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Retail Distribution Strategies for Train Tickets: The Extended UTAUT Model

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Abstract

Purpose: As mobile devices are commonly used and contact-free services are widespread due to the COVID-19 pandemic in the recent distribution environment, this study suggests retail strategies for consumers using high-speed railways. To this end, we analyzed how consumer perception on technologies necessary for use of mobile apps is related to the attitude that drives consumers to continue using the app services. **Research design, data and methodology:** Based on the extended unified theory of technology acceptance and use of technology model by Venkatesh, Morris, Davis and Davis (2003), we added variables proposed by existing theories that studied the technology acceptance model from multiple perspectives and empirically analyzed the relationship between user satisfaction and use intention with structural equation modeling. **Results:** As expected, factors necessary for the use of app services such as performance expectancy, social influence, price value, facilitating conditions, security, and aesthetics had positive effects on user satisfaction, whereas the effect of effort expectancy on user satisfaction was rejected. And user satisfaction was found to have a significant effect on intention to use. **Conclusions:** The results provide implications that strategic retail management of the above factors can motivate passengers to continuously use high-speed railways.

Keywords : Retail Strategy, Mobile Application, Extended UTAUT, User Satisfaction, Use Intention

JEL Classification Code : C46, L10, L84

1. Introduction

The preference for contactless services has increased with the recent proliferation of smart environments and the prevalence of mobile phone use, as well as the COVID-19 environment. In line with the expansion of e-commerce based on the online environment, the railway service industry, which is an industry actively utilizing the mobile and online retail environment, is replacing booking and ticketing services of the past with mobile and other online channels.

According to the data released by Statistics Korea on January 5, 2021, the turnover for online shopping was 15.0631 trillion KRW, showing a 17.2% increase compared to November 2020. The turnover for mobile shopping showed a 21.9% increase compared to the previous year with 10.2598 trillion KRW. More specifically, mobile shopping accounted for a relatively high ratio in food services (96.1%), e-coupon services (86.3%), bags (79.6%), and travel and transportation services (76.8%), which reflects the growing size of mobile service that has surpassed 10 trillion KRW for the first time since the first statistics were published in 2013. With this trend, consumers expect more convenient and high-quality services beyond simplicity in the contact-free purchasing procedures. Hence, service companies must review all contact-free services including apps and improve their quality to increase regular customers and maintain long-term business connections. Presently, thus, we need extensive research on customers using mobile ticketing app

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services for high-speed railway service in the context of retail distribution strategies.

The high-speed rail project, which started on April 1, 2004, as part of the national program, led to productivity and efficiency improvements, revitalization of the local economy, and other social and economic effects in the densely populated Korea. However, it is now facing a crisis due to the competitive marketing strategies of airlines and the expansion of the low-cost airlines market. Accordingly, while it can be said that it is time for a more active response from a retail strategy perspective as well as in-depth research into the industry, equally pressing is the need for research on high-speed rail apps, which is very deficient, since research on high-speed rail mobile reservation apps has tended to focus on specific functionalities or attributes of the app. In addition, there are limitations of using the existing technology acceptance model (TAM) in studies, one of which is that it does not include a more comprehensive variety of influencing factors, which limits its explanatory power. Therefore, this study utilizes the extended UTAUT model, which has emerged as a model with a relatively higher explanatory power that overcomes the limitations of TAM, in order to present the structural relationship between factors explaining user acceptance of high-speed rail app technology with consumer satisfaction and intention to use.

This study aims, first, to expand the key variables and use the extended UTAUT model suitable for high-speed railway apps as an independent variable; second, to analyze the relationship between technology factors necessary for the use of mobile apps and user satisfaction; third, to investigate how user satisfaction formed by the use of high-speed railway app service affects the attitude toward using the company's app. Through this, ultimately, we intend to propose a retail distribution strategy for high-speed rail tickets using mobile ticketing app services.

2. Literature Review

2.1. Mobile Application Service

A mobile app is an app designed and implemented for mobile operating systems (Smith, 2011). In a broad sense, apps refer to all software run on an operating system, and the emergence of apps has enabled a completely different concept of operations than before and dramatically enhanced work efficiency. From the individual users' perspective, mobile apps have the benefit of direct access just by clicking on the app after download unlike the web-based internet environment, allows users to use their own personal mobile devices, and provide various benefits in

use. In contrast, from the perspective of companies as service providers, apps can directly provide consumers with promotional activities as consumers are constantly engaged with the mobile platform and consuming it as a strategic marketing communication channel (Choo & Yoon, 2011).

With such diverse benefits, consumers in the tourism industry are actively using IT to obtain travel information, using the convenience, ease, real-time information and communication possibility, and overcoming space constraints by smartphones, while service companies are using apps as a communication channel with consumers (Wang, Park, & Kim, 2017). In e-commerce, efforts are made to provide a new shopping environment that can be enjoyed by consumers while overcoming space and time constraints using a mobile shopping app and providing product and service information, instructions and user reviews. Recent studies tend to focus on developing mobile apps to provide expertise or pleasure of shopping in general, revealing that mobile apps on online shopping malls serve as a crucial tool that increases consumer preference and loyalty. High-speed railway ticketing services connect online and offline. Consequently, app users use the mobile app to search, book, and pay online, after which they take the train offline to receive the service. For service providers, this can be an effective alternative distribution channel to communicate and make transactions with consumers without saving inventories and within limited service selling time. For users, this can improve efficiency in product search and effectiveness in cost saving, promote interactions between sellers and consumers, and enable rational consumption based on optimized information (Bae, Lee, & Cha, 2004; Jeon & Yoon, 2018). Mobile apps for KTX or SRT ticket booking include features such as calling the train crew, alerts for train departure/arrival, SNS login, mobile receipt faxing services, and ticket gifting in addition to ticket booking and selling, thereby offering various services to consumers and expanding the value of reciprocity. In this situation, using mobile apps that has become a major distribution channel, like the Internet in the past, is changing into an essential technology that must be managed for continuous use, not a new one-way technology that must be accepted by consumers (Lee, 2016).

Accordingly, this study examines passengers using mobile ticketing apps run by high-speed railway KTX and SRT, for which customers may have higher expectations than general railway, based on customer transaction. Further, the study determines, by applying the extended TAM, how attributes necessary for the app service use affect consumer satisfaction.

2.2. Extended Unified Theory of Acceptance and Use of Technology

The TAM is a theory that explains the causal relations of belief that affects attitude, which then affects acceptance intention and behavior based on the theory of reasoned action (TRA). It is a theory that studies the extent to which consumers accept new technologies, systems, and services (Davis, 1989). However, some scholars point out the need for more diverse approaches to the impact of exogenous variables. Venkatesh et al. presented the unified theory of acceptance and use of technology (UTAUT) in 2003, by integrating the theory of reasoned action (TRA) and the theory of planned behavior (TPB) with the existing TAM. The UTAUT can be regarded as a more evolved model than TAM since it offers a more diverse approach to the influence of exogenous variables and has a higher explanatory power. Thereafter, the extended UTAUT theory was presented in 2012, which was a theory explaining acceptance and use of technology in a general individual consumer context, contrasting with the UTAUT model, which was about technology acceptance in a mandatory environment to improve performance within the organization, and which was primarily targeted at members of the organization. Thus, Venkatesh et al. (2003) combined the TAM, TRA, and theory of planned behavior (TPB) to solve this problem and suggested the UTAUT model, with increased explanatory power. The extended UTAUT integrated 32 concepts derived from eight models related to technology acceptance, such as TAM, TRA, motivation model (MM), TPB, model of PC utilization (MPCU), innovation diffusion theory (IDT), and social cognitive theory (SCT) that comprised of three factors affecting acceptance intention, one factor affecting behavior, and four factors with moderating effect. Compared to the explanatory power of TAM at 40%, that of UTAUT can be approximately 70%, showing much higher explanatory power (Venkatesh et al., 2003).

The extended UTAUT consists of a total of seven independent variables, that is, the four variables constituting the initial UTAUT (performance expectancy, effort expectancy, social influence, facilitating conditions) and three additional variables (price value, hedonic motivation, habit). It started by analyzing the relationships with (behavioral) intention to use. Thereafter, follow-up studies continued to refine and supplement independent variables to suit the characteristics of the industry or target (Venkatesh, Thong, & Xu., 2012).

In the initial UTAUT model of 2007, “performance expectancy,” “effort expectancy,” “social influence,” and “facilitating conditions” were presented as independent factors affecting intention to accept new information technology and service, satisfaction, and other consumer

response. Additionally, the moderating effects of voluntariness of use, gender, age, and experience were analyzed (Venkatesh & Davis, 2000). Performance expectancy is a concept similar to usefulness in the TAM, representing how much work performance is improved by using certain technologies or systems. Effort expectancy is similar to usefulness in the TAM, defined as the ease of using and understanding certain technologies or systems. Social influence is similar to subjective norm in TRA, indicating the influence on individuals when members of the organization affect one another to behave in a particular manner. This is the belief that people close to each other use similar technologies or systems. Facilitating condition is a similar concept as perceived behavioral control in the TPB, facilitating conditions in the MPCU, and suitability in the IDT, showing the belief that there is an infrastructure for organized and technical support to facilitate use of certain technologies or systems.

In the subsequent study on the extended UTAUT by Venkatesh et al. (2003), variables such as “price value,” “hedonic motivation,” and “habit” were added to the representative four variables of the existing UTAUT, in accordance with the study subject in search of a more effective approach. The extended UTAUT model was viewed as a more suitable model for the general public, since the limitations of the existing UTAUT model (e.g., its focus on members of the organization) needed to be overcome (Venkatesh & Davis, 2000).

For the extended UTAUT, Venkatesh et al. (2003) undertook a more effective approach by adding independent variables to the four major factors of the UTAUT according to the participants. The authors claimed limitations in the UTAUT model as it studied only members of organizations and raised the need for a suitable model for the general public. Accordingly, they included factors such as price value, hedonic motivation, and habit in addition to the existing technology acceptance factors as components of the extended UTAUT, through which they revealed that the general public was more sensitive to price value than members of a specific organization (Venkatesh & Davis, 2000). The value of price is a concept of how much value the perceived benefit has compared to the financial cost when using a particular technology, and it is related to the effect on purchase intention by forming perceived price value or quality among consumers.

Empirical studies in Korea based on the extended UTAUT added a security feature to factors affecting simple payment service acceptance (Chung & Jung, 2019), explaining that various financial services on a contact-free mobile environment, where the service provider cannot be identified, have uncertainty and risks; thus, security is a critical element that cannot be overlooked. The concept of security can be said to be the degree to which a certain

service technology is trusted in terms of security, the process is safe, and a problem can be solved amicably when it occurs (Kong & Choi, 2018). A study on fashion sharing apps added convenience, efficiency, and aesthetics to social influence and facilitating conditions, and aesthetics is supporting users to enjoy the apps' visual elements and conveniently use the services (Head, 1999).

This study aims to analyze technology acceptance of general individual passengers using high-speed rail app services, based on prior studies using the extended UTAUT to analyze acceptance and use of technology in a general consumer context. Based on the fact that many previous studies are revealing the significant relationship of factors of the extended UTAUT with satisfaction or purchase intention (Martins, Oliveira, & Popovič, 2014; Raman & Don, 2013; Venkatesh et al., 2003), this study added price value, which replaces economic feasibility, security, and aesthetics to the basic factors of the UTAUT model such as performance expectancy, effort expectancy, social influence, and facilitating conditions as the independent variables for technologies necessary for use of high-speed railway app services, thereby developing the UTAUT model optimized for high-speed railway ticketing services and analyzing the relationship with user satisfaction (Chung & Jung, 2019; Kim, 2019; Martins et al., 2014; Raman & Don, 2013; Venkatesh et al., 2003; Venkatesh & Davis, 2000).

2.3. Use Intention

Davis (1989) defined use intention as the extent to which one intends to conduct certain behavior and claimed that it serves as a key factor affecting actual behavior. Studies on the UTAUT measure use intention as the intention, expectation, or plan to use information systems (Davis, 1989). Most studies on technology acceptance present that use intention is a factor affecting user behavior and claims that it is a variable that has been constantly tested as a key factor determining user behavior in the use of technology (Davis, 1989; Martins et al., 2014).

In a study on the acceptance intention and use of simple payment service, Kang and Kim (2016) is defined use intention as the intention to use a particular technology or system and referred to it as the intention or plan to use simple payment, measuring use intention as the intention to use, plan to use, or need to use.

This study on passengers using high-speed railway services defined service use intention as the intention to use a service company based on these previous theories and determined the relationship of user satisfaction with the factors of the extended (Davis, 1989; Kang and Kim, 2016; Martins et al., 2014; Venkatesh et al., 2003).

3. Research Methods and Materials

3.1. Study Model and Hypothesis

3.1.1. Effects of the extended UTAUT model for high-speed railway app service on user satisfaction

If the composition of the independent variables in the extended UTAUT models of prior studies can be summarized, it can be broadly divided into two categories. Either the same seven variables of the extended UTAUT model of Venkatesh et al. (2003) are applied, or the four variables constituting the initial UTAUT (performance expectancy, effort expectancy, social influence, facilitating conditions) are used along with other variables that are modified and supplemented according to the characteristics of the study. In the study of the airline reservation app, the same seven variables of the extended UTAUT of Venkatesh et al. (2003) were applied (Escobar-Rodríguez & Carvajal-Trujillo, 2014). In the study of financial services with payment functions, there was a tendency to add variables such as security, reliability, or perceived risk due to the industry requirement of protecting personal information or privacy (Kim & Lee, 2020; Shim & Dong, 2020; Venkatesh et al., 2003). In studies on augmented reality (AR), video service, drone use, and other cases when the purpose of use was for recreational functions, variables such as hedonic motivation were added (Kim & Chung, 2019). In studies analyzing design functions such as user interfaces, variables such as aesthetics were also added (Kim, 2019). In addition, as many studies have shown, technical readiness was included in financial services (Shim & Dong, 2020), while price value was excluded when services were provided free of charge, or when there were no benefits in terms of cost for using the services (Kim & Chung, 2019; Kim & Lee, 2020; Lee & Sung, 2017; Shim & Dong, 2020). In other cases, the necessity of face-to-face contact was also included in consideration of the COVID-19 situation (Shim & Dong, 2020).

Hypotheses in this study were established based on several prior studies using the extended UTAUT, which explained that the higher the acceptance of technology, the higher the intention to use the technology, and the higher the user satisfaction (Chung & Jung, 2019; Kim, 2019; Martins et al., 2014; Raman & Don, 2013; Venkatesh & Davis, 2000; Venkatesh et al., 2003). In setting up the extended UTAUT research model suitable for the high-speed rail app, security and aesthetics were added to the variables of the extended UTAUT model of Venkatesh et al. (2003), whereas hedonic motivation and habits were deleted. This was based on previous studies of online financial services that dealt with security, and previous

studies of shared service app that dealt with aesthetics, as well as the determination that security and aesthetics were highly relevant in increasing user satisfaction, given the characteristics of the high-speed rail app that includes booking and ticketing functions (Chung & Jung, 2019; Kim, 2019; Kim & Chung, 2019; Kim & Lee, 2020; Lee, 2016; Martins et al., 2014; Shim & Dong, 2020; Venkatesh et al., 2012).

According to the initial UTAUT model, consumers feel that many factors of technology-based services are useful, easy to use, or fun, thereby forming satisfaction. Satisfaction for each factor is combined to form overall satisfaction, which emphasizes the importance of each individual technology acceptance factor. However, the extended UTAUT model overcomes the limitation of the initial model's simplicity and generalization. The extended model expanded the scope of this technology acceptance intention and optimized the factors suitable for the industry, thereby having a greater influence on user satisfaction than the initial model.

Effort expectancy refers to the level of easiness while using the system. This study established the following hypotheses, based on previous studies by Venkatesh et al. (2003), Chung and Jung (2019), and Martins et al. (2014) that found that the more convenient and easier to use a new technology is, the higher the user satisfaction and the intention to use the technology, although Escobar-Rodríguez & Carvajal-Trujillo's (2014) study on airline apps did not find such significant relationships (Chung & Jung, 2019; Escobar-Rodríguez & Carvajal-Trujillo, 2014; Martins et al., 2014; Venkatesh et al., 2012).

Therefore, this study set up the following research hypotheses based on many previous theories on the extended UTAUT model that proved that higher acceptance intention in technology use will lead to higher user satisfaction (Chung & Jung, 2019; Kim, 2019; Martins et al., 2014; Raman & Don, 2013; Venkatesh & Davis, 2000; Venkatesh et al., 2003).

H1: Effort expectancy will have a significant positive effect on user satisfaction.

Performance expectancy refers to the degree to which an individual perceives that using a system will help them improve their job performance. The following hypotheses were established in this study, based on previous studies on airline apps and the study by Kang et al. (2020) on smart farms, which found that the more convenient and easier to use a new technology is, the higher the user satisfaction and the intention to use the technology (Escobar-Rodríguez & Carvajal-Trujillo, 2014; Shim & Dong, 2020).

H2: Performance expectancy will have a significant positive effect on user satisfaction.

Social influence is the extent to which the perceptions and opinions of friends, family, etc., affect users' views on the adoption of a particular technology. Although a study by Lee and Sung (2017) on free mobile video services did not show any significant relationships (Lee & Sung, 2017), The following hypotheses were established in this study, based on the results of studies by Kim and Lee (2020), Venkatesh et al. (2012), and Raman and Don (2013), which found that an individual's intention to use a new technology is increased by the influence of people around them (Bae et al., 2004; Kim & Lee, 2020; Venkatesh et al., 2012).

H3: Social influence will have a significant positive effect on user satisfaction.

The facilitating conditions refer to the user's perception that there is the availability of adequate technical and organizational infrastructure to enable the use of a particular technology Venkatesh et al. (2012). Although Kim and Lee's (2020) study on kiosks did not find significant relationships, The following hypotheses were established in this study, based on the studies by Venkatesh et al. (2012), Chung and Jung (2019), and Martins et al. (2014), which found that the more a new technology is perceived as having a good technical support base, the higher the user satisfaction or the intention to use the technology (Kim & Chung, 2019; Kim & Lee, 2020; Martins et al., 2014; Venkatesh et al., 2012).

H4: Facilitating conditions will have a significant positive effect on user satisfaction.

Price value refers to the cost-effectiveness of the adoption of a new technology. Although Kang et al.'s (2020) study on smart farms did not find significant relationships, Studies by Escobar-Rodríguez & Carvajal-Trujillo, 2014 and Lee (2016) on hotel and airline reservation apps found a significant relationship between price value and user satisfaction or intention to use. Therefore, the following hypotheses were established in this study, based on the judgment that there will be a significant relationship between price value and user satisfaction in the high-speed rail app (Kang et al., 2020; Escobar-Rodríguez & Carvajal-Trujillo, 2014; Lee, 2016).

H5: Price value will have a significant positive effect on user satisfaction.

Security refers to the degree to which a system is perceived as safe when using it. Hypothesis 6 was established in this study with the expectation that there may be a significant relationship between security and user satisfaction in high-speed apps with payment functions, based on prior studies by Chung and Jung (2019) on easy payment service, and by Shim and Dong (2020) on Internet-only banks, which found relationships between security-related factors and intention to use (Chung & Jung, 2019; Shim & Dong, 2020; Walker, 2002).

H6: Security will have a significant positive effect on user satisfaction.

Aesthetics refers to the degree to which visual elements are enjoyable when using the system and the degree to which support is available for the convenient use of the service. Based on the results of Head’s (1999) previous study on fashion sharing apps, which examined the relationship between aesthetics and intention to use (Head, 1999), the following hypothesis was established in this

study. There will be a significant relationship between design factors related to user interfaces and user satisfaction of the high-speed rail app, which was used by passengers of various ages and classes.

H7: Aesthetics will have a significant positive effect on user satisfaction.

3.1.2. Effect of user satisfaction on use intention

Existing theories on the extended UTAUT model mostly comprise the intention to accept the technology as the independent variable, and deal with the direct relationship with intention to use. However, it can be predicted that how users feel about service providers, such as satisfaction, will have a significant influence on intention to use in the acceptance and use of technology field, similar to what has been proven through various previous studies in various fields; that is, user satisfaction has a significant effect on potential behavioral intentions, such as intention to use (Bhattacharjee, 2001; Venkatesh et al., 2003).

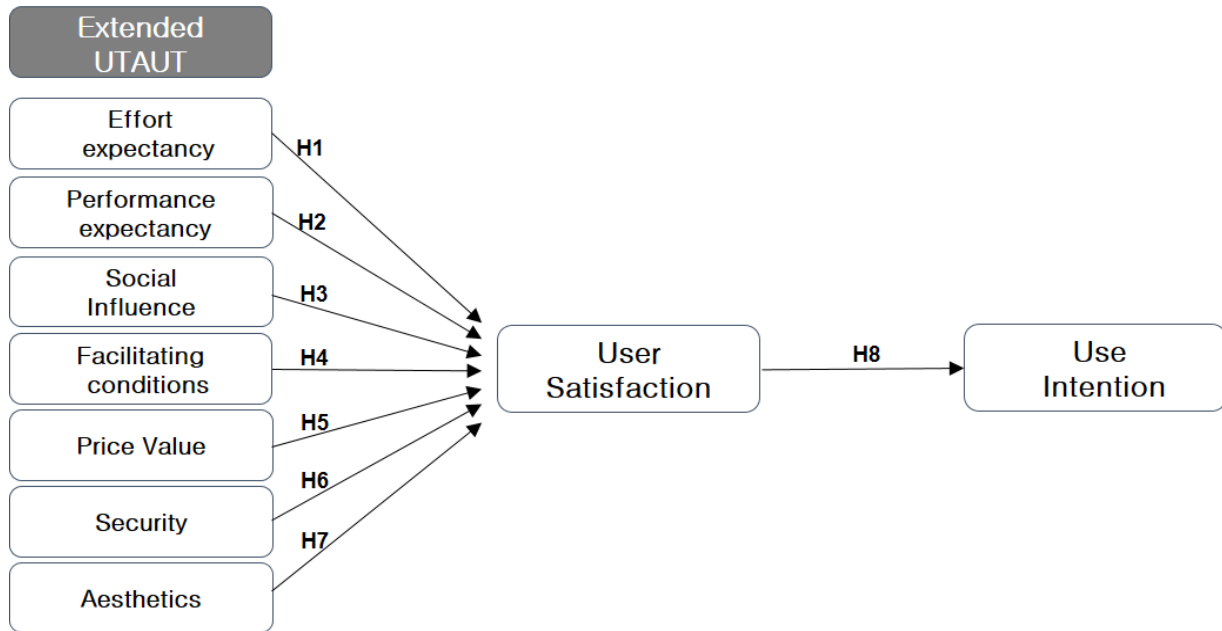


Figure 1: Research Model

Previous studies in various fields have long proved the significant effect of user satisfaction on potential future behavioral intention such as use intention. In theories of technology acceptance, studies have been actively conducted on the relationship between user satisfaction with service providers and use intention that triggers purchase behavior (Bhattacharjee, 2001; Venkatesh et al., 2003). Based on the results of previous studies, this study

set the following research hypothesis assuming that users satisfied with technology acceptance factors experienced in using high-speed railway ticketing app services will be willing to continue using the app services.

H8: User satisfaction will have a significant positive effect on use intention.

The research model based on these hypotheses is as follows.

3.3. Collecting Data and Analysis Method

The study participants were consumers with experience in booking tickets using a high-speed railway app. The configuration of questionnaires is shown in Appendix 1. An online survey was conducted for 12 days from October 1 to 12, 2020. The survey results of 200 participants were

analyzed, excluding missing values or insincere responses and adding the responses of 100 SRT app users and 100 KORAIL app users. As shown in Table 1, 50.5% of the respondents were male and 49.5% were female, showing a similar gender distribution as well as an even age distribution, with most respondents in their 30s (29.5%) and 40s (31.0%). Most of them lived in Seoul (41%) and Gyeongsang-do (28%), followed by Gyeonggi-do (19%), Chungcheong-do (9%), and Gangwon-do (3%).

Table 1: Respondent characteristics

Division		Frequency	%	Division		Frequency	%	
Gender	Man	101	50.5	Place of residence	Seoul	82	41.0	
	Women	99	49.5		Gyeonggi-do	38	19.0	
Age	Below 20	2	1.0		Gangwon-do	6	3.0	
	20-29	32	16.0		Chungcheong-do	18	9.0	
	30-39	59	29.5		Gyeongsang-do	56	28.0	
	40-49	62	31.0		Education	Below High school	12	6.0
	50-59	34	17.0			Below Univ.	135	67.5
	Above 60	11	5.5	Above MA degree		53	26.5	
	Total		200	100.0	Total		200	100.0

4. Empirical Analysis Results

4.1 Validity and Reliability Analysis

This study conducted an exploratory factor analysis using SPSS 15.0 to extract factors of technology acceptance necessary for using high-speed railway app services and extracted seven final factors such as performance expectancy, effort expectancy, social influence, facilitating conditions, security, and aesthetics from the ones identified in previous studies (Venkatesh et al., 2003; Venkatesh & Davis, 2000; Chung & Jung, 2019; Head, 1999; Martins et al., 2014; Raman & Don, 2013). We used the AMOS

measurement model to conduct a confirmatory factor analysis and selected and elaborated on the measurement items, after which we finally developed three items for each factor. To test the convergent validity of each construct, we verified the size of standardized factor loadings, average variance extracted (AVE), and construct reliability. As shown in Table 2, standardized factor loadings of all the measured variables were high (0.812–0.933). In addition, the construct reliability was higher than 0.7, and AVE exceeded 0.6, proving good convergent validity between the constructs and measured variables in this study, and the model fit was also acceptable.

The discriminant validity analyses results are as shown in Table 3. The discriminant validity analysis of research

items was based on the method by Fornell and Larcker (1981), where the square root of AVE must be higher than

0.7 and higher than the correlation coefficients of other research items, which was satisfied in this study.

Table 2: Confirmatory Factor Analysis

Constructs	Measure	Factor Loading	S.E	C.R	Concept Reliability	AVE
Effort Expectancy	PE1	.908	-	-	.832	.706
	PE2	.863	.063	22.642		
	PE3	.869	.055	20.856		
Performance Expectancy	EE1	.898	-	-	.945	.772
	EE2	.933	.042	19.237		
	EE3	.859	.048	18.832		
Social Influence	SI1	.875	-	-	.921	.592
	SI2	.929	.038	23.734		
	SI3	.903	.051	22.923		
Facilitating Conditions	FC1	.884	-	-	.894	.659
	FC2	.909	.058	17.682		
	FC3	.841	.039	15.374		
Price Value	PV1	.909	-	-	.735	.597
	PV2	.898	.031	23.671		
	PV3	.857	.041	12.639		
Security	SC1	.858	-	-	.879	.692
	SC2	.853	.065	21.717		
	SC3	.871	.058	20.634		
Aesthetics	AT1	.853	-	-	.901	.738
	AT2	.872	.047	17.162		
	AT3	.812	.038	15.056		
User Satisfaction	US1	.912	-	-	.881	.867
	US2	.896	.036	23.745		
	US3	.924	.038	20.946		
Use intention	UI1	.915	-	-	.924	.893
	UI2	.914	.049	20.938		
	UI3	.898	.051	18.218		

Note: $\chi^2 = 361.563$, $df = 196$, $p = .000$, $GFI = .908$, $AGFI = .903$, $RMR = .047$, $RMSEA = .054$, $NFI = .889$, $CFI = .957$

4.2. A Study Model and Hypothesis

Table 4 shows the structural equation analyses results using AMOS 18 to analyze the model fit. Results

indicated $\chi^2=361.287$ (df=186, $p=.000$), and the model fit indices GFI, AGFI, NFI, and CFI were 0.905, 0.914, 0.893, and 0.945, respectively.

Table3 : Discriminant Validity Analyses Results

Items	1	2	3	4	5	6	7	8	9
1. Effort Expectancy	.84								
2. Performance Expectancy	.65	.88							
3. Social Influence	.42	.56	.77						
4. Facilitating Conditions	.36	.39	.32	.81					
5. Price Value	.58	.48	.61	.35	.77				
6. Security	.39	.42	.45	.26	.38	.83			
7. Aesthetics	.31	.29	.34	.24	.47	.28	.86		
8. User Satisfaction	.64	.57	.63	.34	.52	.62	.59	.93	
9. Use Intention	.59	.65	.56	.35	.66	.51	.41	.69	.94

Note: The bold italic numbers on the diagonal line are square roots of AVE.

Moreover, RMR and RMSEA were 0.048 and 0.053, respectively, satisfying the assessment criteria for

convergent validity and showing a satisfactory model fit.

Table 4: Covariance Structure Analysis

Hypothesis	Path	Estimate	S.E	t-value	p-value
1	Effort Expectancy → User Satisfaction	.102	.074	1.152	.823
2	Performance Expectancy → User Satisfaction	.512	.103	5.528	**
3	Social Influence → User Satisfaction	.328	.063	4.261	**
4	Facilitating Conditions → User Satisfaction	.082	.082	1.243	.066*
5	Price Value → User Satisfaction	.093	.078	1.587	.079*
6	Security → User Satisfaction	.319	.070	3.295	**
7	Aesthetics → User Satisfaction	.251	.064	2.021	**
8	User Satisfaction → Use Intention	.796	.079	7.346	**

Note: $\chi^2=361.287$ (df=186, $p=.000$), GFI=.905, AGFI=.914, RMR=.048, NFI=.893, IFI=.923, CFI=.945, RMSEA=.053 **: $p<.05$, *: $p<.1$

This study analyzed the structural relationship of technology acceptance intention perceived by users of KORAIL app services with customer satisfaction and use intention, and the results are shown in Table 4. Among the eight hypotheses presented in this study, Hypotheses 2, 3, 4, 5, 6, 7, and 8 were accepted, proving that performance expectancy, social influence, security, and aesthetics had a significant positive effect on user satisfaction, and user satisfaction had a significant positive effect on use intention.

Hypothesis 1 was rejected, indicating that effort expectancy did not have a significant effect on user satisfaction.

5. Results and Discussion

This study examined consumers currently using high-speed railways, in the backdrop of an increasing use of mobile app services in the expanding smart environment and mobile market from a retail management perspective. Further, it was studied how consumer perception on technologies necessary for the use of apps affects their attitude to continue using the app services in order to suggest a retail distribution strategy for high-speed rail tickets.

Accordingly, based on the extended UTAUT by Venkatesh et al. (2003), this study added variables identified in previous theories that studied the technology

acceptance model from various perspectives, such as performance expectancy, effort expectancy, social influence, facilitating conditions, price value, security, and aesthetics to form the extended UTAUT for high-speed railway app services. Our findings can be summarized as follows.

First, performance expectancy, social influence, security, aesthetics, price value, and facilitating conditions were analyzed as variables that significantly impact consumer satisfaction in their respective order of significance, among the seven variables proposed in this study as an extended UTAUT model for high-speed rail app service. However, effort expectancy was found not to have a significant impact on consumer satisfaction.

Among the seven factors influencing technology acceptance, performance expectancy was found to have the greatest influence on consumer satisfaction. This means that it is important for consumers to recognize that reservations and other transactions made through the app are efficient and useful. Accordingly, marketing strategies are needed that can increase cognitive and emotional benefits provided to consumers using the app, although these results are contrary to the results of Escobar-Rodríguez & Carvajal-Trujillo's (2014) study on airline reservation apps (Escobar-Rodríguez & Carvajal-Trujillo, 2014).

Social influence was the second most important factor influencing consumer satisfaction, which was similar to the results Shim and Dong's (2020) regarding study on Internet-only banks and their users, which showed that social influence had the most important impact on the relationship with intention to use (Shim & Dong, 2020). This means that user satisfaction can be further increased by using promotional strategies that will make the user's important acquaintances believe that using the app is to be taken for granted or preferred.

This reflects the fact that consumers consider security as a basic requirement for app services provided in non-face-to-face situations, and also means that the more the consumer can be assured that his/her personal information or retail transaction details can be protected, which may otherwise be exposed in the process of purchasing a ticket through the app, the greater the consumer satisfaction is likely to be.

Aesthetics was also found to be a factor that had a significant effect on satisfaction. Such a result means that consumers perceive the design and the user interface to be important factors, and suggests that it is important to develop an interface that can embrace various groups since the number of users using mobile apps continues to grow regardless of age.

It was found that price value also had a significant effect on consumer satisfaction, which means that the more the

cost-effectiveness of the technology adoption is recognized, the higher the satisfaction. It would be a good way to improve customer satisfaction by preparing and promoting various benefits that will allow passengers to perceive that using the high-speed rail reservation app is cost effective, either financially or psychologically.

It was found that the facilitating conditions also had a significant effect on consumer satisfaction, which suggests that it is important to provide a well-equipped technical base for users in using the system and to provide an easily accessible window in case of inconvenience or failure to use.

On the other hand, the effect of effort expectancy on consumer satisfaction was rejected, which was contrary to the results of studies by Venkatesh et al. (2012) and Chung and Jung (2019), but in line with the results of studies by Escobar-Rodríguez & Carvajal-Trujillo (2014) (Chung & Jung, 2019; Escobar-Rodríguez & Carvajal-Trujillo, 2014; Shim & Dong, 2020; Venkatesh et al., 2012). These results indicate that while the degree of easiness when using the system is important, the scope or function of the high-speed rail app is too simple to lead to consumer satisfaction. In particular, the fact that aesthetics (i.e., user interface) was found to have a significant effect on satisfaction, along with the fact that effort expectancy (i.e., ease of use) was rejected, indicates that consumers' desire for convenient use has already been reflected in the various functions provided within the app.

Second, user satisfaction was found to have a significant effect on intention to use. It was found that user satisfaction formed by factors influencing the acceptance of a new technology has an important influence on the formation of the intention to use.

In terms of academic and practical implications, this study can be used first as a useful marketing material in managing future high-speed rail app from a practical perspective, since it analyzes in detail the relationships between user satisfaction and various factors influencing acceptance of the technology of high-speed rail apps. In particular, it provides valuable information on customer satisfaction strategies, by comparing the effects of factors that directly affect satisfaction. It also provides service providers with who facing consumers at the end of the distribution chain effective ideas for attracting potential customers, and offers information related to the establishment of retail distribution strategies to improve consumers' intentions to purchase.

Second, to increase customer satisfaction, it is most important that consumers feel it is most beneficial and efficient to use the high-speed rail app for booking and ticketing, since it was found that performance expectancy had the greatest influence on technology acceptance. Retail management strategies to make customers feel that high-

speed rail is simpler and more cost effective than the competing airlines can also be highly effective. Additionally, it may be a good idea to consider offering additional benefits to customers who are more frequent and active users of the high-speed rail app.

In order to protect the app as a distribution channel of an information, it is important to ensure that the app is hack-proof and can be used safely. In addition to designing the user interface for ease of use, the design and color scheme of the app must be concise and beautiful so that users feel the visual beauty of it. It is also a prerequisite that the system provides immediate feedback in the event of difficulty in use, if user satisfaction is to be increased.

Lastly, this study found a significant relationship between social influence and price value with intention to use the high-speed rail app, unlike in prior studies on airline apps, which found no significant relationship between social influence and price value with intention to use. Thus, it is judged that the competitiveness of high-speed rail can be enhanced by using more diverse technological factors that affect the ultimate goal of distribution management, which is to enhance consumer satisfaction.

The academic implications of this study are as follows. First, as a study targeting high-speed rail app users, it has the advantage that it includes a larger variety of influencing factors than the existing TAM. In addition, the structural relationship between user satisfaction and intention to use the high-speed rail app is presented in one model because it applies the extended UTAUT model, which is a model with relatively higher explanatory power. Furthermore, this study differs from previous studies in that it adds the variables security and aesthetics to the extended UTAUT of Venkatesh et al. (2012), and deletes hedonic motivation and habits, in setting up the extended UTAUT research model suitable for the high-speed rail app. Thus, it differs from previous studies on the same transportation industry, such as on airline apps, which just used the same factors used in Venkatesh et al.'s (2012) study.

Second, this study is also academically meaningful in that it empirically analyzed and presented factors that affect user satisfaction and intention to use, in the respective order of significance (i.e., performance expectancy, social influence, security, aesthetics, price value, facilitating conditions) among the seven factors used in the extended UTAUT model for the high-speed rail app. Effort expectancy was found to not have a significant effect on user satisfaction.

Third, this paper was the first to apply the technology acceptance model to the high-speed rail app from a retail management perspective, adding scalability to technology acceptance model studies. Previous studies on the high-speed rail app had just examined the properties of the app

itself. In addition, this study has meaningful contributions for examining high-speed railway app services that had not been sufficiently studied previously, thereby meeting the demand of the times.

The study limitations are that there may be a bias because the survey was conducted online due to the COVID-19 pandemic and that the subjects were limited to passengers of KORAIL and SRT, which are considered business competitors to airlines. Thus, the results may not be suitable for generalizing to all railway and public transportation users. Further studies can conduct more in-depth research by overcoming these limitations and applying more diverse consumer characteristics as variables.

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Appendix 1: The configuration of questionnaires

Constructs	Measurement Indicators	Related Study
Performance Expectancy	<ul style="list-style-type: none"> -Using the high-speed rail app makes the high-speed rail ride more convenient. - Using the high-speed rail app will be very useful. - Using the high-speed rail app is efficient in every way. 	Venkatesh et al.(2012) Chung & Jung (2019)
Effort Expectancy	<ul style="list-style-type: none"> - Adapting to the high-speed rail app is very easy. - Learning how to use the high-speed rail app is easy for me. - It is easy for me to understand the functions of the high-speed rail app. 	Venkatesh et al.(2012) Chung & Jung (2019)
Social Influence	<ul style="list-style-type: none"> - I want to recommend the high-speed rail app to the people around me. - I wish my friends could use the high-speed rail app. - I want most people who directly influence my behavior to use the high-speed rail app. 	Venkatesh et al.(2012)
Facilitating Conditions	<ul style="list-style-type: none"> - I can usually use the high-speed rail app without the help of others. - I Have the necessary knowledge to use the high-speed rail app - If there is a problem using the high-speed rail app, I can get help and solve it. 	Venkatesh et al.(2012)
Price Value	<ul style="list-style-type: none"> - Using the high-speed rail app will have a high price/performance ratio. - It is cheap compared to the value provided by the monetary/effort cost of the high-speed rail app. - At the current monetary/effort cost level, the high-speed rail app provides good value. 	Escobar-Rodríguez & Carvajal-Trujillo (2014)
Security	<ul style="list-style-type: none"> - The high-speed rail app will be safe from hacking. - My personal information used while using the high-speed rail app will not be leaked. - Personal transaction details in the high-speed rail app will not be leaked to the outside. 	Walker et al. (2002)
Aesthetics	<ul style="list-style-type: none"> - The color of the high-speed rail app screen draws the user's attention. - Service usage information on the high-speed rail app screen is clear. - The design of the high-speed rail app ticket reservation screen is good. 	Head (1999)
User Satisfaction	<ul style="list-style-type: none"> - Overall, I am satisfied with the use of the high-speed rail app. - Using the high-speed rail app does not disappoint my expectations. - Using the high-speed rail app to obtain information related to ticket reservations is more satisfactory than other methods. 	Bhattacharjee (2001)
Use Intention	<ul style="list-style-type: none"> - I plan to use the high-speed rail app in the future. - I think the high-speed rail app is worth using. - I want to actively use the high-speed rail app in the future. 	Bhattacharjee (2001)