



# Service robots are an option for contactless services due to the COVID-19 pandemic in the hotels

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**Abstract** The development of robotics in the current COVID-19 pandemic scenario can change the face of the industries. Robots are becoming more prominent in the hospitality industry. In this scenario, the usage of service robots for hotels is the best option. This study is performed using TAM and TRI theories. The constructs selected for the study are perceived ease of use, perceived usefulness, attitudes, behavioural intention, discomfort, insecurity, and trust. Survey-based research is carried out with the help of a questionnaire. The target population are the employees working in the hotels. Ten hypotheses are proposed for the study. This study highlights the acceptance of service robots

in the hotels of India. Out of ten proposed hypothesis, five hypotheses were accepted, and the rest were rejected. For data analysis, structural equation modelling in AMOS 20.0 was carried out. This study will help the managers and the top management in the adoption of service robots.

**Keywords** Covid-19 · Service robots · Contactless service · Hotels · Customers · Acceptance

## Introduction

Automation is used in many industries, which is going to replace human labour. Robots are defined as programmed machines which are capable of carrying out multiple tasks at a time. Automation services are going to replace 14% of jobs in the next 15 to 20 years. The robotics industry by 2025 will create new jobs of approximately 133 million but will also replace 75 million jobs (Nam et al. 2020). Robots can be used in the hospitality sector, especially in hotels, restaurants, and bars. Service robots (SR) are designed to provide information and used in the hospitality sector (Kim et al. 2021). The tasks performed by the SR in the hospitality industry are welcoming the guests, preparing food, taking orders, cleaning the rooms, providing room services, carrying luggage, etc. (Chen et al. 2021).

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The first hotel to use robots was Henn-na Hotel in Nagasaki, where all the employees were robots (Reis et al. 2020). Other SR in the hotels around the world are hotel Aloft using robot ALO (Nam et al. 2020; Vatan and Dogan 2021); hotel Yotel using a robot Yobot; and the hotel EMC2 using robot Cleo and Leo (Vatan and Dogan 2021). In Boston, Spycy uses automated cooking robots for preparing meals for customers (Fusté-Forné, 2021). In Seoul, South Korea, Merry-Go Kitchen takes orders from the customers and provides the services. Automated restaurants can take orders, cook food, and deliver to the customers (Chen et al. 2021; Seo and Lee 2021). SR can help hotels in achieving competitive advantages in the market.

COVID-19 had changed the operation of the hospitality sector (Chen et al. 2021). Many hotels and restaurants are struggling to survive. The tourism industry had a 50% drop in hotel revenue, a 70% drop for tour operators, and a 90% drop for airlines (Grundner and Neuhofer 2021). All of this has put unprecedented strain on the tourism industry, resulting in a significant drop in revenue and a lack of liquidity (Chuah and Yu 2021). To deal with the uncertainties in the hospitality industry, they need to bring changes in technological platforms, structure, and processes (Minor et al. 2021). It is an excellent option to use robots in their services to survive and recover as it will provide contactless and distanced delivery of the products (Mukherjee and Chittipaka 2021). Technological innovation is helping many industries to recover from the pandemic (Baral et al. 2021). Hotels are using contactless services, which reduces the human-to-human interaction, which will help reduce the spread of the virus (Lafranca and Li 2020). COVID-19 has demanded a solution to deal with the uncertainty in the hospitality industry by using automation and robotics as technological innovation (Bogue 2020; Chiang and Trimi 2020; Pillai et al. 2021). This study is conducted among the luxury and five-star hotels in India. Adopting technological innovation requires a huge cost, and the hotels below five stars would not afford it. Previous studies have shown the adoption of robotics in five-star hotels where the cost is not a barrier (Nam et al. 2020). With the introduction of robots in five-star hotels, customer satisfaction will increase in comparison with humans. Also, the customers will not fear visiting the hotels due to COVID-19 transmission from humans. So, the

hotel's loss during the COVID-19 pandemic can be easily overcome, and they can have profit. Previous studies have shown robots as a possible solution to fight against the COVID-19 pandemic (Kim et al. 2021). The technology acceptance model (TAM) and technology readiness index (TRI) measure the attitude and intention of the customers or the users. This study measures the attitude and intention of employees for the adoption of robotics in their hotels. Earlier studies like (Kamble et al. 2019) used TAM to measure the intention or attitude of the employees.

A study conducted by Nam et al. (2020) highlighted the use of robotics and AI in the luxury hotels of Dubai. Previous studies conducted by Lee et al. (2018) and Seo and Lee (2021) show robots in hotels and restaurants using the TAM model. Studies conducted by Kim et al. (2021); Lau (2020); Minor et al. (2021); Wang and Wang (2021) showed robots as a possible solution for the hotel industry to fight the COVID-19 pandemic. Previous studies measured the perception of hotel managers towards robots adoption (Ivanov et al. 2020; Lee et al. 2018). Also, the customer preference and adoption behaviour towards robots were measured (Seo and Lee 2021). But no such studies were found regarding the COVID-19 pandemic measuring the intention of the employees to adopt robots in their operations. Also, no studies regarding robot adoption could be found concerning India. No study has been found using the TAM model to measure the adoption of robots in hotels after the COVID-19 pandemic. So, there is a need for the study as it has become important for the hotel industry to come out from the losses incurred due to COVID-19. With the adoption of robot's customer satisfaction will increase, also the fear of visiting the hotels for virus transmission will also decrease.

This study proposes the hospitality industries deal with the uncertainties by using SR in their operations. SR will help in the contactless services to the customers and provide better efficiency than humans. Further, the paper is arranged as Sect. 2 discusses the literature review. Section three discusses the research methodology. Section four discusses the result. Section five discusses the discussion, and section six discusses the conclusion.

## Literature review

### Service robots in hospitality industry

In manufacturing industries, robots are used for performing jobs like lifting the product from one location to another, performing welding, cutting, packaging the products, etc. (Chuah and Yu 2021; Ivanov et al. 2018). The purpose of using robots is to increase work efficiency, labour productivity, lifting heavy materials, etc. (Manthiou et al. 2020; Mingotto et al. 2020). In recent times SR can be found in the hospitality industries to achieve customer satisfaction. Bulchand-Gidumal (2020) argued that SR could be used along with staff for the guests in the hospitality sector to achieve operational excellence and increase labour productivity. There had been high operating costs for the service industries, especially in hotels. Approximately 50% of the hotel operating cost is the labour cost.

Vatan and Dogan (2021) determined the perception of hotel employees towards SR in the hotels of Turkey. The study's findings were that hotel employees believe that while SR may provide various benefits and advantages to employees and businesses, they also believe that service robots may cause issues during customer communication. Hotel employees believe that SR will increase the unemployment rate in the future. Lu et al. (2021) highlighted the challenges of using SR in achieving customer experiences. Byrd et al. (2021) measured customer expectation and actual performance of the food delivery robots. This study found that the consumers ranked robots as the most environmentally friendly and human delivery as the most convenient service. Customers also anticipated lower service-related performance from robot delivery in terms of service efficiency and ease of use. Fusté-Forné and Jamal (2021) highlighted the challenges and opportunities of robots in the hospitality sector. A detailed review of the literature is conducted, examining the growing use of robots as a business strategy, their central role in in-service experiences, and some essential ethical and management issues arising from robotization, specifically service robots in hospitality and tourism.

Kim et al. (2020) measured the customer innovativeness towards robotics restaurants. It was found that with the usage of automated systems, robotic restaurant managers must focus more on quality experience-

seeking, hedonic experience-seeking, venturesomeness, and social distinctiveness, which helps to improve the image of robotic restaurants. Webster and Ivanov (2020) showed that the guest gave high-performance ratings for the SR and showed positive attitudes for its adoption. Hwang et al. (2020) aimed at comprehending the role of motivated consumer innovativeness in the context of a robotic restaurant. To test six hypotheses, 427 people in South Korea completed an online survey. According to the data analysis findings, product knowledge plays a moderating role in the relationship between overall image and word-of-mouth intentions. Zeng et al. (2020) showed the growing interest and demand of SR in the tourism industry. Ivanov et al. (2020) investigated the hotel manager perceptions towards SR in Bulgaria. According to the findings, respondents believe that repetitive, dirty, dull, and dangerous hotel tasks would better suit robots.

In contrast, hotel managers would prefer to use employees for tasks requiring social skills and emotional intelligence. McCartney and McCartney (2020) investigated a conceptual framework for the SR in the hospitality sector. The employee, consumer, and public policy considerations examined the challenges and benefits of SR adoption in the hospitality industry. SRs are increasingly being used in the hospitality and tourism industries. Xu et al. (2020) examined how the SR will impact leadership and human resource management in the hospitality industry. The findings showed that, while service robots are expected to increase the efficiency and productivity of hotel activities, they may also pose challenges such as high costs, skill shortages, and significant changes to hotel organisational structure and culture.

Li et al. (2019) researched and found that the customers' perception towards the roles of the SR is good, and the customers love to visit the restaurant where the robots perform cleaning, take orders, and serve food. Osawa et al. (2017) researched the customer evaluations for the SR in the check-in assistance and delivery performance. Table 1 shows recent literature on SR in the hospitality sector.

Service robots in managing the uncertainties of the COVID-19 pandemic

The hospitality industry is related to food safety and its services. It needs to provide food safety, better

**Table 1** Recent literature on service robots in the hospitality sector

Sl. no	Authors	Objective of the study
1	Vatan and Dogan (2021)	To determine the employees' perceptions of SR in Turkish hotels
2	Byrd et al. (2021)	This study compares food delivery robots and human-delivered food
3	Ivanov et al. (2020)	The hotel managers' perception of SR in the hotels of Bulgaria was evaluated
4	Fusté-Forné and Jamal (2021)	This study discusses the challenges and opportunities for SR in the hospitality sector
5	Kim et al. (2020)	This study aims to analyze consumer innovativeness in robotic restaurants
6	Hwang et al. (2020)	This study helps in understanding the motivation behind the customer innovativeness concerning the robots used in the restaurant
7	McCartney and McCartney (2020)	This research introduces an acceptance framework concerning customers, employees, and policymakers for the SR
8	Xu et al. (2020)	This research uses the Delphi method to investigate human resource experts' perception of SR in the hospitality industry

benefits, change the customers' perception of hotels, and protect visitors (Rahimzhan and Irani 2020). In this context, the adoption and implementation of SR in hotels will be much more effective and provide a risk-free environment (Kim et al. 2021). This pandemic has changed the mindset of the industry's person, and top management is ready to adopt automation in their operations (Chen et al. 2021). This pandemic has boosted the usage of SR to manage the risk of labour shortage in the hospitality sector (Wang and Wang 2021). With the implementation of SR in the hotels, the concern of the customers can be addressed. Customers are more concerned about the infection transmission when they visit the hotels.

Wang and Wang (2021) reviewed the literature on solutions to pandemic conditions using robots in the hospitality sector. The current achievements of robotic technologies are reviewed and discussed in various categories, followed by determining the representative work's technological readiness level. The future research trends and essential technologies are then highlighted, including artificial intelligence, 5 G, big data, wireless sensor networks, and human–robot collaboration. Fusté-Forné and Jamal (2021) highlighted the challenges and opportunities of robots in the hospitality sector. A detailed review of the literature examines the growing use of robots as a business strategy, their central role in in-service experiences, and some essential ethical and management issues arising from robotization, specifically service robots in hospitality and tourism. Chen et al. (2021) examined

customers' experiences with contactless hospitality services in Taiwan's intelligent hotels. It also analyzes empirical data and provides insights that illuminate the nuances of contactless hospitality service customer experiences. Kim et al. (2021) compare hotel customers' perceptions of human and robot interaction before and after the covid-19 pandemic. The perceived threat played a significant moderating role in consumers' preference for robot-staffed hotels; respondents' preference was attributed to the global health crisis. This study has several theoretical and managerial implications by improving the understanding of technology acceptance during a health crisis. Chuah et al. (2021) investigate customer value perceptions of service robots and their impact on customer attitudes and behaviours towards robotic restaurants. Customers' willingness to use and pay more for automated restaurants is determined by their attitudes towards robots, which are influenced by functional, conditional, epistemic, emotional, co-creation, and social values, according to the results of a survey of 445 potential diners in Taiwan. Further, implications for restaurant pricing policies should be considered by restaurant managers when developing strategies to keep their business afloat in these difficult times.

Chiang and Trimi (2020) discussed deploying robots has been to improve productivity. The current COVID-19 pandemic has brought a more pressing goal: providing contactless service for social distancing. Based on real-world data, this study investigates the service quality provided by robots in a hotel

setting. A sample of 201 guests provided their expected service quality by robots and their actual performance experience after the service. According to the findings, customers' top priorities for the quality of service provided by robots were assurance and dependability, while tangible and empathy were not as important. Customers were dissatisfied with the responsiveness of robots, but this construct was determined to be of low priority. Zeng et al. (2020) highlighted humanoid robots, autonomous vehicles, drones, and other intelligent robots are used to reduce human contact and the potential spread of the SARS-CoV-2 virus in a variety of ways, such as delivering materials, disinfecting and sterilizing public spaces, detecting or measuring body temperature, providing safety or security, comforting and entertaining patients, to create robotic applications that improve tourist experiences, protect natural and cultural resources, encourage citizen participation in tourism development decision-making, and create new 'high-touch employment opportunities for travel, tourism, and hospitality workers'. Lau (2020) observed that there had been a steep rise in the use of SR for cooking in hotels. Table 2 shows recent literature on SR in managing the uncertainties of the COVID-19 pandemic.

## Hypothesis development

Davis proposed the TAM in 1985, which examines the adoption of the latest technological innovation by measuring the perceptions of its end users. TAM uses variables like perceived usefulness (PU) and perceived ease of use (PEOU). Technology adoption leads to diffusion. Pattansheti et al. (2016) defined technological adoption as the stage for selecting the organization or individual's technology. Verma and Sinha (2018) described technological adoption as the organization's willingness to adopt the latest technology that can benefit the firm. The technology readiness index (TRI) is defined as the technological enablers' mindset or the inhibitors' mindset to determine human's predisposition for using new technology (Hajiyev et al. 2017). TRI measures the beliefs of the people to adopt the technology. TRI consists of four factors, mainly innovativeness, optimism, insecurity, and discomfort.

PU is defined as a person's subjective belief that specific technology can improve job performance (Davis 1989). When people believe it is easy and requires little effort, they are ready to consider a PEOU (Park et al. 2018). PEOU and PU had been studied for the hospitality sector for examining the technological acceptance of much latest innovation like Facebook commerce (Liébana-Cabanillas et al. 2016), self-service in hotels (Kaushik et al. 2015), mobile tourism (Tan et al. 2017), usage of mobile

**Table 2** Recent literature of SR in managing the uncertainties of the COVID-19 pandemic

Sl. no	Authors	Objective of the study
1	Chen et al. (2021)	This study analysed the experience of the customers for the contactless hospitality services in the smart hotels in Taiwan
2	Fusté-Forné (2021)	This study discussed the impact of SR as staff, waiters, and chefs in gastronomic and dining facilities in the hospitality sector
3	Wang and Wang (2021)	This study used a literature review to find possible solutions to the pandemic conditions using robots in the hospitality sector
4	Kim et al. (2021)	This study compared the customers' perception towards human and robot interaction in the hotels before and during the covid-19 pandemic
5	Chuah et al. (2021)	This study examined the behavioural intention of the customers towards the SR
6	Chiang and Trimi (2020)	This study examined the service quality and performance experience of the robots from the guests visiting the hotels
7	Lau (2020)	This study used AI and robots to formulate strategies to deal with current pandemic situations in China's hotel industry
8	Zeng et al. (2020)	This study examined the usage of robotics, AI to manage the pandemic situation

wallets in hotels (Lew et al. 2020), use of biometric technology in functions or festivals, and cashless payment service (Ozturk 2016). Previous studies of PU and PEOU had been used by (Rajan and Baral 2015; Kamal et al. 2019; Pattansheti et al. 2016). Trust (T) is defined as the person's belief in a specific technology (Yuen et al. 2020). Tussyadiah et al. 2020 defined trust as the user's expectation that the technology will fulfil the firm's needs. Trust can play an essential role in accepting SR in the hospitality industry as the SR can perform many tasks and make decisions automatically. Employees need to trust the usage of SR in the hotels (Kamal et al. 2019). This pandemic has created many uncertainties in the market. The employees need to generate that amount of trust for the acceptance of the SR. Employees trust that implementing service robots will increase the number of customers, and the customer's experience will be good. Previous studies related to trust had been used by Baki (2016), Chircu et al. (2000), Pavlou and Pavlou (2001).

Attitude (AT) is the positive and negative feelings or beliefs for a specific technology (Ajzen and Fishbein 1975). AT can be found as the psychological tendency to depend on a particular technology (Jung et al. 2021). Ajzen 1991 defined AT as the degree of the person's favour and disfavoured towards any technology. Previous studies (Vallade et al. 2020; Yuen et al. 2020; Michels et al. 2021; Pattansheti et al. 2016) used attitude in their studies.

H1 PEOU positively impacts the PU for SR.

H2 PEOU positively impacts AT towards using the SR.

H3 PU positively impacts AT towards using the SR.

H4 Trust will affect PU for SR.

H5 Trust will affect PEOU for SR.

H6 AT positively affects behavioural intention to use the SR.

Discomfort (DIS) is defined as the feeling of uneasiness towards the usage of any particular technology. These arise due to change the resistance of the employees in the adoption of the latest technology. People having a high level of DIS find difficulties in the acceptance of the newest technology. DIS is found to negatively affect PU (Parasuraman 2016). DIS also directly affects PEOU (Walczuch et al. 2007). Insecurity (INS) is defined as the creation of doubt in the mind of the users towards any technology without knowing its benefits. INS is related to ambiguity and low usage (Upadhyay and Chattopadhyay 2015). Insecurity among the employees was found that their jobs may be lost with the use of service robots. Employees having INS towards technology develop doubt and negative perception. INS is found to negatively influence PU and PEOU (Godoe and Johansen 2012). Previous studies (Kamble et al. 2019; Pattansheti et al. 2016; Walczuch et al. 2007) used DIS and INS in their studies. Therefore, the following hypotheses are developed for the hotel industry (Fig. 1; Table 3).

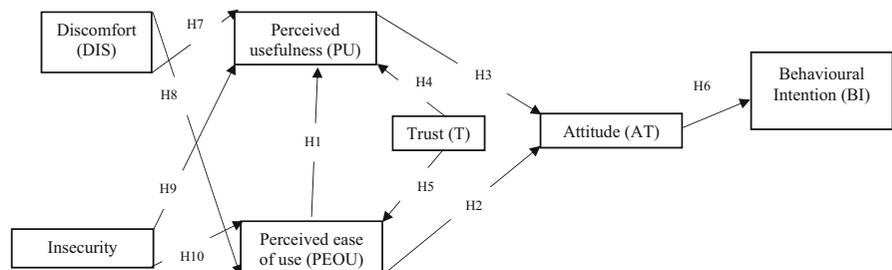
H7 DIS while using SR negatively affects the PU of SR.

H8 DIS while using SR negatively affects the PEOU of SR.

H9 INS negatively affects the PU of SR.

H10 INS negatively affects the PEOU of SR.

**Fig. 1** Proposed theoretical model



**Table 3** Recent literature using TAM model

Sl. no	Authors	Adoption behaviour	Objective of the study
1	Kaur and Soch (2021)	Mobile shopping adoption by Indian consumers	This study analysed the intentions of consumers in India for the adoption of mobile shopping
2	Seo and Lee (2021)	Robots in hotels	This study investigated the usage of robots service in hotels and restaurants
3	Yuen et al. (2020)	Autonomous vehicle adoption	This study examined the adoption of autonomous vehicles in smart cities
4	Dutot et al. (2019)	Smartwatch adoption	This study explored the adoption difference of smartwatches in three countries China, Thailand, and France
5	Kamble et al. (2019)	Blockchain	This study examined the adoption of blockchain technology in the supply chain of firms
6	Taherdoost (2018)	E-service technology	This study examined e-services technology acceptance among the technology users
7	Verma and Sinha (2018)	Mobile-based agricultural Extension service	This study examined the application of mobile service in agriculture
8	Wu and Chen (2017)	Intention to use MOOCs	This research studied the motivation for the acceptance of MOOCs among Chinese participants

## Research methodology

### Sample

The constructs and related items were identified from the literature review. After consulting the industry experts and academicians, the variables and items are finalized, and a questionnaire is developed for the study (Baral and Verma 2021). The industry experts and academicians suggested a few modifications in the items as per the requirement of the study in luxury hotels. To eliminate the ambiguity in the questionnaire, the language of the questionnaire was also improved. Again the questionnaire was discussed with the experts, and after their consent, the questionnaire was finalized. This step helped us in completing the content validity and framing a suitable questionnaire. The questionnaire was divided into two sections. In the first section of the questionnaire, questions related to educational background, gender, etc., were asked. In the second section, the perception of respondents towards the adoption of robots was measured. At the beginning of the survey, to make the respondents familiar with the study, the aim of the study was

described. A note was also mentioned that the collected information would not be shared with anyone and it will only be used for the research purpose. A seven-point Likert scale was used in the questionnaire (Mukherjee et al. 2021).

Data were collected using an online survey with the target population. The target population was the employees working in luxury and five-star hotels. Initially, a pilot survey was conducted with 57 participants before going for the final survey. Cronbach's alpha for the pilot survey was more significant than 0.70 (Fornell and Larcker 1981). Finally, the questionnaire was mailed to 487 participants for the final survey. Only 297 participants returned the questionnaire, which was filled, so the sample size for the study was taken to be 297. The t-test was done to analyze the difference in the response received in the early stage (197) and later stage (200) group of data. The result proved the absence of non-response bias. And finally, the total response of 356 data was found to be fit. Common method bias (CMB) helps check and verify whether the responses filed by the respondents are biased. For this, Harman single factor test is performed in the software of SPSS 20.0. All the

factors are grouped into one factor using EFA. The result indicated that the first factor captured 25.318% (well below 50%) (Podsakoff 2003); therefore, the data are free from CMB.

#### Instrument development

Scales were adopted from the previous studies (Alalwan et al. 2017; Davis 1989; Godoe and Johansen 2012; Parasuraman 2016; Venkatesh et al. 2003). DIS has three indicators DIS1, DIS2, and DIS3. INS has

three indicators INS1, INS2, and INS3. PEOU has four indicators PEOU1, PEOU2, PEOU3, and PEOU4. PU has four indicators PU1, PU2, PU3, and PU4. T has three indicators T1, T2, and T3. AT has four indicators AT1, AT2, AT3, and AT4. Behavioural intention (BI) has four indicators B1, B12, B13, and B14. Table 4 shows the measurement items.

**Table 4** Measurement scale

Construct	Indicators	Measurement items	Sources
Perceived ease of use (PEOU)	PEOU1	Using the features of SR will be easy	Godoe and Johansen (2012)
	PEOU2	I think the operations of SR are clear, and it is understandable	
	PEOU3	I think this would be easier to perform the operations with the help of SR	
	PEOU4	I think using SR will help in contactless delivery	
Perceived usefulness (PU)	PU1	SR will reduce operational failures	Davis (1989)
	PU2	Using SR will improve the efficiency	
	PU3	Using SR will create unnecessary problems among the employees	
	PU4	Using SR will lot of attraction among customers, and they will feel safe visiting	
Trust (T)	T1	I believe that using service with help in gaining back the trust of the customers	Alalwan et al. (2017)
	T2	Customers will be happy to have a SR	
	T3	I do not trust SR as they may create a problem for the customers	
Attitude (AT)	AT1	It will be desirable to use SR	Davis (1989)
	AT2	I have a negative attitude towards SR's usage	
	AT3	Employees will be happy with the implementation of SR	
	AT4	I have a positive attitude towards SR's usage	
Discomfort (DIS)	DIS1	It will be challenging to understand the functions of SR	Parasuraman (2016)
	DIS2	Employees will find it challenging to perform with the SR	
	DIS3	Technology always seems to fail at the worst possible time	
Insecurity (INS)	INS1	I do not consider it safe for our hotel to adopt SR	Parasuraman (2016)
	INS2	Always double-check that a machine or system isn't making a mistake after automating it	
	INS3	When are visiting a firm, people prefer to talk with human employees than the SR	
Behavioural intention (BI)	BI1	We are using SR in our hotels	Venkatesh et al. (2003)
	BI2	Our hotel will use SR in future	
	BI3	I expect that our hotel will use a SR	
	BI4	Our hotel has no intention of adopting SR in the near future	

**Table 5** Demographics of the respondents

Characteristics	Percentage
Gender	
Male	82
Female	18
Educational qualification	
PhD	6
Graduate	52.31
Masters	42
Respondent's position	
IT managers	23.00
Hotel managers	32.00
F& B manager	28.00
Top executives	17.00

### Demographic profile

The target population was the employees working in the hotels of India. The respondents' positions were IT managers, hotel managers, FandB managers, and top executives. The educational qualification of the respondents was PhD, graduate, masters. Table 5 shows the demographic profile of the respondents.

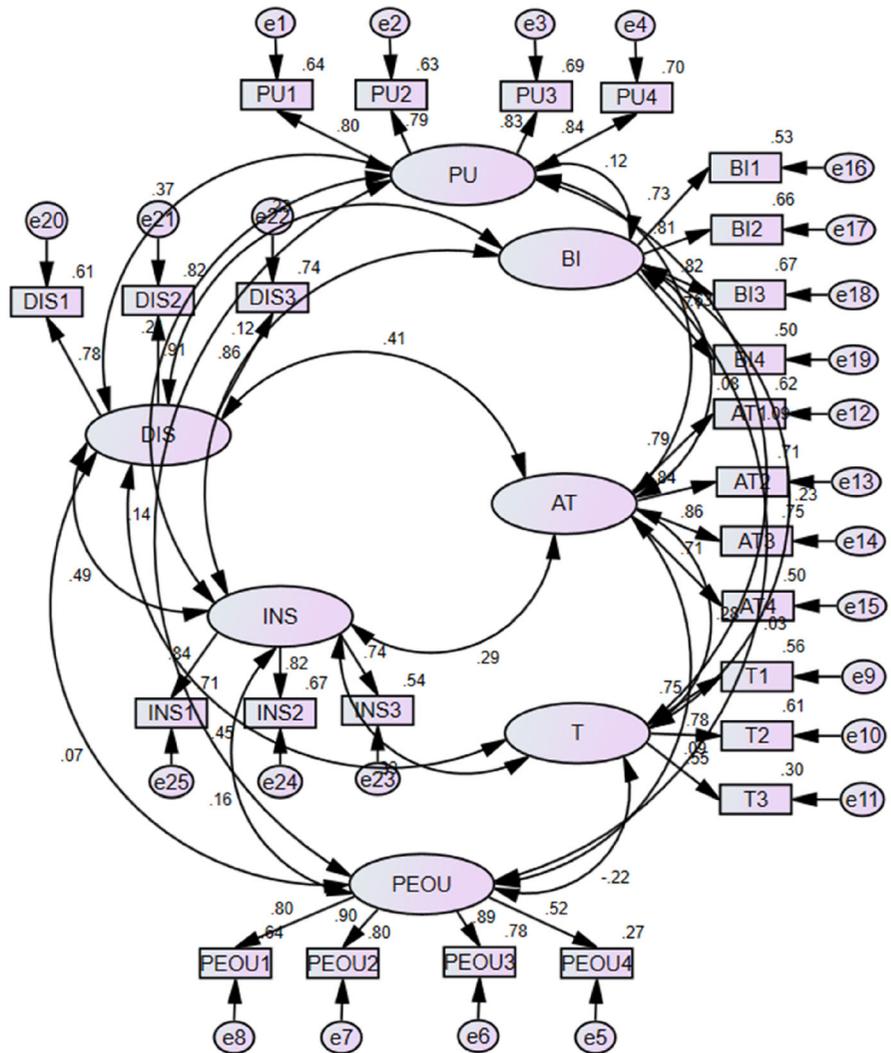
### Result

The standardized coefficient for all the indicators is measured, and Cronbach's alpha value was greater than 0.70 (Henseler et al. 2009), as shown in Table 6. The composite reliability of the constructs should be greater than 0.70 (Allen 2017). All the factor loadings

**Table 6** Cronbach's alpha, composite reliability, AVE, factor loadings

Construct	Indicators	Cronbach's alpha	Composite reliability	Factor loadings
PU	PU1	0.888	0.889	0.850
	PU2			0.797
	PU3			0.791
	PU4			0.830
AT	AT1	0.874	0.872	0.761
	AT2			0.819
	AT3			0.850
	AT4			0.743
PEOU	PEOU1	0.859	0.899	0.851
	PEOU2			0.879
	PEOU3			0.889
	PEOU4			0.694
DIS	DIS1	0.883	0.875	0.837
	DIS2			0.862
	DIS3			0.811
INS	INS1	0.84	0.871	0.820
	INS2			0.891
	INS3			0.784
T	T1	0.718	0.812	0.788
	T2			0.807
	T3			0.707
BI	BI1	0.848	0.921	0.784
	BI2			0.837
	BI3			0.870
	BI4			0.801

Fig. 2 CFA model



of measurement items must be significant and above 0.50 (Netemeyer et al. 2003).

The confirmatory factor analysis (CFA) assessment was carried out for the reliability, convergent validity, and discriminant validity of measuring instrumentation to confirm the hypothesized structure. Figure 2 represents the confirmatory factor analysis for the latent variables. The values obtained are within the acceptable threshold level (Byrne 2010). The average variance extracted (AVE) for each construct must be greater than 0.50 (DeVellis et al. 2003). Discriminant validity investigates how distinct the constructs are from each other in a proposed model (Chan et al. 2007). Discriminant validity values are shown in

Table 7. The model fit for the CFA model was confirmed as acceptable (Chi-square = 404.266; df = 254; CMIN/DF = 1.592, GFI = 0.902; NFI = 0.903; CFI = 0.961; RMSEA = 0.045; PNFI = 0.765; PCFI = 0.814).

Structural equation modelling (SEM) was used for testing the hypothesis. The model fit for the proposed model was confirmed as acceptable (Chi-square = 550.740; df = 265; CMIN/DF = 2.078, GFI = 0.909; NFI = 0.942; CFI = 0.926; RMSEA = 0.060; PNFI = 0.767; PCFI = 0.818). Table 8 shows the values of hypothesis test result. The value of critical ratios (CR) and the standard error (SE) should be  $\geq 1.96$  and +

**Table 7** Discriminant validity values

	AVE	Variance extracted between factors						
		PU	AT	PEOU	BI	DIS	INS	T
PU	0.817	1						
AT	0.793	0.648	1					
PEOU	0.828	0.677	0.657	1				
BI	0.823	0.673	0.653	0.681	1			
DIS	0.836	0.684	0.664	0.692	0.685	1		
INS	0.832	0.68	0.661	0.638	0.637	0.635	1	
T	0.768	0.628	0.609	0.688	0.688	0.696	0.641	1

**Table 8** Hypothesis test results

Path	Estimate	S.E	C.R	P	Hypothesis
PU ← PEOU	0.45	0.099	4.55	0.000	Supported
AT ← PEOU	− 0.001	0.093	− 0.01	0.829	Rejected
AT ← PU	0.64	0.080	7.95	0.005	Supported
PU ← T	0.19	0.064	2.97	0.000	Supported
PEOU ← T	0.31	0.047	6.60	0.003	Supported
BI ← AT	0.10	0.05	1.98	0.000	Supported
PU ← DIS	0.03	0.047	0.64	0.595	Rejected
PEOU ← DIS	0.01	0.03	0.33	0.260	Rejected
PU ← INS	0.05	0.059	0.80	0.780	Rejected
PEOU ← INS	0.06	0.042	1.43	0.348	Rejected

2.5 to − 2.5, respectively. The squared correlation for PEOU is 0.38; PU is 0.61; AT is 0.40; BI is 0.70.

Hypothesis 1, PEOU positively impacts the PU for SR is supported ( $\beta = 0.45$ ,  $p = 0.000$ ;  $p < 0.05$ ). Hypothesis 2, PEOU positively affects AT towards using the robot service is rejected ( $\beta = -0.001$ ,  $p = 0.829$ ;  $p > 0.005$ ). Hypothesis 3, PU positively impacts AT towards using the SR is supported ( $\beta = 0.64$ ,  $p = 0.005$ ;  $p < 0.05$ ). Hypothesis 4, T will affect the PU for SR is supported ( $\beta = 0.19$ ,  $p = 0.000$ ;  $p < 0.05$ ). Hypothesis 5, T will effect on PEOU for SR is supported ( $\beta = 0.31$ ,  $p = 0.003$ ;  $p < 0.05$ ). Hypothesis 6, AT positively affects behavioural intention to use the SR is supported ( $\beta = 0.10$ ,  $p = 0.000$ ;  $p < 0.05$ ). Hypothesis 7, DIS while using SR negatively affects the PU of SR is rejected ( $\beta = 0.03$ ,  $p = 0.595$ ;  $p > 0.005$ ). Hypothesis 8, DIS while using SR negatively affects PEOU of SR is rejected ( $\beta = 0.01$ ,  $p = 0.260$ ;  $p > 0.005$ ). Hypothesis 9, INS negatively affects PU of SR is rejected ( $\beta = 0.05$ ,  $p = 0.780$ ;  $p > 0.005$ ). Hypothesis 10,

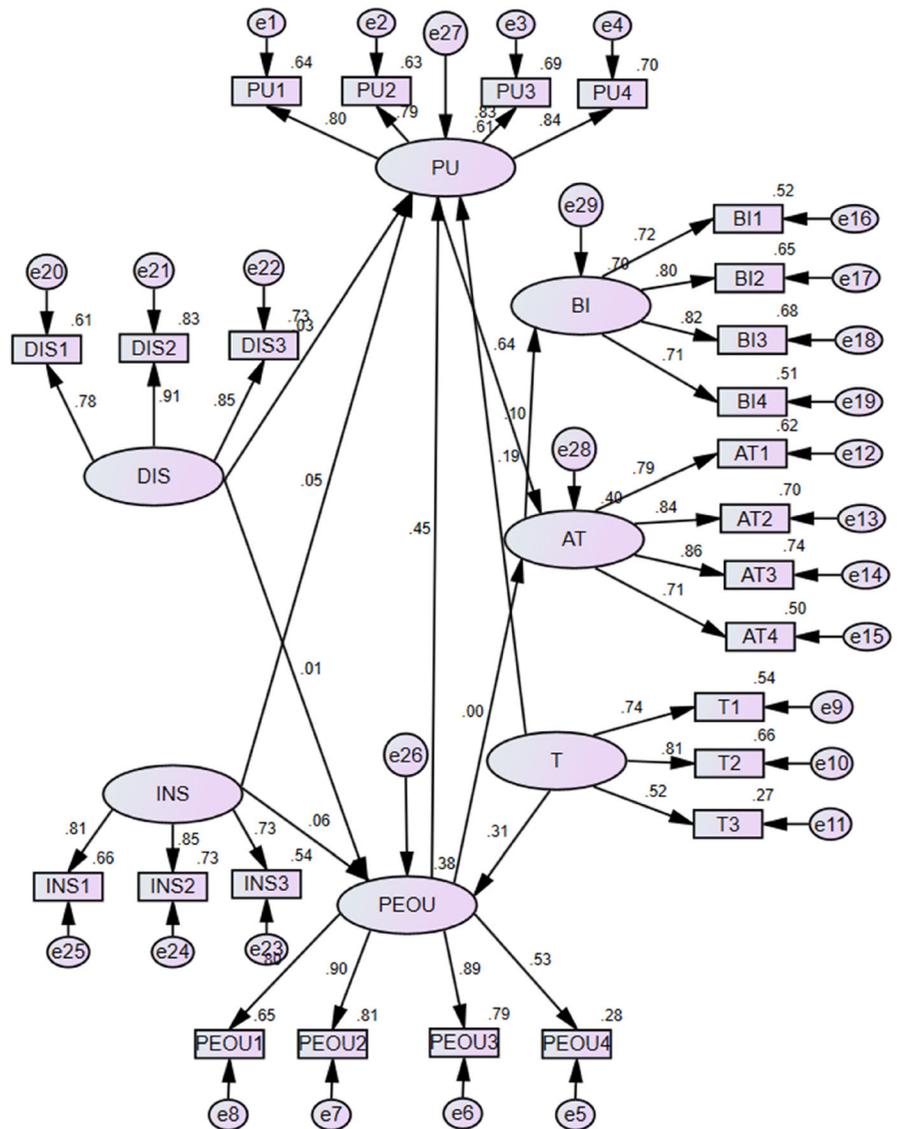
INS negatively affects PEOU of SR is rejected ( $\beta = 0.06$ ,  $p = 0.348$ ;  $p > 0.005$ ) (Fig. 3).

## Discussion

### Findings

Hypothesis 1, PEOU positively impacts the PU for SR, is supported. Our result is supported by most of the other studies (Min et al. 2019; Rajan and Baral 2015; Shih et al. 2012; Taherdoost 2018). Hypothesis 2, PEOU positively impacts AT towards using the SR, is rejected. This result is contradicted most of the other study results (Kamal et al. 2019; Pattansheti et al. 2016; Scherer et al. 2019; Vallade et al. 2020; Yuen et al. 2020) but supported by (Kamble et al. 2019). The second hypothesis that got rejected implies that the employees lack the belief that the SR will decrease the efforts of work, which is affecting the attitude of the employees. Hypothesis 3, PU positively impacts AT towards using the SR is supported. It is supported by

Fig. 3 Structural model



other studies (Michels et al. 2021; Pattansheti et al. 2016; Singh et al. 2020). Hypothesis 6, AT positively affects behavioural intention to use the SR, is supported. Previous study results support our result (Al-Gahtani 2011; Pattansheti et al. 2016; Safa et al. 2015; Tan et al. 2017; Wu et al. 2012). Hypothesis 7, DIS, while using SR, negatively affects the PU of SR. Hypothesis 8, DIS, while using SR, negatively affects PEOU of SR, is rejected. Some of the previous study results do not support our result (Walczuch et al. 2007) but are supported (Kamble et al. 2019; Pattansheti

et al. 2016). The hypothesis related to discomfort got rejected implies that the hotel industry employees will have to discomfit in using SR. This discomfort is generated due to a lack of knowledge about the latest innovations and their benefits. Hypothesis 9, INS negatively affects the PU of SR, and Hypothesis 10, INS negatively affects PEOU of SR, is rejected. Our result is supported by a previous study (Kamble et al. 2019; Pattansheti et al. 2016). The hypothesis related to insecurity got rejected implies that the employees of the hotel industry are not having proper knowledge

about the service robots. Insecurity is generated due to a change in resistance among the employees. Hypothesis 4 Trust will affect PU of SR, and Hypothesis 5 Trust will affect PEOU for SR are supported. Our result is supported by a previous study (Baki 2016; Chircu et al. 2000; Pavlou and Pavlou 2001; Wu et al. 2012).

### Implications

This study examines the acceptance of SR in the hotels of India. COVID-19 pandemic has impacted the hospitality industry in a bad manner. COVID-19 has significantly impacted the Indian hotel sector as demand is at an all-time low. They face severe challenges like labour shortage, customer fear of visiting the hotels or restaurants, etc. If the employees are not able to trust the latest technological innovations, these will generate change resistance among the employees, creating insecurity among the employees regarding the technological adoptions. The hotel industry needs to think about the adoption of SR. To make contactless delivery, acceptance of SR is the best option. Trust plays an essential role in the approval of the SR. Our results supported both the hypothesis related to trust. Managers and top management need to trust the SR in their operations. When human beings face high risk and unpredictable situations, trust plays an important role and becomes powerful. Thus, trust becomes very much critical in the SR environment.

### Conclusion

This research paper aims to propose SR in the hospitality sector. The main contribution of the article was to study the behavioural intention of the hotel employees towards the adoption of service robots in the hotel industry. Due to the COVID-19 pandemic, the hospitality sector was affected a lot, and customers prefer contactless hotels. Providing contactless service in the hotel's SR is an excellent option as these will prevent the transmission of the virus from one person to another. This study is conducted using TAM and TRI. Ten hypotheses were proposed for the study, out of which five hypotheses got accepted. The target population was the employees working in five star and luxury hotels. This study will help the hospitality

sector to understand the importance of SR in hotels and adopt it in the near future.

The limitation of the study was that survey was conducted online, and there were no field visits. Visiting the hotels and collecting data would have created more insights and knowledge. The sample size for the study was less. The study was limited to five stars and luxury hotels only.

In the future, this study can be extended to bars and restaurants. The constructs of TAM 2 and TAM 3 can be used for future studies. Sample size can also be increased. SR studies can be proposed for other sectors also.

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