Attitude of Consumers toward Restaurant Service Robots Based on UTAUT2 Theory[*]

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Abstract

Recently, the use of serving robots has been increasing due to the increase in preference for non-face-to-face services and the rise in the minimum wage due to the coronavirus. When analyzing previous studies related to serving robots, it was confirmed that most of the studies on the functions and technologies of serving robots were conducted. Therefore, this study analyzed the factors affecting the attitude and customer satisfaction of restaurant consumers toward serving robots by adding performance expectations, effort expectations, and speed factors among the UTAUT2 models. The survey period was conducted from July 28, 2021 to September 9, 2021, and 306 out of a total of 310 surveys were used for analysis, excluding 4 unfaithful surveys. For the analysis, exploratory factor analysis, reliability analysis, confirmatory factor analysis, and hypothesis test were performed using SPSS 20.0 and AMOS 20.0, and the research results are as follows. First, it was found that performance expectation, effort expectation, and speed had a significant positive (+) effect on attitudes. Second, it was found that attitude had a significant positive (+) effect on customer satisfaction. This study researched customer selection attributes of robot service restaurants using the UTAUT2 model, and also provided academic and practical implications.

Keywords: Serving Robot, Attitude, Customer satisfaction, UTAUT2

Major classifications: Restaurant Management, Restaurant Marketing, Customer Eating-out behavior

1. Introduction

Food-tech means creating a new industry or adding added value to existing industries by combining advanced information and communication technology (ICT) with food or food industries (Park, 2016). According to the "2020 Domestic and Foreign Food Trend Survey Report" by the 2020 Ministry of Agriculture, Food and Rural Affairs and Korea Agro-Fisheries & Food Trade Corporation, "Safe Food Tech," a new term that combines safety and food tech, was selected as one of the trends to emerge in 2021. This drew attention as various food tech technologies such as kiosks, cooking robots, and serving

robots were combined with the dining environment as consumers who are sensitive to safety and safety prefer eating out. In addition, "Food Tech" was selected as one of the global eating out trends not only in Korea but also in the "2020 Overseas Eating Trend Survey," indicating that interest in food tech is high not only in Korea but also abroad. In response to this restaurant trend, the restaurant industry is using various food techniques such as serving robots, robot chefs, and food printing, starting with delivery apps, and related technologies are rapidly developing. This will soon change the environment of the foreign media industry (Lee, 2018).

The era of popularization of "serving robots" is opening with the non-face-to-face trend of the COVID-19 era and the burden of labor costs caused by the minimum wage hike (Shin, 2021), and according to the International Robot Federation, the service robot market is expected to grow 42.2% by 2022 (Park, 2020). Starting with Pizza Hut in August 2018 (Shin, 2018), "Elegant Brothers," which produced the delivery application of "Baedal Minjok," are steadily expanding the supply of serving robots, and companies such as "LG Electronics" and "KT" as well as "Elegant Brothers" are paying attention to the serving robot market (Yoon, 2021).

The use of serving robots in the restaurant industry is indispensable due to the development of these technologies, changes in trends caused by COVID-19, and rising labor costs.

Looking at existing studies related to serving robots, most of them are papers related to technologies and functions related to serving robots (Kim et al., 2019). Through this study, it is expected to be meaningful in that it can predict whether consumers accept the new "serving robot" technology using the UTAUT2 model.

2. Theoretical background

2.1. Serving robot

Serving robot, a type of service robot developed for the main purpose of serving used in the restaurant industry, refers to a robot with a limited mission of "serving," unlike service robots with a wide range of radius of use (Jang & Lee, 2021). Serving robots are used in such a way that when the serving robot carries the ordered food to the front of the customer's table, the customer puts the food on the table himself.

In the serving robot, the robot replaces the serving that the employee has to do, and at that time, the employee can provide other high-quality services, thereby increasing the efficiency. It can also provide customers with a attraction called robot serving and provide promotional effects of "we lead future stores" (Park, 2020). However, serving robots simply take over the task of moving food, and cannot put food directly on the customer's table or clean up the tableware used by the customer. In addition, communication with customers has limitations, such as one shot rather than in both directions (Namgung, 2020).

2.2. UTAUT2 model

Based on Davis (1989)'s Technology Acceptance Model (TAM), research was conducted to analyze the factors influencing the acceptance of new technologies, and Venkatesh et al. (2003) presented a unified theory of acceptance and use of technology (UTAUT1), and performance. Subsequently, Venkatesh et al. (2012) suggested UTAUT2, which adds three factors: hedonic motivation, price value, and habit to UTAUT1.

UTAUT1 and UTATU2 show the biggest difference in the context in which each model is applied, while UTAUT1 is a model for enhancing the predictive power of employees' technology acceptance intention and use under organizational contexts, while UTAUT2 is a model for enhancing the predictive power of technology acceptance (consumer use context). This study used the UTAUT2 model, and only two factors were used: performance expectation and effort expectation. Performance expectation is a concept similar to the perceived usefulness of TAM, and is the degree to which it is believed that by using technology, it can be helped to improve workability (Kim & Lee, 2020; Chung, 2018). Expectation of effort is a concept similar to the perceived ease of TAM, and is the degree to which technology or service can be easily used. Social impact is the degree to which important people around them believe that the party accepting the technology should use the new technology.

Referring to various previous studies, in a study on consumer acceptance of Kim and Lee (2020) franchise snack bar kiosk services, it was explained that performance expectations, effort expectations, social impact, and entertainment motivation had a significant positive (+) effect on usage attitude.

In addition, Qu and Lee (2020) said that looking at the research on the attitude and intention of tourists to use tourism

blockchain technology, performance expectation, effort expectation, social impact, promotion conditions, and entertainment motivation have a positive effect on the attitude of use. Therefore, the following hypothesis was established based on these preceding studies.

H1: Performance expectation will have a significant positive (+) effect on attitudes.

H2: Effort expectation will have a significant positive (+) effect on attitude.

2.3. Rapidness

In a study by Yun and Ko (2020) on the effect of non-face-to-face service quality on satisfaction and purchase intention of restaurants, rapidness was defined as the time required to execute the service and was found to have a significant positive (+) effect on customer satisfaction. Based on these preceding studies, in this study, speed was defined as the time required to use a serving robot, and the following hypothesis.

H3: Rapidness will have a significant positive (+) effect on attitudes.

2.4. Attitude

Attitude is a universal evaluation of an individual's specific object. Attitude is accepted as the variable that has the greatest influence on consumer intentions (Cha, 2020; Kwak et al., 2021; Kwak & Cha, 2021). According to a study by (Kim et al., 2019) Jeong and Kim (2020), it was proved that consumer attitudes affect customer satisfaction.
Based on these preceding studies, the following hypothesis was established.

H4: Attitude will have a significant positive (+) effect on customer satisfaction.

2.5. Customer satisfaction

Customer satisfaction refers to the consumption experienced by consumers by purchasing and consuming corporate products and services not only exceeds expectations but also positively (Cha, & Lee, 2018; Cha & Seo, 2019; Cha & Seo, 2020; Cha & Noh, 2020; Jun & Kim, 2020).

3. Research method

3.1. Establishing a research model and hypothesis

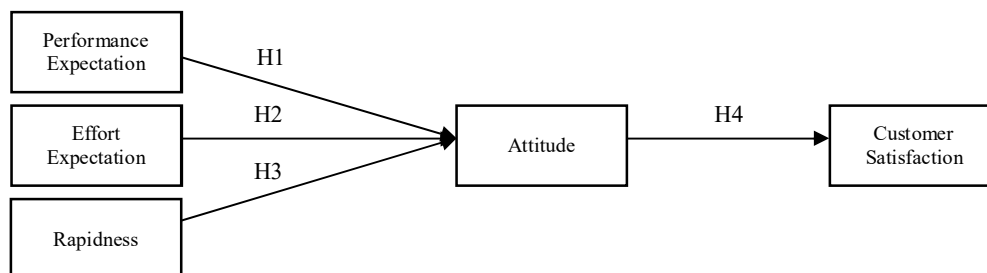**Figure 1:** Research model

In this study, the UTAUT2 model was used to analyze the intention of restaurant consumers to accept robot restaurants, and performance expectations, promotion conditions, and effort expectations were composed of independent variables.
Based on the preceding studies presented in the theoretical background, a research model and hypothesis as shown in Figure 1 were created.

3.2. Questionnaire composition.

For the questionnaire related to performance expectations, a study by Kim and Lee (2020) and previous studies by Lee (2018), Choi et al. (2017) were referenced. The questions in the questionnaire consisted of a total of three questions: 'The technology of a serving robot will be useful,' 'I can reduce time and effort by using the serving robot,' and 'The serving robot will satisfy my needs.' For the questionnaire on effort expectations, previous studies by Shim and Dong (2020), Qu and Lee (2020), Choi et al. (2017) were referenced. The questions are 'serving robots will be easy to use,' 'it will not be difficult to learn and learn how to use serving robots,' and 'it will be easy to adapt to serving robots. 'It consisted of a total of three questions as '. The questionnaire related to speed was constructed based on previous studies by Yun and Ko (2020). The questionnaire consisted of a total of three questions: 'Serving robots will process quickly,' 'Serving robots will transport food quickly,' and 'Serving robots will provide rapid service.' The questionnaire on attitudes was constructed based on previous studies by Qu and Lee (2020), Jeong and Kim (2020). The question is, 'I think the serving robot is great,' and 'The serving robot will meet my expectations. It consisted of a total of two questions as '. Finally, the questionnaire on customer satisfaction was constructed based on previous studies by Jeong and Kim (2020). The questionnaire consisted of a total of two questions: 'The overall use of serving robots will be satisfactory' and 'There is no complaint about the introduction of serving robots.' All questions were measured using the Likard 5-point scale (1: Not at all, 5: Very much so).

3.3. Data collection and analysis method.

This study conducted a survey to verify the hypothesis. The items in the survey were modified appropriately for the study among the items conducted by previous researchers. The survey was conducted from July 28, 2021 to September 9, 2021 as a non-face-to-face online survey using the Google survey. The actual use video of the serving robot for about one minute was attached so that respondents who conducted the online survey could grasp information on the serving robot before starting the survey. A total of 310 questionnaires were collected, of which a total of 306 questionnaires were used for analysis, excluding 4 unfaithful ones.

As an analysis method, exploratory factor analysis and reliability analysis were performed using SPSS 20.0 to analyze the validity and reliability between measurement variables. In addition, AMOS 20.0 was used to verify concentrated validity and discriminant validity through confirmatory factor analysis.

4. Empirical results

4.1. Demographic characteristics of the sample

Table 1: Demographic characteristics of respondents (n=306)

Demographic traits		No. of sample	(%)	Demographic traits		No. of sample	(%)
Gender	Male	58	19	Occupancy	Student	280	91.5
	Female	248	81		Office worker	11	3.6
Age	10s	4	0.3		Own business	2	0.7
	20s	291	95.1		Professional	8	2.6
	30s	0	0		Sales/Service	2	0.7
	40s	9	2.9		House wife	1	0.3
	50s	2	0.7		Etc	2	0.7
	Over 60s	0	0	Married or single	Married	13	4.3
Occupation	A high school graduate or lower	3	1		Single	293	95.7
	College of medicine/graduation	29	9.5	Income per month (Thousand Kr)	100 ≥	273	89.2
	4 years of enrollment/graduation	262	85.6		101~200	8	2.6
	Graduate school	12	3.9		201~300	15	4.9
					301~400	0	0
					400 <	10	3.3

Gender, age, education, occupation, marital status, and average monthly income were analyzed as demographic characteristics. The demographic characteristics of respondents are shown in Table 1. First of all, out of 306 people, 58 were male, 19%, and 248 were female, 81%. As for the age, 291 people in their 20s were found to be 95.1%, 9 people in their 40s, 2.9%, and 6 people in total, 1%. The highest educational background was 85.6% of 262 students enrolled/graduated for four

years, followed by junior college enrollment/graduation with 29 students with 9.5%. As for the occupation, 280 students were the highest with a total of 91.5%, with 11 office workers with 3.6% and 8 professionals with 7 jobs other than 2.6%. Whether or not to marry was 293 unmarried people, a total of 95.7%, and married people were 13 people, 4.3%. Finally, 273 people earned less than 1 million won per month, a total of 89.2%, 15 people earned less than 201-3 million won, 8 people earned 4.9% 101-2 million won, and 10 other profits total 3.3%.

4.2. Exploratory factor analysis and reliability analysis.

Table 2: Exploratory factor analysis

	Variables			Variance (%)	Cronbach's
	1	2	3	Total 81.165	Alpha
Performance expectations 01	0.254	0.296	0.807		
Performance expectations 02	0.310	0.249	0.758	28.360	0.847
Performance expectations 03	0.253	0.102	0.845		
Effort expectation 01	0.121	0.863	0.200		
Effort expectation 02	0.135	0.915	0.060	27.034	0.870
Effort expectation 03	0.071	0.807	0.345		
Rapidness 01	0.812	0.095	0.337		
Rapidness 02	0.894	0.132	0.183	25.771	0.908
Rapidness 03	0.911	0.121	0.264		

Table 3: Exploratory factor analysis

	Variables		Variance (%)	Cronbach's
	1	2	Total 85.112	Alpha
Attitude 01	0.237	0.930	43.819	0.833
Attitude 02	0.555	0.736		
Customer satisfaction 01	0.762	0.442	41.293	0.764
Customer satisfaction 02	0.899	0.222		

In order to analyze the exploratory factors and reliability of the measured variables, the analysis was conducted using SPSS 20.0 (see <Table 2> and <Table 3>). During exploratory factor analysis, factor extraction was conducted in the principal component method, and VERIMAX was used as the rotation method.

Looking at Table 2, it can be seen that three items were grouped into one factor for performance expectations, three items for effort expectations were grouped into one factor, and three items for speed were grouped into one factor. The Cronbach's Alpha values representing reliability were 0.847, 0.870, and 0.908, respectively, and all of them were 0.7 or higher, ensuring reliability.　In addition, as a result of the analysis, it was found that a total of three factors, performance expectation, effort expectation, and speed, account for 81.165% of the total variance.

Looking at Table 3, it can be seen that two items of attitude were grouped into one factor, and customer satisfaction was also grouped into one factor. The total variance explanatory power of attitude and customer satisfaction was 85.112%, and Cronbach's Alpha values were 0.833, 0.0.764, all of which were 0.7 or higher, securing reliability.

4.3. Confirmatory factor analysis.

Confirmatory benefit analysis was conducted using AMOS 20.0, and intensive validity and discriminant validity were verified. Looking at the values indicating the suitability of the study model, the Chi-square value has 218.660 (p=0.000, df=55), the NFI value is 0.924, the CFI value is 0.942, and the RAMSEA value is 0.099, satisfying the appropriate reference value.

CR values and AVE values are required to confirm the concentrated validity. Construct reliability (CR) is a value that can determine concentrated validity as a concept reliability value. When the conceptual reliability value is 0.7 or more, the concentration validity can be considered good (Andorson & Gerbing, 1988). In addition, Average variance extracted (AVE) is used to determine convergence validity as an average variance extraction index. The average variance extraction value must be 0.5 or more to have concentrated validity. Looking at <Table 4>, the conceptual reliability value of each factor has a value between 0.802 (customer satisfaction) and 0.949 (attitude), all of which are 0.7 or higher, and similarly, the average variance extraction value of each factor has a value between 0.671 (customer satisfaction) and 0.824 (attitude). Therefore, it

can be seen that all factors have intensive validity. Table 5 shows the results of verifying discriminant validity. The criterion for determining discriminant validity has discriminant validity when the root value of the AVE value is higher than the correlation coefficient. Looking at Table 5, it can be seen that the root value of AVE exceeds the correlation coefficient value of each factor, and discriminant validity has been secured.

Table 4: Confirmatory factor analysis result

Variables	Measure	Standardized Regression Coefficient	CR	AVE
Performance expectations	Performance expectations 01	0.868	0.863	0.677
	Performance expectations 02	0.784		
	Performance expectations 03	0.785		
Effort expectation	Effort expectation 01	0.830	0.921	0.800
	Effort expectation 02	0.847		
	Effort expectation 03	0.827		
Rapidness	Rapidness 01	0.815	0.915	0.783
	Rapidness 02	0.854		
	Rapidness 03	0.974		
Attitude	Attitude 01	0.727	0.949	0.824
	Attitude 02	0.899		
Customer satisfaction	Customer satisfaction 01	0.855	0.802	0.671
	Customer satisfaction 02	0.728		

Chi-square = 218.660 (p=0.000 , df=55), NFI = 0.924 CFI= 0.942 RMSEA=0.099

Table 5: Discriminant validity through correlation analysis

	Attitude	Performance expectations	Rapidness	Effort expectation	Customer satisfaction
Attitude	0.866	-	-	-	-
Performance expectations	0.741	0.813	-	-	-
Rapidness	0.549	0.622	0.884	-	-
Effort expectation	0.497	0.557	0.322	0.835	-
Customer satisfaction	0.863	0.893	0.626	0.532	0.794

Note: The numbers along the diagonal are the square root of AVE

4.4. Hypothesis test.

To verify the research hypothesis, structural equations were analyzed using AMOS 20.0. <Table 6> shows the results of hypothesis verification. First, looking at the verification results of Hypothesis 1 (H1), the path coefficient value between performance expectation and attitude was 0.601 (t=8.149, p<0.001), indicating that performance expectation had a significant positive (+) effect on attitude. Second, according to the verification results of Hypothesis 2 (H2), the path coefficient value between effort expectation and attitude was 0.124 (t=2.074, p<0.05), indicating that effort expectation had a significant positive (+) effect on attitude. Third, looking at the verification results of Hypothesis 3 (H3), the path coefficient value between speed and attitude was 0.099 (t=2.384, p<0.05), indicating that speed had a significant positive (+) effect on attitude. Finally, looking at the verification results of Hypothesis 4(H4), the path coefficient value between attitude and customer satisfaction was 0.974 (t=0.974, p<0.001), indicating that attitude has a significant positive (+) effect on customer satisfaction. In conclusion, hypotheses H1, H2, H3, and H4 were all adopted.

Table 6: Hypothesis test result.

Hypothesis	Paths	Paths Coefficient	*t* value	*p* value	Results
H1	Performance expectations → Attitude	0.601	8.149	***	Support
H2	Effort expectation → Attitude	0.124	2.074	*	Support
H3	Rapidness → Attitude	0.099	2.384	*	Support
H4	Attitude → Customer satisfaction	0.974	13.911	***	Support

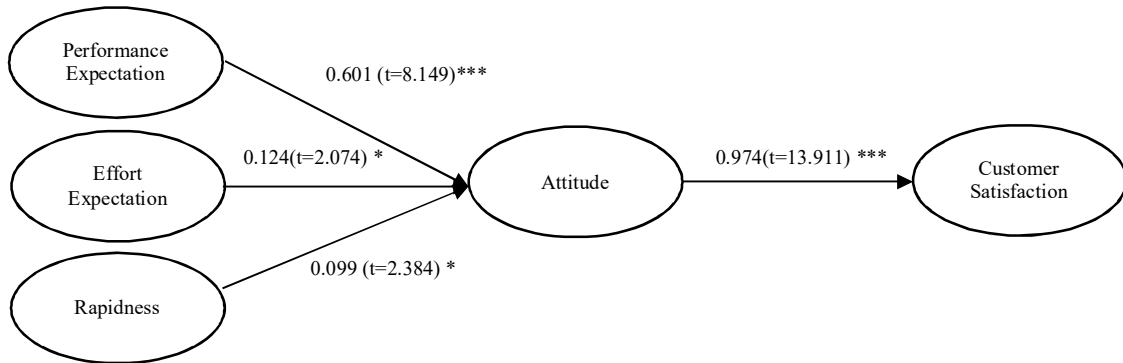* *p*<0.05, ** *p*<0.01, *** *p*<0.001

Figure 2: Hypothesis test result

5. Conclusion

  This study examined the factors that have a good influence on customers' attitudes toward serving robots that have recently emerged in the restaurant industry as a way to deal with issues such as non-face-to-face service issues and rising labor costs, and to find out whether these attitudes have a significant effect on customer satisfaction. During the study, among the variables constituting the UTAUT2 model, performance expectation effort expectations and additional speed variables were added to analyze whether they had a positive (+) effect on attitudes, and whether attitudes had a positive (+) effect on customer satisfaction. As a result of testing the hypothesis using the structural equation, it was confirmed that performance expectation, effort expectation, and speed had a significant positive (+) effect on the user's attitude toward the serving robot, and attitude had a positive (+) effect on customer satisfaction.

  There are limitations of this study. First, the characteristics of the sample are biased. It can be seen that the demographic characteristics of the sample were biased toward women (81%), those in their 20s (95.1%), students (91.5%), unmarried (95.7%), and average monthly income of less than 1 million won (89.2%). Second, during the sample survey, the actual users of the serving robot were not surveyed. Of course, it was conducted after watching the actual use video of the serving robot during the survey, but I think it can have a different perception than the actual use. The number of restaurants using serving robots continues to increase, but this study did not conduct a survey on users because it has not been commercialized, but if serving robots are distributed a little more than now, future studies will have to conduct a survey on customers who actually used them. Third, there are various factors that can act as variables in using serving robots, but this study was limited to performance expectation, effort expectation, and speed. Therefore, in future studies, more diverse factors should be considered and further research should be conducted.

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