as a driving factor in the remarkable shift observed in the service industry in recent years (Hou et al., 2021), are redefining service deliveries (Chen, Xue, et al., 2022). Service robots are information technology in a physical embodiment, providing customized services by performing physical as well as non-physical tasks with a high degree of autonomy (Jörling et al., 2019), and used in service settings of tourism and hospitality (T&H) industry such as theme and amusement parks, car rental, restaurants, airports, hotels, galleries, and museums (Choi et al., 2021; Ivanov et al., 2017; Kim & Cha, 2024). In the T&H domain, service robots interact with customers directly or indirectly and provide various services such as

guided tours or transportation (Guan et al., 2022). Due to the market potential of service robots in the T&H, it is crucial to investigate customer attitudes (Go et al., 2020). Because T&H is a human-centered industry, acceptance of robotic technologies is based on customers (Lu et al., 2019). Regarding customer perceptions of emerging technologies such as service robots, Ivanov et al. (2018) state that AR will vary from person to person, and that attitudes will be critical in accepting or against robot technologies.

Researchers have examined a variety of antecedents that may influence the acceptance of service robots in T&H. Researchers have found that age (Ayyildiz et al., 2022), gender (Ivanov et al., 2020), hedonic motivation (Lin et al., 2020), occupation (Ivanov & Webster, 2019), success desire (Tojib et al., 2022), and place of

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residence (Ivanov et al., 2018) affect tourists' attitudes. Among the other variables examined in the HRI research in T&H service settings were interest, job appropriateness, perceived enjoyment (Abou-Shouk et al., 2021), perceived reliability, perceived usefulness (Ivanov, Duglio, & Beltramo, 2023; Ivanov, Webster, & Seyitoğlu, 2023), perceived safety, and hedonic perceptions (Molinillo et al., 2023).

Despite studies focusing on many socioeconomic and technological aspects, various antecedents are still required to obtain deeper insights into attitudes and adoption toward service robots (Ladeira et al., 2023). Anthropomorphism and TR were chosen in this study, which focused on AR. Although anthropomorphism is a dominating subject of study in HRI (Madhan et al., 2023), there are limited studies that investigate anthropomorphism in many dimensions context of T&H. We cannot fully unveil the importance of anthropomorphism in the T&H domain without examining how it can be perceived (Ding et al., 2022). Song, Li, et al. (2024) studied the impact of robot anthropomorphism on hotel guests' word-of-mouth marketing and continuous usage intentions. Kim et al. (2023) examined the effect of physical and psychological anthropomorphic dimensions of service robots on consumer acceptance. In another study, So et al. (2024) examined the influence of anthropomorphism on consumer perceptions, focusing on the physical appearance of robots. The authors suggested that future research should consider other aspects of anthropomorphism. To evaluate anthropomorphism in a multidimensional manner, we employed "anthropomorphic robot elements perceived by tourists: surface, functional, and inner" in the current study (Christou et al., 2020). Although human resemblance primary anthropomorphic dimension developing AR in the T&H service settings (Jia et al., 2021), the lack of empathy and genuine emotions towards humans (Yildiz et al., 2022) or low communication skills can lead to dissatisfaction (Złotowski et al., 2016). The obvious effects of human-like behavior on users indicate that anthropomorphism extends beyond physical design (Spatola et al., 2021). An anthropomorphic robot's humanlike appearance includes not only its face but also its behaviors and emotions (Murphy, Gretzel, & Hofacker, 2017; Murphy, Hofacker, & Gretzel, 2017). As a result, we evaluated anthropomorphism based on appearance, function, and empathy. Nevertheless, the significance of anthropomorphism is still contingent upon the attributes of individuals. However, the attributes of individuals to accept robots are understudied (Li et al., 2023). Considering that the research was conducted with potential inexperienced tourists in robot usage, we used TR as it helps to determine whether they are ready to use new technologies (Walczuch et al., 2007). For instance, Soliman et al. (2024) examined consumers' behavior towards service robots within the context of TR. They found that discomfort and insecurity can lead to concerns about robots, which affect emotional expectations. TR, as compared to consumer-motivated technology acceptance models, captures both positive and negative cognitive appraisals of technology. It can also provide insights into categorizing potential tourists based on their tendency towards embracing service robots, as it ties to technology use and personality (Flavián et al., 2022). As long as service robots are disruptive technologies, TR is suggested for use in HRI research since it will be exploratory (Belanche et al., 2020).

Based on the aforementioned, this research aims to investigate how anthropomorphism and technological readiness affect people's attitudes toward robots. Specifically, the research aims to explore (a) how the various dimensions of anthropomorphism, such as functional and internal aspects, besides external appearance, influence attitudes towards robots, and (b) how individuals' general attitudes towards technology, including positive aspects (optimism and innovativeness), and negative aspects (discomfort and insecurity), affect their attitudes towards robots. This study advances anthropomorphism research from different contexts. Using TR, this study contributes to pre-experience research by examining the attitudes of tourists who have not yet encountered service robots in the T&H service settings. Husain et al. (2023) conducted a bibliometric analysis of anthropomorphism research in various contexts. According to their findings, studies on anthropomorphism were predominantly conducted in the USA, China, and India. Thus, the current research in a Turkish sample enhances our understanding of HRI.

2 | LITERATURE REVIEW

Anthropomorphism is described as attributing human psychological and physical characteristics to inanimate beings, animals, and natural occurrences (Salles et al., 2020). Anthropomorphism consists of three dimensions: physical, internal, and functional, which include the shape, behavior, and human interaction/communication of robots (Fink, 2012). Accordingly, the physical dimension of anthropomorphism comprises the appearance and mimicry of robots, while the functional dimension includes the robot's features such as listening and speaking. The internal dimension refers to the robot's emotions and functions, such as its ability to sympathize with people (Christou et al., 2020).

A considerable number of studies have been conducted on the anthropomorphism of robots in T&H service settings (Akdım et al., 2023; Christou et al., 2020; Murphy, Gretzel, & Hofacker, 2017; Murphy, Hofacker, & Gretzel, 2017; Seo, 2022). According to a study done by Kim et al. (2023), people are more likely to accept robot barista services when the robots have moderate physical anthropomorphism and high psychological anthropomorphism (service autonomy). Shah et al. (2023) investigated the relationship between robot service quality, customer loyalty, and anthropomorphism in restaurant service settings. The results suggested that as robot anthropomorphism increased, customer interaction also increased in restaurant service settings. In a different study, Qin et al. (2023) examined the relationship between the anthropomorphism of robots employed in frontline roles within hotels and restaurants and trust. It was found that customers tend to trust service robots more if robots have more appearance anthropomorphism. Li et al. (2023) suggested that affective human-likeness of service robots, such as facial expressions, may violate relationship norms and lead to decreased consumer satisfaction in frontline service encounters. The findings indicated that although affective human likeness did not sharply decline consumer satisfaction, they did cause social discomfort, resulting in lower levels of positive consumer satisfaction.

Previous research has indicated that anthropomorphism can affect behavioral intentions. However, anthropomorphism alone may not always be enough to predict behavioral intentions. For instance, in a recent study conducted by Song, Gu, et al. (2024), it was discovered that the anthropomorphism of robots did not have a significant impact on hotel guests' continuance usage intention. The authors suggest that anthropomorphic features alone do not lead to the acceptance of artificial intelligence devices. In this context, TR stands out due to its correlation with people's technology attitudes and key personal characteristics (Hailey Shin et al., 2021). TR developed by Parasuraman (2000) refers to "people's propensity to embrace and use new technologies for accomplishing goals in home life and at work" (p. 308). It measures individuals' whether they are ready to use new technologies and their behaviors toward these technologies (Walczuch et al., 2007). The TR is divided into four dimensions: discomfort, insecurity, optimism and innovativeness. Discomfort and insecurity are inhibitors, while optimism and innovativeness are motivators (Parasuraman & Colby, 2015). Optimism refers to thoughts about the efficiency of technology, whereas innovativeness refers to the technology's pioneering. Furthermore, discomfort is described as a perceived feeling of suffocation from technology, and insecurity refers to mistrust about the potential negative consequences of technology (Parasuraman & Colby, 2015). Baltaci and Dang (2023) conducted a study on the potential tourist reviews of the Henna Hotel, a robotic hotel situated in Japan. The authors observed that the discomfort and insecurity of potential tourists toward robots outweighed optimism and innovativeness. The authors emphasized that individuals are not yet ready for robotic services. Qin et al. (2023) investigated the moderating effect of TR. They found that customers' trust in service robots varied across different groups of characteristics. For instance, individuals who are optimistic about technology might have a more favorable perception of HRI than those who are pessimistic (Hailey Shin et al., 2021). Individuals may exhibit different behaviors when adopting a new technology based on characteristics such as innovativeness, skepticism, and curiosity (Errichello et al., 2019). In this study, we explore how people's behavioral intentions towards HRI are influenced by multidimensional anthropomorphism and TR.

3 | HYPOTHESES DEVELOPMENT

3.1 | Anthropomorphism in the HRI

In the context of HRI, anthropomorphism leads robots to be considered social creatures and has a major influence on consumer adoption (Ruiz-Equihua et al., 2023). So much so that when robots are physically and emotionally resembling people, they can generate emotional relationships among customers (Złotowski et al., 2015). Anthropomorphic characteristics, particularly in T&H service settings, influence tourists' adaption and efficient usage of service robots. As a result of this harmony, tourists connect with the destination, business, or product, enabling anthropomorphism a driving factor in HRI (Ding et al., 2022). Jia et al. (2021) found that anthropomorphism had a

positive impact on user satisfaction with service robots, purchase intention, and attitude towards the hotel. Thus, we posit:

H1. Anthropomorphism has a positive effect on AR.

3.1.1 | Physical anthropomorphism and AR

Previous research has indicated that people have negative perceptions toward extremely humanoid robots (Citak et al., 2021; Lin et al., 2020; Lu et al., 2019). Because it is perceived as less reliable than a machine-like robot (Złotowski et al., 2016). Bartneck et al. (2009) claim that a robot's extremely humanoid appearance raises consumer expectations that the robot cannot meet, and failure to meet those expectations can result in disappointment. Contrary to these findings, several studies have shown that consumers prefer humanoid robots to machine-like robots (Belanche et al., 2021; Christou et al., 2020). Since the T&H industry relies heavily on social relationships, humanoid appearance enhances tourists' emotional bonds and their acceptance of robots (Kazandzhieva & Filipova, 2019), which can lead to higher visitor satisfaction (Jia et al., 2021). We propose the following hypothesis based on the existing literature:

H1a. Physical anthropomorphism has a positive effect on AR.

3.1.2 | Functional anthropomorphism and AR

As well as physical anthropomorphism, functional anthropomorphism affects individual feelings of closeness towards robots. For instance, the inability to respond to unique customer requirements (Akdim et al., 2023; Złotowski et al., 2016) or limited language capabilities (Tung & Au, 2018) could contribute to consumer dissatisfaction with service robots. According to Lin and Mattila (2021), hotel consumers' AR is positively influenced by their functional benefits. Therefore, the functional capabilities of robotic technologies in T&H service areas are crucial for contributing to HRI (Kazandzhieva & Filipova, 2019). In a recent study, Ivanov, Duglio, and Beltramo (2023) and Ivanov, Webster, and Seyitoğlu (2023) point out that when tourists see robots as functional, they will show high acceptance if they are confident that they will perform the tasks correctly. In light of the functional qualities of service robots such as advising customers at the reception or serving food and beverages in restaurants (Hlee et al., 2023), we propose the **H1b** hypothesis:

H1b. Functional anthropomorphism has a positive effect on AR.

3.1.3 | Internal anthropomorphism and AR

According to Christou et al. (2020), robots that understand customer needs and greet them humbly are essential in building a positive

attitude in service industries such as T&H that focus on hospitality. Because the emotion and empathy lack of robots compared to human employees can lead to negative consequences in HRI (Reis et al., 2020; Yıldız et al., 2022). Seyitoğlu et al. (2021) evaluated restaurant managers' and customers' AR. The results showed that employing service robots will reduce customer pleasure and harm the firm because they lack human-specific skills such as emotion, socializing, and smiling. As the T&H industry is perceived as a people's business, internal anthropomorphic characteristics will improve the willingness to accept service robots (Ivanov, Duglio, & Beltramo, 2023; Ivanov, Webster, & Seyitoğlu, 2023). Based on this, we propose the H1c hypothesis:

H1c. Internal anthropomorphism has a positive effect on AR.

3.2 | Technology readiness

It has been found that TR is a valuable construct for understanding people's attitudes about cutting-edge technologies (Blut & Wang, 2020). Consumers are less engaged in AI environments when they are less optimistic. Conversely, consumers are motivated to acquire experience because they perceive higher benefits. As a result, features in artificial intelligence and robotic technologies in T&H firms are related to consumer TR levels (Yin et al., 2023). Ma et al. (2022) highlight that high TR levels of consumers will cause them to be enthusiastic about robotic technologies. Overall, we hypothesize in this study that TR is a critical antecedent in influencing the attitudes of potential tourists toward service robots. Thus, we posit:

H2. Technology readiness has a negative effect on AR.

3.2.1 | Motivators of TR

Optimism positively influences people's attitudes toward technology (Hemdi et al., 2016), and those who are optimistic about the functions of technology are more likely to use it (Hailey Shin et al., 2021). Flavián et al. (2022) found that individuals' optimism about technology influenced their IS robo-advisors. According to the authors, technology optimism encourages consumers to believe that robo-advisors can perform tasks, thus encouraging the use of these tools. In hotels, service robots can provide contactless, comfortable service, which leads to positive expectations. A favorable AR is more likely when expectations, optimism, and confidence are present (Binesh & Baloglu, 2023; Yin et al., 2023). Thus, we posit:

H2a. Customers' technological optimism has a positive effect on AR.

Innovative individuals who seek uniqueness are willing to attempt and explore new technologies (Dai et al., 2015). It has been found that innovative tourists are more open to technology, prefers hotels with the latest technology, and are even willing to pay extra for technological services (Victorino et al., 2009). It has been observed that the relationship between consumers' intention to adopt and AR is influenced by consumers' technological innovation when it comes to service robots with unique functional features (Jung et al., 2023). Zhong et al. (2022) examined the use of hotel in-room service robots from the perspective of multiple stakeholders. Customer profile and perception findings indicated that Paranoids were the largest group. This group comprised highly innovative and optimistic people who were more interested in robot rooms. Thus, the following hypothesis is proposed:

H2b. Customers' technological innovativeness has a positive effect on AR.

3.2.2 | Inhibitors of TR

According to studies of different technologies, including self-service and mobile, consumers' discomfort with technology plays a vital role in determining their willingness to use it (Elliott et al., 2008; Oh et al., 2014). Besides driving attitudes and intentions to use technology, it also distracts consumers from using technology because it affects the perceived benefits and advantages (Gao et al., 2022). Consumers who are uncomfortable about the handing over of complete control to technological systems may be hesitant to use technological services because they believe they have lost control (Flavián et al., 2022). In T&H service settings, when guests do not know how to interact with service robots and feel discomfort, they may prefer human employees (Ivanov & Webster, 2017). Furthermore, the operation of service robots in tight environments such as corridors or elevators used by guests may increase discomfort and create unfavorable perceptions (Tung & Au, 2018). Thus, we propose:

H2c. Customers' technological discomfort hurts their AR.

Insecurity is based on the outcomes of the operations that are carried out by technology rather than a lack of control (Son & Han, 2011), and it serves as a barrier to the adoption of technology (Jarrar et al., 2020). Studies on HRI, demonstrate that the use of robots is less desired in social (babysitting, entertainment, and hair-dressing) activities and will be more appropriate for jobs such as cleaning and providing information (Ivanov & Webster, 2019). These findings reveal that robots are not yet entirely trusted, and emotions of insecurity can reduce individuals' desire to adopt robots (Tussyadiah et al., 2020). In the opposite case, it has been found that persons' perceptions of trust towards smart devices increase their IS of these devices because risk perception is low (Oliveira et al., 2016). Thus, the following hypothesis is proposed:

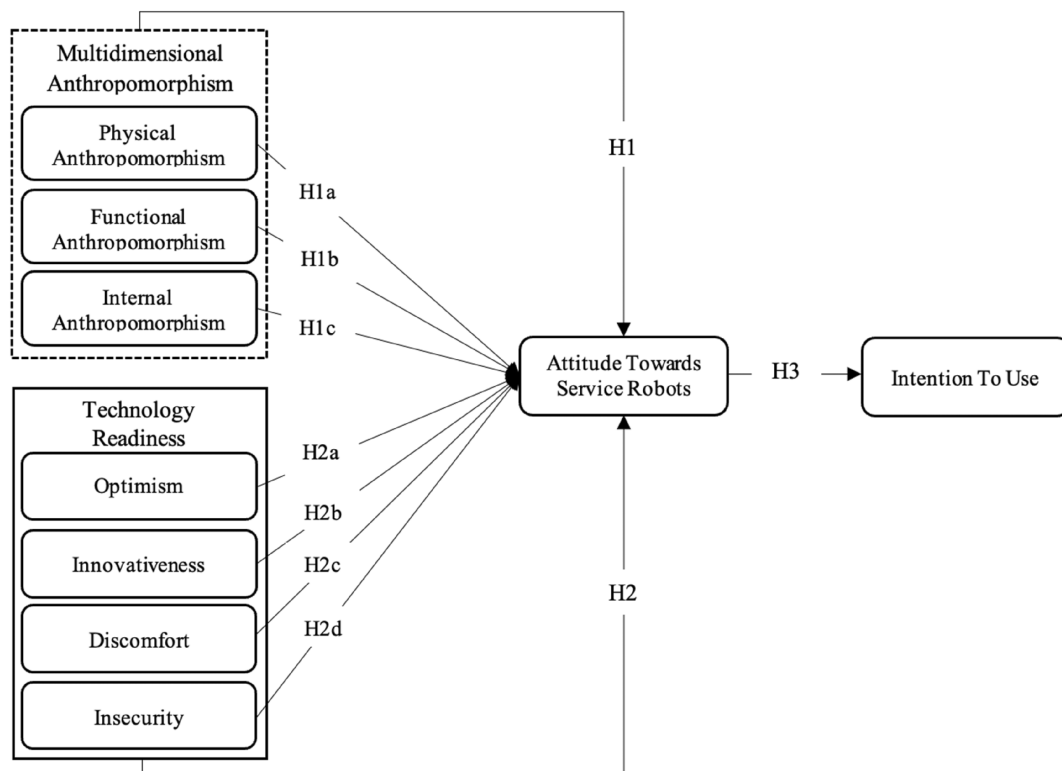


FIGURE 1 Proposed research model.

H2d. Customers' technological insecurity hurts AR.

The theoretical model of this study is depicted in Figure 1.

3.3 | Attitude toward service robots and intention to use

Attitude expresses the positive or negative assessments of individuals as one of the determinants of intention (Ajzen, 1991) and influences behaviors (Bohner & Dickel, 2011). Within the T&H domain, AR tourists' evaluations and opinions about the benefits and effects of robots. These evaluations influence travelers' perceptions and motivate them for future actions (Kazandzhieva & Filipova, 2019). Shin and Jeong (2020) proved that attitude influences the IS robot concierges. Çalli et al. (2023) found that customers' attitudes towards the use of hotels with robot staff have a significant effect on their intention to stay. Thus, we posit:

H3. Customers' AR has a positive effect on their IS.

4 | RESEARCH METHOD

4.1 | Sample and data collection

Data was collected using a survey form between April and June 2023. The data was collected in Antalya, Turkey's important mass tourism

destination. QR codes providing access to online surveys were left at 5-star hotels in the Belek, Kemer, Side, and Alanya regions of Antalya. Additionally, physical survey forms were given to tour guides. Tour guides and hotel receptionists informed tourists about the surveys. This enabled effective communication with tourists. Thus, participation in the surveys was effectively encouraged. Tourists were directed to the survey by tour guides and hotel receptionists. Every tourist over the age of 17 who was willing had the opportunity to participate in the survey. For this reason, the convenience sampling method was used. The original questionnaire was designed in English and then translated into Turkish to maximize translation validity. The form was available for self-completion in Turkish versions as hard copy or online, following tourists' preference. For validity's sake, the questionnaire was pre-tested with 50 subjects whose data were excluded from the main study. Data from 254 face-to-face surveys were obtained. 764 surveys were returned online. A total of 1018 tourists answered the research questionnaire.

4.2 | Measurements

The measurements of the study are based on existing literature. Physical anthropomorphism is adopted from Ninomiya et al. (2015), while functional and emotional anthropomorphism are derived from the studies conducted by Ivkov et al. (2020). The original version of technological readiness was developed by Parasuraman (2000) and consists of 28 items. However, in many studies, the abbreviated version has been preferred (Ma et al., 2022; Pradhan et al., 2018). Therefore,

TABLE 1 Demographic profiles.

Gender	n	%	Marital status	n	%
Men	548	53.8	Married	642	63.1
Female	470	41.7	Single	376	36.9
Previous holiday experience	n	%	Have you been vaccinated?	n	%
Yes	771	75.7	Yes	775	76.1
No	247	24.3	No	243	23.9
Age	n	%	Education	n	%
17–25	187	18.4	Primary or secondary education	79	7.7
26–38	368	36.1	High school	226	22.2
39–51	209	20.5	Undergraduate	291	28.6
52 and above	254	25	Graduate	422	41.5
Occupation	n	%	Status at work	n	%
Public personnel	221	21.7	Employee	405	39.8
Private sector	354	34.8	Manager	137	13.5
Unemployed	167	16.4	Business owner	335	32.9
Other	276	27.1	Other	141	13.8
Domestic travel	n	%	International travel	n	%
Once every few years	253	24.9	Once every few years	234	23
Once a year	274	26.9	Once a year	196	19.3
Twice a year	212	20.8	Twice a year	215	21.1
More than twice a year	279	27.4	More than twice a year	373	36.6

technological readiness was measured using the 10-item short version used in the studies by Zhong et al. (2022). AR is based on the research conducted by Heerink et al. (2009), while the IS robots are derived from Jia et al. (2021). A five-point Likert-style scale was used in all measures (1 = strongly disagree and 5 = strongly agree).

4.3 | Data analysis

In the study, the demographic characteristics of the respondents were listed by frequency analysis via SPSS 25. AMOS24 was used for measurement models, confirmatory factor analyses and hypothesis testing.

5 | FINDINGS

5.1 | Descriptive statistic

Demographic data of the participants are presented in Table 1. Accordingly, 53.8% of the participants were men and 63.1% were married. The majority (75.7%) had a holiday experience before. Nearly half of the participants (48.2%) flew domestically at least twice a year, while 57.7% flew abroad at least twice a year.

5.2 | Measurement model DFA, discriminant validity, convergent validity, and nomological validity

The constructs in our study were evaluated by several reliability and validity criteria. To assess internal consistency, we used homogeneity of variance for normality (skewness and kurtosis) and Cronbach's alpha as first-generation criteria. Model parameters were further estimated with the help of confirmatory factor analysis (CFA) using AMOS24.

As shown in Table 2 the values of skewness (−1.904 and −0.715) and kurtosis (−0.534 and 2.172) were less than the absolute value of 3, confirming that the normal distribution was followed (Kline, 2015). The mean was high, ranging between 2.78 and 4.31. The factor loadings were greater than the cut-off value ($\lambda = 0.7$). In addition, the average variance extracted (AVE) was 0.527–0.705 (>0.5), confirming convergent validity (Hair et al., 2012). For reliability, Cronbach's alpha (α) values (0.711–0.837) and composite reliability (CR) of 0.701–0.870 were close to or greater than the cut-off value (0.7) indicating the appropriate internal consistency of the measurement model (Hair et al., 2012) except for two factors (INN and DIS). Because factor structures consist of two items. Composite reliability is examined in structures with 3 or more items.

For discriminant validity, the square root of the AVE coefficient was calculated. Accordingly, the equation $\sqrt{AVE} > r$ must be satisfied

TABLE 2 Results of the measurement model.

Constructs and items	Λ	\bar{x}	SD	SK	KU
Physical anthropomorphism (PHY) (AVE = 0.632; \sqrt{AVE} = 0.757; CR = 0.870; α = 0.804; \bar{x} = 3.92)					
1. I think the robot design should be cute	0.854	3.98	0.877	-1.539	2.172
2. I think robots should have animal-like shapes	0.820	3.85	0.856	-1.715	1.849
3. I think the shape of the robot should be round	0.753	4.01	0.824	-1.564	1.552
4. I think the robot's voice should be like the voice of a living creature	0.747	3.74	0.831	-1.474	0.943
5. I think the design of the robot should be nice	0.738	4.14	0.741	-1.458	1.507
6. I think robot design must be cool	0.721	3.96	0.753	-1.271	1.984
7. I think the robot should have a human-like shape	0.709	4.09	0.789	-1.255	1.307
8. I think the robot should have a machine-like shape	0.701	3.58	0.864	-1.904	1.438
Functional anthropomorphism (FUN) (AVE = 0.612; \sqrt{AVE} = 0.741; CR = 0.824; α = 0.792; \bar{x} = 3.76)					
1. I think it would be easy to share information with robots in a service environment	0.850	4.23	0.790	-1.327	1.568
2. I think the information shared by robots in a service environment will be easily understandable	0.837	4.12	0.728	-1.154	1.301
3. I think the information provided by robots will be more reliable	0.819	3.84	0.746	-1.136	1.171
4. I think you would be comfortable interacting with robots in a service environment	0.762	3.95	0.809	-0.829	0.588
5. I think you would be more comfortable interacting with robots in a service environment than with humans	0.713	3.14	0.684	-1.205	1.249
6. I think it would be easier to interact with robots than humans in a service environment	0.703	3.27	0.714	-1.581	1.838
Internal anthropomorphism (INA) (AVE = 0.527; \sqrt{AVE} = 0.726; CR = 0.743; α = 0.711; \bar{x} = 3.49)					
1. Robots in a service environment often understand the specific needs of customers	0.754	3.46	0.825	-1.691	1.646
2. Robots should be used when they have the technology to serve customers one-on-one	0.721	4.31	0.836	-1.106	1.206
3. Robots cannot understand a customer's emotions	0.718	3.11	0.814	-1.401	1.630
4. Robots pay special attention to the customer	0.711	3.07	0.847	-1.412	1.353
Innovativeness (INN) (AVE = 0.698; \sqrt{AVE} = 0.835; CR = 0.626; α = 0.786; \bar{x} = 3.06)					
1. I can understand new technological products and services without help from others	0.844	3.14	0.859	-1.787	1.221
2. When a new technology comes out, I am one of the first in my circle of friends to buy it	0.827	2.98	0.768	-1.273	1.714
Optimism (OPT) (AVE = 0.639; \sqrt{AVE} = 0.799; CR = 0.705; α = 0.815; \bar{x} = 3.70)					
1. I like the idea of doing business via computers because they offer the opportunity to work outside working hours	0.836	3.68	0.749	-1.235	1.791
2. Technology gives people more control over their daily lives	0.809	3.89	0.837	-1.783	1.053
3. Technology makes me more efficient in my profession	0.750	3.54	0.763	-1.640	1.127
Discomfort (DIS) (AVE = 0.667; \sqrt{AVE} = 0.817; CR = 0.620; α = 0.837; \bar{x} = 3.43)					
1. New technologies are too complex to be useful	0.820	3.77	0.708	-0.884	0.734
2. When I receive technical support from a high-tech product or service provider, I sometimes feel like I'm being used by someone who knows more than I do.	0.814	3.09	0.764	-0.723	0.738
Insecurity (INS) (AVE = 0.617; \sqrt{AVE} = 0.785; CR = 0.702; α = 0.779; \bar{x} = 3.56)					
1. I do not find it safe to provide credit card information via computer	0.817	4.08	0.884	-0.894	0.349
2. I would hesitate to do business with a place that can only be reached via the internet	0.785	3.76	0.823	-0.943	0.955
3. When you send information via machines or the Internet, you can never be sure whether it goes to the right place	0.753	2.85	0.842	-0.918	0.932
Attitude towards service robots (AR) (AVE = 0.624; \sqrt{AVE} = 0.790; CR = 0.703; α = 0.776; \bar{x} = 3.72)					
1. I think using robots is a good idea	0.815	3.42	0.792	-1.105	0.923
2. I think the robot will make my holiday more interesting	0.810	3.57	0.818	-1.616	1.247
3. It is nice to make the robot usable	0.743	4.17	0.879	-1.270	0.929
Intention to use (IS) (AVE = 0.612; \sqrt{AVE} = 0.782; CR = 0.701; α = 0.782; \bar{x} = 3.07)					
1. I am willing to stay in a hotel serviced by robots	0.807	3.63	0.762	-0.808	-0.534
2. I plan to stay in a hotel serviced by robots	0.772	2.78	0.764	-0.737	-0.353
3. I will try to stay in a hotel serviced by robots	0.768	2.81	0.792	-0.715	0.539

TABLE 3 Correlations and discriminant validity ($\sqrt{\text{AVE}} > r$).

Factors	PHY	FUN	INA	INN	OPT	DIS	INS	AR	IS
PHY	1								
FUN	0.589*	1							
INA	0.624*	0.368*	1						
INN	0.471*	0.474*	0.369*	1					
OPT	0.458*	0.428*	0.257*	0.629*	1				
DIS	-0.367*	-0.227*	-0.351*	-0.417*	-0.351*	1			
INS	-0.392*	-0.352*	-0.563*	-0.207*	-0.264*	0.683*	1		
AR	0.654*	0.387*	0.413*	0.357*	0.488*	-0.541*	-0.679*	1	
IS	0.598*	0.544*	0.378*	0.224*	0.542*	-0.587*	-0.482*	0.601*	1
$\sqrt{\text{AVE}}$	0.757*	0.741	0.726	0.835	0.799	0.817	0.785	0.790	0.701

* $p \leq 0.001$.**TABLE 4** Results of the research hypotheses.

Hypotheses		Results of the research model		
		Beta (β)	T value	Results
H1	Anthropomorphism \rightarrow AR	0.62	17.58	Accepted
H1a	Physical \rightarrow AR	0.57	16.29	Accepted
H1b	Functional \rightarrow AR	0.45	16.11	Accepted
H1c	Internal \rightarrow AR	0.49	17.43	Accepted
H2	Technology Readiness \rightarrow AR	-0.14	4.51	Accepted
H2a	Optimism \rightarrow AR	0.54	12.37	Accepted
H2b	Innovativeness \rightarrow AR	0.37	6.85	Accepted
H2c	Discomfort \rightarrow AR	-0.46	8.67	Accepted
H2d	Insecurity \rightarrow AR	-0.39	7.16	Accepted
H3	AR \rightarrow IS	0.40	14.27	Accepted

(Hu & Bentler, 1999). As shown in Table 3, there is a positive significant relationship between the sub-factors of Anthropomorphism and the attitude towards service robots ([PHY: $r = 0.654$; $p \leq 0.01$]; [FUN: $r = 0.387$; $p \leq 0.01$]; [INA: $r = 0.413$]) and IS ([PHY: $r = 0.598$; $p \leq 0.01$]; [FUN: $r = 0.544$; $p \leq 0.01$]; [INA: $r = 0.378$]). There is a negative significant relationship between the two sub-factors of Technological Readiness and the attitude towards service robots ([DIS: $r = -0.541$; $p \leq 0.01$]; [INS: $r = -0.679$; $p \leq 0.01$]) and IS ([DIS: $r = -0.587$; $p \leq 0.01$]; [INS: $r = -0.482$; $p \leq 0.01$]). There is a positive significant relationship between the two sub-factors of Technological Readiness and the attitude towards service robots ([INN: $r = 0.357$; $p \leq 0.01$]; [OPT: $r = 0.488$; $p \leq 0.01$]) and IS ([INN: $r = 0.224$; $p \leq 0.01$]; [OPT: $r = 0.542$; $p \leq 0.01$]).

Nomological validity is based on the fact that factor structures appear where expected (Campbell, 1960). Previously tested scales were preferred in this study. Therefore, nomological validity was tested based on the similarity of factor structures to previous research results (Messick, 1987). Accordingly, it was seen that the three factors obtained in the anthropomorphism scale were similar to the studies of Ninomiya et al. (2015) and Ivkov et al. (2020). Everything was similar

within the scales of technological readiness (Heerink et al., 2009; Parasuraman, 2000; Zhong et al., 2022), and IS (Jia et al., 2021).

5.3 | Test of structural model

Structural equation modeling (SEM), and maximum likelihood estimation, were carried out to test the causal interconnectedness between research variables. SEM is an appropriate data analysis technique as it permits a simultaneous and comprehensive analysis of relations to be conducted (Tabachnick et al., 2013). Overall, the fit indexes for the structural model: ($\chi^2 = 173.4$; $df = 61$; $\chi^2/df = 2.84$; $p < 0.00$; RMSEA = 0.064. GFI = 0.95; AGFI = 0.92; TLI = 0.94; CFI = 0.95) propose a high model fit to the data.

Table 4 and Figure 2 display the interrelationships (direct/indirect) between the research variables. The results suggest that anthropomorphism has a positive and significant relation with AR ($\beta = 0.62$, t -value = 17.58, $p < 0.001$). Similarly, sub-factors physical anthropomorphism ($\beta = 0.57$, t -value = 16.29, $p < 0.001$), functional anthropomorphism and internal anthropomorphism ($\beta = 0.49$, t -value = 17.43,

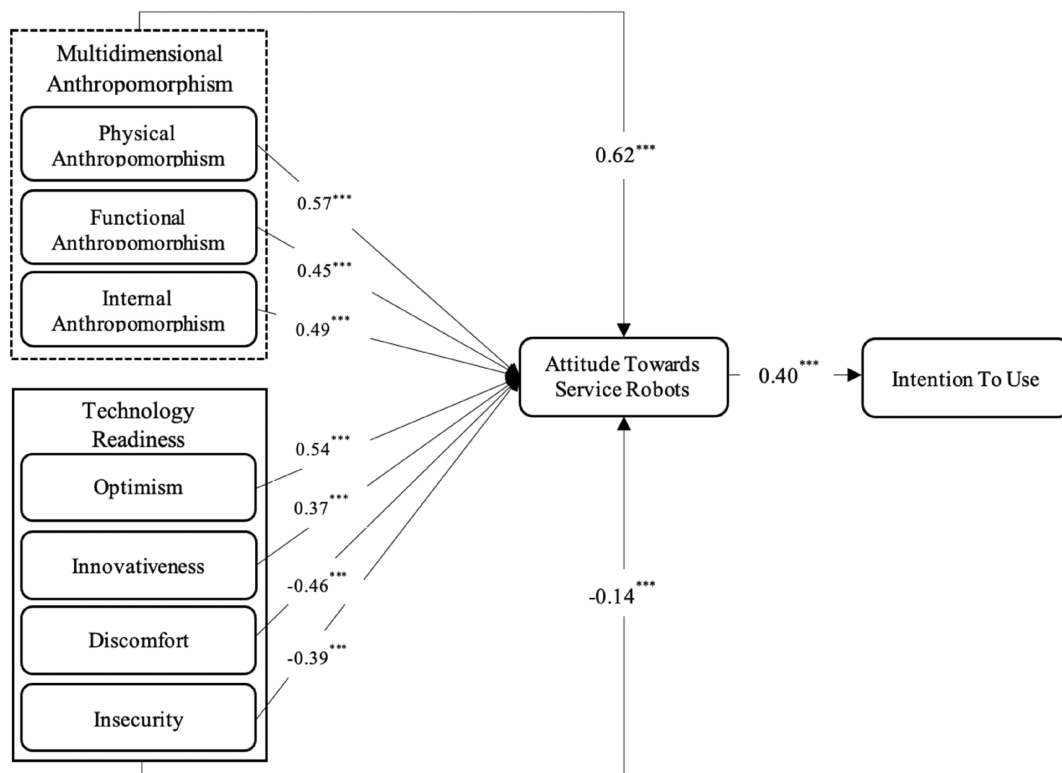


FIGURE 2 The research structural model (** $p < 0.01$).

$p < 0.001$) also have positive and significant relation with AR. Accordingly H1, H1a, H1b, and H1c were supported.

The results suggest that TR has a negative and significant relation with AR ($\beta = -0.14$, t -value = 4.51, $p < 0.001$). Similarly, sub-factors discomfort ($\beta = -0.46$, t -value = 8.67, $p < 0.001$) and insecurity ($\beta = -0.39$, t -value = 7.16, $p < 0.001$) also have negative and significant relation with AR. On the contrary, optimism ($\beta = 0.54$, t -value = 12.37, $p < 0.001$) and innovativeness ($\beta = 0.37$, t -value = 6.85, $p < 0.001$) also have positive and significant relations with AR. Accordingly H2, H2a, H2b, H2c, and H2d were supported. Finally, the effect of AR on IS is positive and significant ($\beta = 0.40$, t -value = 14.27, $p < 0.001$). Accordingly, H3 was accepted.

To detect the mediation effect, all regression coefficients were observed via recommendation from (1) Kelloway (1995) for full and partial mediation conditions; (2) Zhao et al. (2010) for direct and indirect regression procedures; and (3) SEM standardized indirect regression weights. Zhao et al. (2010) suggest that to detect mediation, whether, through employing SEM or regression, the indirect impacts only be significant to show the full effect of mediation, whereas if the direct and indirect regression coefficients are significant partial mediations are supported. Consequently, as shown in Figure 2 all relationships are significant. These results indicate that AR partially mediates the relationship between anthropomorphism and TR. The earlier result is confirmed by investigating the SEM standardized indirect impact from anthropomorphism to IS as the direct effect increased from ($\beta = 0.47$, $p < 0.001$) to a total effect of ($\beta = 0.62$, $p < 0.001$). Similarly, the direct effect of TR to IS

($\beta = -0.28$, $p < 0.001$) increased to a total effect of ($\beta = -0.14$, $p < 0.001$). These results suggest that AR mediates the relationship between anthropomorphism and TR.

6 | DISCUSSION AND CONCLUSION

6.1 | Discussion

This research empirically examines anthropomorphism and TR of tourists and their direct impact on IS as well as indirect impact through AR. The research adopted a multidimensional scale of anthropomorphism and TR. Tourists' attitudes towards the use of robots in the service sector and their IS them were investigated on this basis. We thought that technological readiness was an antecedent variable in technology use. Because in the age of technology, it aims to develop new skills (for example, the use of digital tools) in consumers. The process of developing new talent is full of uncertainty and inevitably faces challenges. The readiness level of the target group is one of the main factors that determine the success of the process (Mankins, 2009). Participating tourists had strong judgments about physical anthropomorphism from an anthropomorphic perspective ($\bar{x} = 3.92$). They were positively free from ambivalence about functional ($\bar{x} = 3.76$) and internal anthropomorphism ($\bar{x} = 3.49$). However, these judgments were not yet definitive. The use of robots in the service sector is not yet widespread. In many destinations, there is none. Receiving service from something other than a human is not yet a

meaningful and embodied experience for tourists. So, this refers to an unknown abstract thing. People tend to be afraid of things they do not know (Bohrer, 1984). This triggers their efforts to fit what they do not know into physical patterns and thus make sense of it (Grünenberg, 2022). According to the tri-reference points theory, people tend to avoid uncertainty and risk (Wang & Johnson, 2012). The fact that physical anthropomorphism is higher than others in the study proves this. Robotic service delivery is authentic. Authenticity represents the fulfillment of the basic obligations and responsibilities that tourists expect from the company, the originality of the subject, the business performance promised to reality and the preservation of the value of consumers (Chen, Xue, et al., 2022). Robots can deliver the basic services that people expect. This provides a sufficient reference for high levels of physical and functional anthropomorphism. However, the lack of elements such as bilateral relations, communication and sociability perception, which encompass the nature of service delivery, reduces internal anthropomorphism. Verhulst et al. (2021) also supports our findings. According to their results, service delivery through digital tools undoubtedly improves the visitor experience. However, this development was valid for the behavioral participation dimension. Because it offered a satisfying experience for visitors to enjoy and the device used gave them the chance to interact with the environment. And he encouraged them to use it again. However, deficits in cognitive and emotional engagement were reported. This situation was similar to the results in our study.

Participating tourists were close to undecided regarding technological readiness. Participants who were completely undecided on innovation ($\bar{x} = 3.06$), were very close to the level of agreement on optimism ($\bar{x} = 3.70$). However, the fact that discomfort ($\bar{x} = 3.43$), and insecurity ($\bar{x} = 3.56$), were above the level of indecision caused technological readiness levels to negatively affect their attitudes towards the use of service robots and their IS them. This reflects people's tendency to accept and use new products, considering ease of use, perceived benefit, and risk (Tahar et al., 2020). Additionally, perceived ease of use and perceived usefulness encourage tourists' attitudes towards the digital experience and behavioral intentions to use it (Liu & Park, 2024). Risk perception and discomfort with innovations reduce the level of technological readiness and negatively affect the IS (Andrea et al., 2021). Additionally, TR has a significant influence on technology adoption (Damerji & Salimi, 2021). TR induces tourist satisfaction more than smart tourism technologies (Hailey Shin et al., 2021). Because tourists' perception and evaluation of the robotic services offered are directly related to their ability to use technology.

Participating tourists' AR were far from ambivalent and very close to participation ($\bar{x} = 3.72$). However, their IS is slightly above indecision ($\bar{x} = 3.07$). They do not plan to realize their positive thoughts about staying in a hotel serviced by robots anytime soon. They are even negative about trying it. Therefore, it seems difficult to turn tendencies to receive service from robots into behavior. Tourism is an experience-centered sector. The subject (providing and receiving service) in the experience process is the human. Tourism businesses adapt new technologies to their service processes to create

personalized consumer experiences (Cimbaljević et al., 2023). Prioritizing and using smart tourism applications in many destinations contributes to making people's travels easier and more enjoyable. Smart technologies, which create a memorable experience for tourists, affect the experience in many ways and affect the attitudes and behaviors of tourists (Pradhan et al., 2018). However, the technological tools used in this process are no different from those used by people in daily life (e-menus, contactless payment, smart routing, smart room systems, etc.) (Koo et al., 2023). The subject of the use of these technologies is human. Technological devices are objects. And they are all "machine" or "smart device app." They have been experienced before and an experience-based attitude has been developed towards them. Robot servants, on the other hand, are human-like and act with artificial intelligence. This is something very new and unexperienced for people. In other words, it is the unknown. According to behavioral economics and prospect theory, people tend to avoid risk (Martynov & Schepker, 2017).

The anthropomorphic tendency was positively associated with the AR. The positive trend towards physical, functional and internal anthropomorphism catalyzed the attitude. People's internalization of anthropomorphism and self-integration with anthropomorphism affect their attitudes towards digital technologies. Self-congruence and situational factors are the main moderators of this process (Alabed et al., 2022). Anthropomorphism positively affects confidence in technology use and increases behavioral IS. Thus, anthropomorphism has a critical role in the adoption of smart services (Liu & Tao, 2022). Anthropomorphism requires a mediating variable in the process of influencing people's behavioral intentions. Anthropomorphism influences the acceptance of autonomous products through previous experience using smart devices (Goudey & Bonnin, 2016). Other studies have shown that trust (Liu & Tao, 2022), engagement (Moriuchi, 2021), psychological distance (Li & Sung, 2021) and perceived usefulness (Kim et al., 2021) are mediating variables. This study demonstrated that AR mediates the relationship. While anthropomorphism affects the IS ($\beta = 0.47$), AR strengthens this effect ($\beta = 0.62$).

Technological readiness is also a significant predictor of IS ($\beta = -0.28$). The insecurity and discomfort of participating tourists about getting services from robots negatively affect the relationship. Perception of risk and security is an important part of the technological readiness process (Mankins, 2009). Individuals develop attitudes and behaviors regarding pro- and anti-technology after a cost-benefit analysis. This study found that AR moderates and reduces the negative effect of technological readiness on IS ($\beta = -0.14$). In this process, attitude gains strength from other variables and affects behavior (Shrigley, 1990). The results obtained in this study showed that optimism ($\beta = 0.54$) and innovativeness ($\beta = 0.37$) strengthen the moderating effect of attitude.

6.2 | Theoretical contributions

This theoretically-based and empirically supported study provides the following contributions regarding the use of robotic technology in

tourism. First, this study develops a comprehensive model using anthropomorphism, technological readiness and attitude variables to explain tourism consumers' IS robotic services. This study empirically demonstrates that it makes significant and distinctive contributions to the understanding of tourism consumers' behavior towards the use of robotic services, both in terms of the diffusion of innovation and uses. Second, the integrated model developed in this research contributes to understanding tourism consumers by combining the effects of anthropomorphism, technological readiness, and attitude on behavioral intention. Third, the relationship between attitude and behavior is still controversial in studies (Kroesen et al., 2017). The research model contributes to extending the theory by showing that tourists' AR influences their behavioral intentions. In addition, AR reduces the effect of factors that negatively affect (discomfort and security) behavioral intention and catalyzes the positive effect (physical anthropomorphism, internal anthropomorphism, emotional anthropomorphism, optimism and innovativeness). Thus, it makes a significant contribution to the attitude and behavior literature.

6.3 | Practical implications

This research makes practical contributions to the relationship between the diffusion of innovation (robotic technology) and authentic experience available to tourism industry practitioners. Tourism businesses can use these technologies to gain competitive power (Buhalis, 2006), achieve sustainability goals (Ivanov, Duglio, & Beltramo, 2023; Ivanov, Webster, & Seyitoğlu, 2023), and gain cost advantages (Castro et al., 2020). However, robotic technology is still very new. People's risk perception towards innovations is high. In such cases, people can make profit-success and loss-failure accounting and can often be prejudiced against innovations. This behavior, which represents the philosophy of the three reference points theory (Wang & Johnson, 2012), is important for tourism businesses to take into consideration.

Although the participating tourists' AR is positive, their technological readiness level is low. They also evaluated the use of robots in tourism as discomfort and insecurity. Businesses need to provide information regarding safety and comfort perceptions in the use and marketing of robotic technology and direct attitudes in this way. For instance, offering specific policies that detail what information robots can access, how they can use it, and methods to prevent potential data leaks can improve guests' risk perceptions (Başer et al., 2023). Otherwise, achieving the desired success with the technology used will be hanging by a thread. Participating tourists' optimism levels towards technology are far from indecision and close to participation. This points to an advantage for tourism service providers. Emphasizing the benefits and practical aspects of the robotic technologies planned to be used will positively affect the attitude towards IS service robots.

Importantly, the moderating effect of AR on anthropomorphism, technological readiness, and IS provides insights into the successful use of robotic technology. This insight can be used for market

segmentation by focusing on the technological readiness of tourism consumers, targeting groups with high levels of optimism and innovativeness. Additionally, tourism service providers can aim to increase tourism consumers' positive AR, focusing on their intention to use and their tendency to accept this technology in the future. For this, they can target groups with high physical anthropomorphism, optimism and innovation. They can shape a marketing strategy around comfort and trust factors for tourism consumers with low technological readiness. Measures need to be taken to encourage tourists and businesses to use robotic services. Digitalization is now used in every field. Businesses, destinations and countries see digital technologies as an important competitive power. Therefore, it is important to create the infrastructure and take measures to increase the level of readiness (Parsons et al., 2023).

6.4 | Limitations and future research

Limitations should be borne in mind when applying the findings presented in the study. The data was collected from tourists in Turkey, so care should be exercised when applying it to tourists who prefer other countries. In the study, we focused on human-like robots. Whether the findings are valid for all automation systems should be tested with new studies. In the study, AR and IS were discussed within the framework of anthropomorphism and TR. Discussing the tri-reference points theory, avoidance theory and other behavioral theories will help generalize the results obtained. While there are tourism consumers who have positive AR, there are also those who do not. Additionally, consumers with no experience of using technology for tourism purposes and/or tourists who actively try to avoid experiences using technology are also part of the market to be reached. Therefore, future research should consider different samples to capture non-users AR and their IS.

In their travel planning, online travel platforms offer tourists an important external source to gather relevant information. These resources have been used for a long time as important products offered by advanced technology (Chen, Hyun, & Lee, 2022). Online reviews encourage tourists' behavioral intentions by influencing trust in the destination (Setiawan et al., 2021). These studies demonstrate the importance of the perception of trust in technology-based service offerings. The reflection of technological advances on tourist experiences is not limited to online reviews. VR applications are an important tool used to enrich the experience of tourists. While tourists enjoy using VR-integrated services, they have a memorable experience. Thus, they are satisfied with their visit (Errichiello et al., 2019). Getting service directly from a robot is a new phenomenon. For this reason, it would not be wrong to compare the service process with robots to a black swan. In other words, since robotic service is not yet very common, it is difficult to predict the reactions of tourists and make a generalization. Kim and Cha (2024) proved that restaurant customers' attitudes towards robot-service restaurants changed before and after the COVID-19 pandemic. In the pre-pandemic period, hedonic values affected emotional values in restaurants with

robot service. Additionally, utilitarian values were at the forefront. After the pandemic, customers paid attention to functional features rather than emotional values. These findings show that standard data for robotic service delivery in the service sector has not yet been established and more study results are needed.

DATA AVAILABILITY STATEMENT

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

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