Customers' acceptance intention of self-service technology of restaurant industry: expanding UTAUT with perceived risk and innovativeness

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Abstract

This study validates the unified theory of acceptance and use of technology (UTAUT) model, extended to include risk and innovativeness as additional factors, to identify antecedents that influence customers' intention to adopt self-service technology at restaurants. Among UTAUT constructs, performance expectancy was the most important determinant of acceptance intention, followed by effort expectancy and social influence. Furthermore, individual innovativeness moderated the effects of social influence and perceived risk on acceptance intention. These findings are meaningful because incorporating information and communication technology (ICT) into food service settings expands the scope of food service research and provides practical implications.

Keywords Fast-food restaurant · Self-service technology · UTAUT · Perceived risk · Innovativeness

1 Introduction

The advancement in information and communication technology (ICT) has played a crucial role in enhancing service standards by transforming the facets of interaction between service firms and customers (Barrett et al. 2015; Iqbal et al. 2018). Moreover, ICT has continuously altered the way consumers and companies experience services (Scherer et al. 2015). Meanwhile, marketers promote the use of

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self-service technology (SST) as a means of assisting service employees to reduce costs and improve services (Taillon and Huhmann 2019). SST is defined as technological interfaces that enable customers to use services independent of direct assistance from firm employees (Meuter et al. 2000). In other words, SST has replaced direct contact between buyers and service providers, and the former can use a service without face-to-face interaction with the service firm's employees (Iqbal et al. 2018; Martins et al. 2014). The introduction of SST that enables customers to produce services can reduce labour costs and improve the operating efficiency of the non-production activities of firms (Considinea and Cormicana 2016). SST offers convenience and independence for customers and reduces waiting time (Turner and Szymkowiak 2019).

Most customers in the service industry consider SST valuable because of its convenience (Kaushik et al. 2015). In the restaurant industry, SST is rapidly gaining attention and has the potential to innovate almost every aspect of dining experience (Beldona et al. 2014; Hanks et al. 2015). In South Korea, the food service industry has also expanded non-face-to-face services in a move to improve profitability through self-service systems and labour cost reduction and to decrease laborious workloads (Joins 2019). Unmanned kiosks, which were introduced in fast-food restaurants in 2014, have been neglected by consumers for some time because of their unfamiliarity and difficulty of use. Nowadays, this technology is rapidly spreading to small restaurants. The reason for this is fourfold: (1) political; (2) economy-related (lower wage increase); (3) socio-cultural (non-face-to-face preference); and (4) science and technology-related (simple payment and ICT evolution) (Chosun Biz 2019). Specifically, according to Lotteria and McDonald's, the top two fast-food restaurant chains in South Korea, nearly 60% of all the locations operated by each of them having installed with touchscreen kiosks (Yonhapnews 2019). However, such kiosks have downsides as well, such as being less cost-effective than expected, as human labour is still required for maintenance of the installed kiosks (Yonhapnews 2019). In addition, despite shortening the order and payment times, self-service kiosks have been described as being incapable of meeting the various demands of individual customers (Chosun Biz 2018).

Thus, SST in restaurants has both positive and negative aspects in terms of customer usage. This underscores the need for further study of the consumer behaviours associated with the acceptance of SST before promoting SST as a way of improving the profitability of food service providers. To this end, this study assesses the empirical validity of the unified theory of acceptance and use of technology (UTAUT) model in the context of SST. Prior to the UTAUT, the technology acceptance model (TAM) was used to explain users' acceptance behaviours towards various types of information and technology. However, the UTAUT is known to be more explainable with respect to usage intention and behaviour, as it overcomes the TAM's limitations (Venkatesh et al. 2012).

In the literature, perceived risk is identified as a factor used to predict attitudes towards SST (Kaushik et al. 2015). Higgins and Shanklin (1992) suggest the risks of not using a product as intended because of technical complexity and the receipt of negative feedback when purchasing a product that does not match the reference group's preferences. In food service settings, customers want to interact with service

employees, and any situation in which this desire is not fulfilled can be perceived as a risk (Curran and Meuter 2005). Because most consumers may face uncertainty when purchasing technology-based goods and services, perceived risk is considered an important variable affecting the intention to adopt SST. Similarly, individual innovativeness has a moderating effect on the prediction and consequences of the perception of certain systems (Agarwal and Prasad 1998; Dabholkar and Bagozzi 2002). This means that highly innovative individuals have a more positive perception of technological characteristics, including performance and effort expectancies (San Martín and Herrero 2012).

Therefore, to expand the research on food service consumer behaviour so that it includes ICT acceptance and usage, the present study suggests a research model that adds perceived risk as one of the UTAUT's independent variables as well as an individual's innovativeness as a moderating variable. This will broaden the scope of consumer behaviour research in the food service sector to include the adoption and use of ICT. This attempt has been made to analyse the factors that affect customer intention to adopt SST from a broader perspective and, subsequently, to differentiate the present study from previous research. The results of this study explain consumer adoption behaviours for South Korean restaurants' transition to SST and provide practical information to establish marketing strategies for the sustainable management of food service firms.

The rest of this paper is structured as follows. Section 2 presents the literature review and proposes the hypotheses. Section 3 introduces the methodology. Section 4 presents the results. Section 5 presents the theoretical and practical implications, limitations, and conclusion.

2 Literature review and hypotheses

2.1 Self-service technology

SST extends to various industries such as dining out, finance, distribution, and media-enabled transportation services (through PCs, smartphones, and kiosks). With the increasing use of SST, Meuter et al. (2000) classified the types of SST according to its purpose and the interface of use. Based on the purpose, SST is classified into customer service, direct transaction, and self-help, while based on the interface, it is classified into telephone/interactive voice response, online/internet, interactive kiosks, and video/CD. The cases corresponding to each have been summarised. The most widely used SST interface in the offline hospitality industry is the self-service kiosk (SSK). SSKs are mainly used for hotel check-in/out, airport self-check-in, order-payment of fast food, and in large food courts (Kincaid and Baloglu 2005; Riebeck et al. 2008).

Many studies have focused on whether customers will adopt new technologies (Kaushik et al. 2015). Liu (2012) analysed the effect of consumer use on attitudes regarding SSTs in various fields. He recommended that companies should constantly appeal to consumers about the attractiveness of using SST. Kaushik et al. (2015) extended the technology acceptance model (TAM) to examine tourists' trust,

acceptance attitude, and acceptance intention with regard to self-service hotel technologies (SSHTs). Fernandes and Pedroso (2017) pointed out the limitations of research on SST acceptance, and revealed the effect of self-checkout attributes in retail stores on perceived quality, overall satisfaction, and revisit intention.

Several studies have examined customer behaviour focusing on the contextual aspects of kiosk use. Gelderman et al. (2011) reported that most airline passengers wanted to use the kiosk when waiting time was high, and thus, kiosk use was greatly affected by its environment. Yi and Kim (2017) emphasized that in an SST environment, while face-to-face contact with employees is minimized, interaction with other customers becomes more frequent, and hence, the role of other customers gains importance.

2.2 The unified theory of acceptance and use of technology

The UTAUT model was developed in parallel with many research studies exploring why and how individuals adopt new information technology (Venkatesh et al. 2003). Prior to the UTAUT, the TAM, which was developed by Davis (1989), was commonly used in studies on user adoption of new technologies. However, the TAM was found to limit the analysis of interactive relationships in IT environments because it does not take into account the effects of various exogenous variables (Agarwal and Karahanna 2000). Therefore, Venkatesh et al. (2003) developed the UTAUT, a new technology adoption model, by combining and controlling seven different theories: the theory of reasoned action, the TAM, the motivational model, the theory of planned behaviour (TPB), the combined TAM and the theory of planned behaviour (C-TAM-TPB), the model of PC utilization (MPCU), and the innovation diffusion theory (IDT). Thus, the UTAUT offers a greater understanding of the intention to use information systems and subsequent use behaviour than the TAM (Fig. 1)

The UTAUT has four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. All four constructs are associated with behavioural intention, but the last construct is known to exert a direct influence on usage behaviour (Venkatesh et al. 2003). In addition, gender, age, experience, and
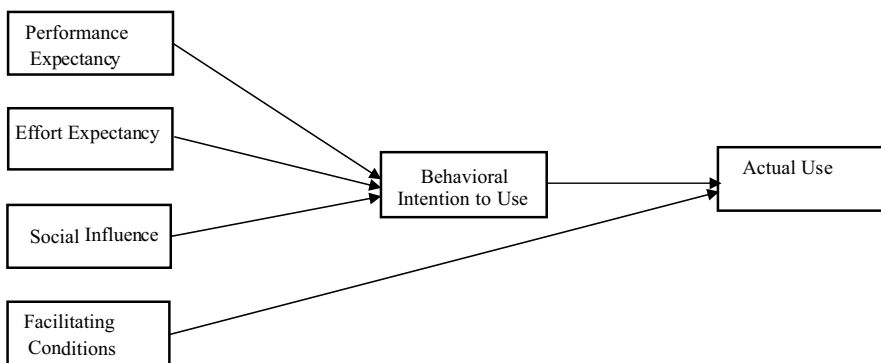

Fig. 1 Unified Theory of Acceptance and Use of Technology (UTAUT)

voluntariness are the moderating variables for the causal relationships between these constructs. The concepts of these UTAUT constructs and relevant previous research follow. Performance expectancy, which is similar in concept to the TAM's perceived usefulness, refers to the degree to which an individual perceives that using an information system will help improve his or her job or task performance (Venkatesh et al. 2012). In other words, it is related to usefulness and increases in productivity and efficiency that users perceive when using new technology. Chiu and Wang (2008) assert that positive usage intention is triggered when users perceive that an information system is easy to use and requires little time and effort to learn. Research in various fields suggests that performance expectancy has significant effects on the user's intention to adopt as well as subsequent actual use. Some e-commerce studies also report a positive influence of performance expectancy on the user's intention to adopt: San Martín and Herrero (2012), who investigate online agricultural tourist products; Arenas-Gaitán et al. (2015), who research internet banking services; and Singh and Matsui (2017), who study online shoppers. M-commerce research has also increased in conjunction with the fast growth of mobile commerce. According to some of these studies, a positive correlation between performance expectancy and the intention to adopt new technology has been demonstrated in the context of mobile services. Some examples are: (1) payment systems by Slade et al. (2015) and Liébana-Cabanillas et al. (2018); (2) for banking services by Alalwan et al. (2018); (3) for healthcare services by Alam et al. (2018); (4) for m-commerce platforms by Sair and Danish (2018); and (5) for flight booking apps by Jeon et al. (2019).

Effort expectancy, which is similar to TAM's perceived ease of use, refers to the degree of convenience and ease associated with the use of an information system (Venkatesh et al. 2012). Easy access to technology incentivizes consumers to use it, increasing their chances of accepting and adopting the technology (Alam et al. 2018; Dwivedi et al. 2017). That is, effort expectancy is positively correlated to the intention to adopt a technology. Venkatesh et al. (2003) report that effort expectancy significantly influences technology adoption initially, but the influence lessens as time passes. This means that effort expectancy could be a crucial determinant of the intention to adopt a technology in the early introduction stage, but such influence on technology acceptance fades with time as users become accustomed to using the technology. Given that research on the acceptance of technology is generally conducted at the introduction stage, there is a high likelihood of the existence of causal relationships between effort expectancy and acceptance intention. In their m-commerce study, Sair and Danish (2018) find a positive effect of effort expectancy on acceptance intention. This finding has been confirmed by numerous studies (Alalwan et al. 2018; Arenas-Gaitán et al. 2015; Jiang et al. 2016; San Martín and Herrero 2012; Slade et al. 2015).

Social influence is defined as the degree to which a user perceives that others important to him/her believe that he/she should use a new information system (Venkatesh et al. 2012). Its concept is similar to subjective norms in the theory of rational behaviour (Venkatesh et al. 2012). That is, an individual is likely to be influenced and persuaded by the people who are close to him/her and perceive that the use of new technology is important (Bagozzi and Lee 2002; Lee et al. 2019). In a study by Venkatesh et al. (2003), social influence has a significantly positive effect

on behavioural intention in mandatory contexts, but it exerts a minimal effect in voluntary contexts. The positive effect of social influence on acceptance intention has been reported in multiple studies (Ain et al. 2016; Alam et al. 2018; Leicht et al. 2018; Slade et al. 2015).

Facilitating conditions refer to the degree to which an individual believes that technical and organizational infrastructures exist to support the use of new technology (Venkatesh et al. 2012). Its concept is similar to perceived behavioural control (TPB and C-TAM-TPB), facilitating conditions (MPCU), and compatibility (IDT). According to the results of an empirical analysis by Venkatesh et al. (2003), facilitating conditions had no direct effect on behavioural intentions but did on actual usage. Moreover, facilitating conditions have been reported to affect acceptance intention positively (Ain et al. 2016; Alalwan et al. 2018). Based on these earlier studies, we developed the following hypotheses using the four primary constructs of the UTAUT model:

H1 The performance expectancy of using a fast-food restaurant kiosk significantly influences acceptance intention.

H2 The effort expectancy of using a fast-food restaurant kiosk significantly influences acceptance intention.

H3 The social influence of using a fast-food restaurant kiosk significantly influences acceptance intention.

H4 The facilitating conditions of using a fast-food restaurant kiosk significantly influence acceptance intention.

2.3 Perceived risk

Perceived risk, which was first proposed by Bauer (1967), is defined as a combination of uncertainty regarding consequences after selection and the seriousness of the consequences. Featherman and Pavlou (2003) define perceived risk as a possible loss when pursuing a desired outcome. Mandrik and Bao (2005) explain that the perception of risk is derived from feelings of uncertainty or anxiety about the behaviour as well as the seriousness or importance of its negative outcomes. As a key concept in the literature on consumer behaviour, perceived risk has been considered as a variable that exerts an influence in the early stage of decision-making (Zeithaml et al. 2006). Many previous studies examine perceived risk, especially in the field of electronic commerce, in which the consumers are aware of the risk. These studies (Ain et al. 2016; Lee 2009; Morosan and DeFranco 2016; Slade et al. 2015) examine how the perceived risks—mainly applied to TAM and UTAUT—affect consumer response to innovative products. Perceived risk has been a common extension of UTAUT (Mandrik and Bao 2005).

Some previous studies extend the UTAUT model by adding perceived risk even though, unlike the four primary constructs of the UTAUT model, it represents a

major factor that negatively affects the technology acceptance process (Slade et al. 2015). As a result, several researchers claim that perceived risk negatively affects user intention to adopt a new product (Conchar et al. 2004). However, others refute that claim by stating that negative effects on acceptance intention have not been documented (Mitchell and Harris 2005). Meanwhile, Featherman and Pavlou (2003) report a negative influence of perceived risk on the intention to adopt an e-service. Lee (2009) ascertains that financial and security risks perceived by internet banking users negatively affect acceptance intention. Slade et al. (2015) also find that perceived risk is negatively associated with the intention to use remote mobile payments. Based on these prior studies, we developed the following hypotheses:

H5 The perceived risk of using a fast-food restaurant kiosk significantly influences acceptance intention.

2.4 The Moderating role of innovativeness

Consumer innovativeness has become one of the key factors that influence the purchase and adoption of new products, and its concept is defined by scholars in the field of consumer behaviour (Rogers 2003; San Martín and Herrero 2012). Rogers (2003) defines it as the degree to which an individual adopts innovation earlier than others do in his/her social system. Slade et al. (2015) describe it as the tendency of an individual to try out and experience new technologies.

Consumer innovativeness, as a predisposition that is important to the diffusion and adoption of new products or technologies, is emphasized as a crucial driver of organizational survival through continuous profitability (Hoffmann and Soyez 2010). Consumers open to innovations are more likely to adopt new products and technologies (Rogers 2003), indicating that consumer innovativeness has a positive impact on innovative adoption behaviour (Huang et al. 2011). When sharing the same technological information, consumers with high innovativeness are more likely to develop a positive perception, compared with less innovative consumers (Agarwal and Prasad 1998). Dabholkar and Bagozzi (2002) explain that innovativeness in the information technology domain acts as a moderator between the consequences of perception towards a specific system and the associated antecedents. San Martín and Herrero (2012) report that innovativeness has a moderating impact on the influence of performance expectancy only in the causal relationship between the four UTAUT factors and the intention to buy online. However, in a study by Leicht et al. (2018), consumer innovativeness is found to play a moderating role on the effects of performance expectancy, effort expectancy, and social influence in the relationship between these factors and the adoption of self-driving cars. Furthermore, consumers with high innovativeness exert a greater influence in this causal relationship, compared to those with low innovativeness. Based on these prior studies, we developed the following hypotheses:

H6 Customers' innovativeness significantly moderates the relationship between performance expectancy and acceptance intention to use a fast-food restaurant kiosk.

H7 Customers' innovativeness significantly moderates the relationship between effort expectancy and acceptance intention to use a fast-food restaurant kiosk.

H8 Customers' innovativeness significantly moderates the relationship between social influence and acceptance intention to use a fast-food restaurant kiosk.

H9 Customers' innovativeness significantly moderates the relationship between facilitating conditions and acceptance intention to use a fast-food restaurant kiosk.

H10 Customers' innovativeness significantly moderates the relationship between perceived risk and acceptance intention to use a fast-food restaurant kiosk.

All the hypotheses are included in the theoretical model depicted in Fig. 2.
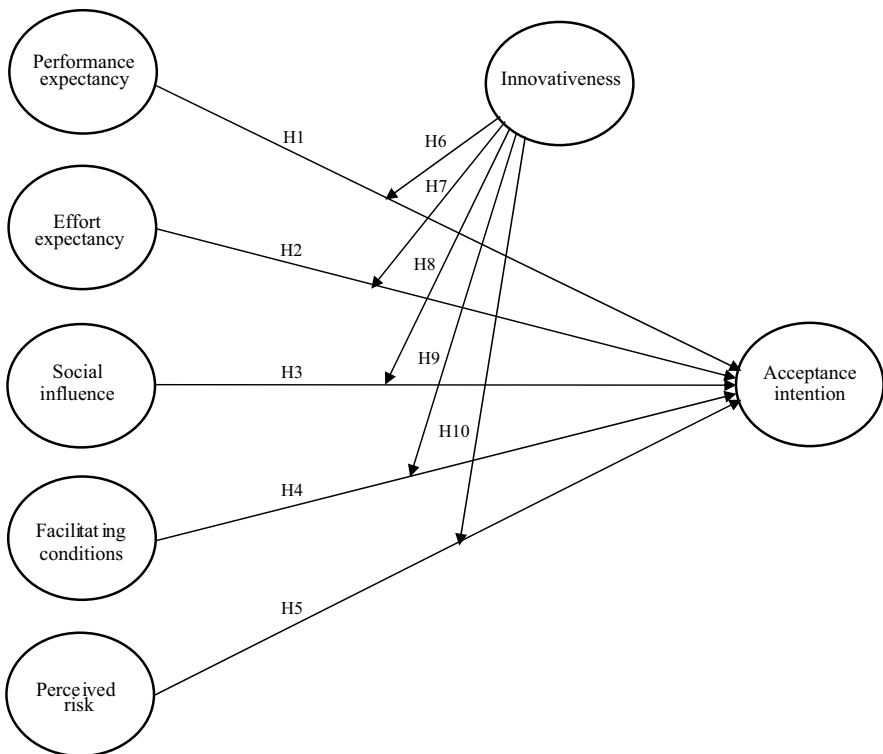

Fig. 2 Theoretical framework

3 Methodology

3.1 Sampling and data collection

In this study, a sample was extracted from the population aged 20 and older living in South Korea who had used self-service kiosks at fast-food restaurants over the last 3 months. The fast-food restaurants selected for this study included Lotteria, McDonald's, Burger King, and KFC because these are the top four players in South Korea in terms of market share (Foodbank 2017). It is therefore assumed that users of these top four brands represent the population purchasing from fast-food restaurants.

Data were collected from July 15 to 24, 2019, via Macromill Embrain, which is a reliable and leading online research company in South Korea with a panel of more than 1.3 million responses. Screening questions were administered before a respondent was invited for an interview. Panel members were asked if they had experience placing an order and paying for it at a kiosk at any of the previously mentioned four fast-food restaurants over the previous 3 months. Those who met this inclusion criterion were selected for this study. The questions were presented to all respondents in the same order. Then, a sample of 295 respondents was selected and used for the empirical analysis. A profile of the sample is shown in Table 1. Since the net response rate was 9.82%, the data set was subjected to non-response bias analysis using wave analysis. Answers gathered within the initial 5 days were classified as 'early responses', while those gathered during the last 5 days were classified as 'late responses'. Using both these two groups, an independent t-test was carried out

Table 1 Respondents' profiles

Demographic characteristics	Frequency	Percentage
Gender		
Male	140	47.5
Female	155	52.5
Age		
20–29 years	118	40.0
30–39 years	99	33.6
40–49 years	50	16.9
50–59 years	18	6.1
Above 60 years	10	3.4
Marital status		
Single	194	65.8
Married	101	34.2
Educational level		
High school	27	9.2
2-year university	52	17.6
4-year university	191	64.7
Graduate school	25	8.5

and results indicated a non-significant difference between them; revealing no non-response bias within the dataset.

3.2 Research instrument

To meet the research objectives, the survey instrument was composed of seven elements, which were derived from previous studies. Four items measure each of the four primary UTAUT constructs (i.e. performance expectancy, effort expectancy, social influence, and facilitating conditions) and acceptance intention from the studies of San-Martín and Herrero (2012), Venkatesh et al. (2012), Arenas-Gaitán et al. (2015), and Lee et al. (2019). Four items are related to perceived risk from the studies of Featherman and Pavlou (2003), and Lee (2009). Four items measure innovativeness from the studies of Jeon et al. (2019) and Leicht et al. (2018).

Since all the questions were developed in English in the previous studies, we redeveloped the questionnaire using the double translation protocol (Harkness 2011). The questionnaire used was first translated into Korean by two bilingual professors who had sufficient understanding of this study. After the survey was completed, the Korean version was translated back into English by two bilingual professors from related fields in order to be of use in this study. There was little difference between the two English versions of this questionnaire. Additionally, before this survey, a pilot test was conducted to confirm whether the participants could fully understand the survey items. The survey was finalised after deleting items that were difficult to accurately measure during the pilot test. All scale items were measured with five-point Likert-type scales ranging from "strongly disagree" to "strongly agree". A self-administered questionnaire survey was designed to collect empirical data on kiosk usage in fast-food restaurants (see Appendix A).

3.3 Analytical methods

The analysis used the Statistical Package for the Social Sciences (SPSS) 22.0 and Analysis of a Moment Structures (AMOS) 22.0. The demographic characteristics were analysed using SPSS 22.0. Data analysis was carried out in Anderson and Gerbing's (1988) two-step approach to test our hypotheses: measurement model and structural model evaluation. Confirmatory factor analysis (CFA) was first conducted to test the adequacy of the measurement model and assess composite reliability and convergent validity. Structural equation modelling (SEM) was then performed to test hypothetical relationships among the five constructs proposed in the conceptual model.

4 Data analysis and results

4.1 Measurement model

The goodness of fit of the measurement model was assessed using a CFA. To assess the fit of the model, cut-off values of seven fit indices—χ^2/df (<3), goodness-of-fit index (GFI >0.90), root mean square error of approximation (RMSEA <0.08), root mean square residual (RMR <0.08), normed fit index (NFI >0.9), incremental fit index (>0.9), and comparative fit index (CFI >0.9)—were used (Hair et al. 2016). Table 2 indicates the results of the CFA after removing one item (i.e. "It takes me more time to settle an order using a kiosk than to order through an employee") related to perceived risk, which reduces the goodness of fit of the model based on the squared multiple correlations (SMC >0.4) value.

The measurement model had a good fit with the data collected ($\chi^2 = 484.154$, df $= 303$, CMIN/df $= 1.598$, RMR $= 0.033$, GFI $= 0.894$, NFI $= 0.906$, IFI $= 0.963$, CFI $= 0.962$, RMSEA $= 0.045$). The adequacy of the measurement model was tested using standard criteria, namely reliability, convergent validity, and discriminant validity. First, reliability was assessed based on composite construct reliability (CCR) values. As shown in Table 2, all the values exceeded 0.7, demonstrating adequate composite reliability (Hair et al. 2016). The average variance extracted (AVE) values of all constructs were higher than the minimum threshold of 0.5, indicating the convergent validity of the measures (Hair et al. 2016).

To evaluate discriminant validity between factors that indicate convergent validity, the AVE value of each latent construct was compared to the square of the correlation between any pair of latent constructs to check if the former is higher than the latter (Fornell and Larcker 1981). As shown in Table 3, the squared values of the correlation among latent constructs were between 0.000 and 0.365 inclusive, which were lower than the AVE values ranging from 0.512 to 0.809, demonstrating discriminant validity of all latent constructs.

4.2 Structural model

SEM was conducted using the AMOS 22.0 statistical package. To test the hypotheses established through the SEM path coefficients, the fit of the structural model describing the relationships among constructs was assessed. The model fit indices were $\chi^2 = 484.154$, df $= 303$, $p = 0.000$, CMIN/df $= 1.598$, RMR $= 0.033$, GFI $= 0.894$, NFI $= 0.906$, IFI $= 0.963$, CFI $= 0.962$, and RMSEA $= 0.045$, meeting the standard assessment criteria. The result of each hypothesis test describing the causal relationship between any pair of constructs is presented in Table 4. H1 was supported because performance expectancy positively and significantly influences acceptance intention ($\beta = 0.338$, $t = 3.381$, $p = 0.000$). H2 was supported because effort expectancy positively and significantly influences acceptance intention ($\beta = 0.207$, $t = 3.042$, $p = 0.002$). H3 was supported because social influence positively and significantly influences acceptance intention ($\beta = 0.088$,

Table 2 Measurement model assessment

Variables and items	Loading	Cronbach's α	CCR	AVE
Performance expectancy (PE)				
PE1	0.851	0.833	0.893	0.682
PE2	0.878			
PE3	0.583			
PE4	0.705			
Effort expectancy (EE)				
EE1	0.809	0.915	0.944	0.809
EE2	0.866			
EE3	0.885			
EE4	0.857			
Social influence (SI)				
SI1	0.937	0.916	0.918	0.740
SI2	0.932			
SI3	0.869			
SI4	0.707			
Facilitating conditions (FC)				
FC1	0.691	0.812	0.892	0.674
FC2	0.763			
FC3	0.793			
FC4	0.638			
Perceived risk (PR)				
PR1	0.760	0.729	0.755	0.512
PR2	0.789			
PR3	0.559			
Acceptance intention (AI)				
AI1	0.720	0.823	0.899	0.691
AI2	0.820			
AI3	0.772			
AI4	0.637			
Innovativeness (IV)				
IV1	0.857	0.896	0.906	0.706
IV2	0.867			
IV3	0.837			
IV4	0.747			

AVE = average variance extracted; CCR = composite construct reliability

$t = 2.144$, $p = 0.032$). H4 was rejected because facilitating conditions do not significantly influence acceptance intention ($\beta = 0.074$, $t = 0.698$, $p = 0.485$). H5 was rejected because perceived risk does not significantly influence acceptance intention ($\beta = -0.057$, $t = -1.054$, $p = 0.292$). Also H8 and H10 are supported because innovativeness moderates the relationship between social influence and SST acceptance

Table 3 Correlations of analysis between the variables

Variable	1	2	3	4	5	6	7
PE	**0.682**	0.365	0.188	0.271	0.024	0.091	0.294
EE	0.604	**0.809**	0.111	0.301	0.057	0.180	0.266
SI	0.434	0.333	**0.740**	0.130	0.000	0.212	0.132
FC	0.521	0.549	0.361	**0.674**	0.095	0.129	0.194
PR	−0.154	−0.238	−0.013	−0.309	**0.512**	0.058	0.041
IV	0.301	0.424	0.460	0.359	−0.241	**0.691**	0.144
AI	0.542	0.516	0.364	0.441	−0.203	0.379	**0.706**
Mean	3.927	4.014	3.074	3.839	2.958	3.470	3.949
SD	0.667	0.718	0.893	0.587	0.778	0.836	0.591

Diagonal (bold) elements show the average variance extracted (AVE). Below the diagonal is the correlation coefficient. Above the diagonal is the square root of the correlation coefficient

Table 4 Results of structural model analysis

Hypotheses		Beta	t-value	p-value	Decision
H1	PE→AI	0.338	3.381**	0.000	Supported
H2	EE→AI	0.207	3.042**	0.002	Supported
H3	SI→AI	0.088	2.144*	0.032	Supported
H4	FC→AI	0.074	0.698	0.485	Rejected
H5	PR→AI	−0.057	−1.054	0.292	Rejected
H6	PE * IV→AI	0.044	0.668	0.504	Rejected
H7	EE * IV→AI	−0.149	−1.863	0.063	Rejected
H8	SI * IV→AI	0.502	7.821**	0.000	Supported
H9	FC * IV→AI	−0.070	−0.569	0.579	Rejected
H10	PR * IV→AI	−0.469	−5.752**	0.000	Supported

Critical t-values. *$p<0.05$, **$p<0.01$

intention ($\beta=0.502$, $t=7.821$, $p=0.000$), perceived risk and SST acceptance intention ($\beta=0.469$, $t=5.752$, $p=0.000$). As the level of user innovativeness increases, the influence of the social influence and on the acceptance intention increases, and the influence of the perceived risk and on the acceptance intention decreases as well. H6, H7, and H9 are rejected, as the suggested interactions do not have a significant influence on the SST acceptance intention.

5 Discussion and conclusion

5.1 Theoretical implications

This study provides theoretical and practical implications important for food service providers (management and employees). From a theoretical perspective, the present study significantly expands the scope of food service research by incorporating

technological aspects. In this study, we extended the UTAUT framework by adding two additional variables (i.e. perceived risk and innovativeness) to propose a model that can explain the intention to use a self-service kiosk.

In conclusion, the present study identified effective predictors of the intention to adopt a self-service kiosk by: (i) testing the UTAUT framework in relation to the use of self-service kiosks (SST) at South Korean restaurants; (ii) extending the UTAUT framework to include additional variables; and (iii) determining predictors of consumer intention to use a self-service kiosk, contributing to the existing literature. Accordingly, the theoretical framework proposed and tested in this study can be used as a basis for future studies on consumer behaviour with regard to food service technologies.

In particular, we have emphasized consumer innovation as a factor influencing the proliferation and acceptance of new products and technologies (Hoffmann and Soyez 2010). This had been overlooked in a previous study that had applied the extended TAM in a tourist behaviour study on hotel SST (Kaushik et al. 2015). Our study differs from previous studies as it identifies the effect of consumer innovativeness on the relationship between the variables of the extended UTAUT model and the acceptance intention. Since SST does not involve face-to-face contact with employees, there is a high risk that consumers will fail when using SST (Yi and Kim 2017). Therefore, establishing consumer innovativeness as a variable that reduces the perceived risk of consumers towards SST is a significant contribution to the existing literature.

5.2 Practical implications

From a practical perspective, the information on variables that affect the consumer intention to use a self-service kiosk is useful for marketing strategies aimed at boosting kiosk applications in restaurants. By installing self-service kiosks, restaurants can take advantage of benefits such as reduced maintenance and labour costs. In sum, marketing strategies for the use of innovative SST will provide food service providers with a competitive advantage. The present study identified performance expectancy as the most important factor influencing the consumer's intention to adopt a self-service kiosk. Performance expectancy is mostly associated with the practical functions of online/digital channels. Therefore, food service providers need to ensure the usefulness and ease of use of kiosks to make kiosk-based ordering and payment systems faster and more accurate than the traditional ordering process. Kiosks must be functional to allow customers to customize their menus and enter additional specific requirements. An appropriate number of kiosks should be available to minimize waiting time for use. For customers, promptness is an important feature of kiosks that reduces customer inconvenience. To shorten the time an individual takes to use a kiosk, the quick understanding of user instructions is essential. Therefore, user instructions for menu location, special orders, and payment on the start screen must be specific and descriptive for easy understanding. In busy locations, smartphone-enabled self-ordering systems are necessary (e.g. Starbucks' Siren Order, which allows customers to place an order on the way to a store).

Customer innovativeness was found to moderate the effects of social influence and perceived risk on acceptance intention. A positive correlation was also observed between innovativeness and the intention to use a kiosk. Accordingly, customers can be classified according to their level of innovativeness to understand their acceptance intention better. To that end, target customer segmentation is necessary. The levels of innovativeness among potential customers, which may vary by restaurant location, can be identified to adjust self-service kiosk deployment; in other words, there should be more self-service kiosks for more innovative potential customers. However, customers with low innovativeness may be influenced to use kiosks by those with high innovativeness when the latter use a kiosk during their visit to a restaurant. Thus, those with high innovativeness appear to reduce the negative feelings of their counterparts with low innovativeness that may arise from the use of kiosks. Communication between these two groups can promote technology diffusion (San Martín and Herrero 2012), increasing the likelihood of creating a positive impact on a customer's intention to adopt SST at restaurants.

5.3 Conclusion

This study identifies the major factors that affect user intention to adopt a self-service kiosk, a new service available in South Korean restaurants, using the UTAUT model extended to include perceived risk and innovativeness. The model includes multiple independent variables (i.e. performance expectancy, effort expectancy, social influence, facilitating conditions, perceived risk, and innovativeness).

The analysis reveals the positive influence of performance expectancy, effort expectancy, and social influence on consumer adoption intention. The intention to use a self-order and self-payment kiosk is influenced by the usefulness of the kiosk, perceived ease of use, and acquaintances who have used the service. However, facilitating conditions and perceived risk has no significant influence on the intention to use a self-service kiosk. Individual innovativeness is found to moderate the effects of social influence and perceived risk on acceptance intention. Ultimately, the extended UTAUT model is able to partially explain South Koreans' intention to use a self-service kiosk in a restaurant.

5.4 Limitations and future research

Despite its findings and implications, the present study has the following limitations, which suggest directions for future studies. First, as data were collected in South Korea only, the generalization of the results of this study may be limited. Second, this study focused on fast-food restaurants, making it inappropriate to apply the results to other types of restaurants, namely casual and fine-dining restaurants, or sectors. Further studies are needed to identify consumers' intention to adopt an SST at different types of restaurants and in different industries. Third, respondents in their 20s and 30s constituted 73.6% of the sample, which is linked to the online

administration of the survey conducted in this study. The participation of those in the 40+ age groups is low due to their unfamiliarity with online technology. Therefore, the study population may not be broad enough to represent fast-food restaurant customers as a whole. Given that online surveys are susceptible to selection bias (Wright 2005), future studies need to employ different data collection methods as a means of reducing bias and improving survey response rates.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

Appendix A: Measurement items for study

Measure items	
Performance expectancy	
PE1	Using kiosks in fast-food restaurants enables me to accomplish the ordering and payment process quicker
PE2	Using kiosks in fast-food restaurants is effective for food ordering and payment
PE3	Using kiosks in fast-food restaurants is better than ordering and paying through an employee
PE4	Using kiosks in fast-food restaurants is useful
Effort expectancy	
EE1	Learning how to use a kiosk for purchasing food is easy for me
EE2	My interaction with kiosks for the purchase of food is clear and understandable
EE3	Using kiosks in fast-food restaurants is easy for me
EE4	It is easy for me to become skilful at using kiosks for purchasing food
Social influence	
SI1	People who influence my behaviour think that I should use kiosks for purchasing food in fast-food restaurants
SI2	People who are important to me think that I should use kiosks for purchasing food in fast-food restaurants
SI3	People whose opinions I value prefer that I use kiosks for purchasing food in fast-food restaurants
SI4	Listening to the media influences the use of kiosks
Facilitating conditions	
FC1	If you have a problem with a kiosk, staff will be able to help you
FC2	I feel comfortable using kiosks for purchasing food in fast-food restaurants

Measure items	
FC3	The fast-food restaurant has a kiosk with enough features to use the self-order-payment service
FC4	The fast-food restaurant provides easy-to-understand procedures and methods for using kiosks
Perceived risk	
PR1	There is a risk that the ordering and payment processes will not work due to a kiosk system malfunction
PR2	Kiosks present the risk of incorrect ordering and payment
PR3	I am afraid that my order will be incorrectly processed or paid when using a kiosk
Acceptance intention	
AI1	I will always try to use kiosks in fast-food restaurants
AI2	I plan to use kiosk restaurants often when buying fast food
AI3	I am always willing to use kiosks in fast-food restaurants
AI4	If I get a chance, I will use a kiosk in a fast-food restaurant
Innovativeness	
IV1	When a new product or service is released, I am one of the first to use it
IV2	In general, I like to try out new products and services when they are available
IV3	If I get news of new technology, I will find a way to try it out
IV4	I am willing to give up existing product or service technologies to accommodate new innovative product or service technologies

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