

Investigating the Factors Influencing the Usage of Smart Entry Service: Incheon International Airport Case Study

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Abstract

This study seeks to improve our understanding of airport users' intentions of using the smart entry service (SES) by testing a research model that considers functionality, security, perceived enjoyment, perceived ease-of-use, perceived usefulness, and intention to use simultaneously. The variables that affect the intention of using the SES were investigated, and the correlations among the variables were analyzed. Through the E-Technology Acceptance Model (TAM) that is based on the concept of self-service technology, a research model of the intention of using SES was developed in this study. Surveys were conducted targeting 276 passengers who were experienced with SES, and the correlations among the variables were analyzed using a structural equation modeling. It was found that there were significant relationships between the variables, except in four paths. The result showed that factors such as functionality, security, perceived enjoyment, perceived ease-of-use, and perceived usefulness were confirmed to have positively affected the intention of using SES. The outcomes of this study may be used as baseline data for establishing a strategy to promote the use of the SES.

Keywords: smart entry service, self service technology, technology acceptance model

1. Introduction

Nowadays the aviation industry confronts the necessity of providing passengers with fast and precise entry services. The simplification of the process of emigration and immigration is a worldwide trend as recommended by International Civil Aviation Organization (ICAO), International Air Transport Association (IATA), and Airports Council International (ACI). Accordingly, countries and airports of the world have tried to simplify the process of emigration and immigration, and to prepare related systems. In particular, the passport/visa screening time and the service quality are considered to directly affect the airport service evaluation. Therefore, reduction in the entry service time is considered important to airports. Incheon International Airport (IIA) has introduced SES in an attempt not only to improve the passenger processing system but to consistently increase the efficiency of the entry service. In this study, the relations among the variables that affect the intention of using Incheon International Airport SES were investigated through the study model that simultaneously considers the factors such as functionality, security, perceived enjoyment, perceived ease-of-use, and perceived usefulness.

2. Self Service Technology and Korea Immigration Smart Service

2.1 Korea Immigration Smart Service

SES is the most updated entry service system that is used at the designated gates after passport number and bio information such as fingerprints and face are registered. SES has been widely accepted in the airports of more than 40 countries of the world including Australia's Smart Gate, Hong Kong's e-Gate, Netherland's Privium, and America's Global Entry. IIA started to use SES from June 2008. Passengers of Incheon International Airport can complete entry service within 12 seconds by using SES instead of face-to face screening. Since SES has been introduced, one million passengers have used SES for the past four years, and as of January 2013, the number reached 14 million. IIA continues to promote the SES usage for enhancing the efficiency of the process of emigration and immigration, and tries to understand the major variables that affect the intention of using SES as well as their correlations.

2.2 Self Service Technology and Technology Acceptance Model

Self Service Technology (SST) is the customers' own use or procurement of services (Anselmsson, 2001). In SST, technological factors can be involved in or not. When companies try to convert their method of providing services from the conventional one to self-service, the options of self-service can be unattractive, so they may face difficulties in marketing (Bateson, 1985). Therefore, companies must explain customers about the procedures and advantages of the new services considering the roles of customers (Wang & Namen, 2004). SSTs are "technological interfaces that enable customers to produce a service independent of direct service employee involvement" (Meuter et al., 2000, p. 50). These days many companies in various fields provide customers with a wide variety of self-service options using new technologies. These technology-based services are expected to be a core factors in the long-term business success. Parasuraman (1996) stated the importance of self-service as a fundamental change in the service industry. Use of SST can result in improvements in efficiency, cost, time, and conveniences such as accessibility. In addition, customers can create services for themselves using SST, and can accept larger responsibilities on the results (Choi et al., 2011; Mills et al., 1983; Zeithamal, 1981).

The effects of SST have been under study. Oh et al. (2013) analyzed the effects of SST on the intention of use with the items of perceived ease-of-use, individuality, autonomy, and efficiency. Lin and Hsieh (2011) developed SSTQUAL containing functionality, security, convenience, perceived enjoyment, assurance, and design. Based on quality and TAM, Ha and Stoel (2009) confirmed the relations among perceived ease-of-use, perceived enjoyment, and perceived enjoyment. Jang and Noh (2011) analyzed the correlations among design, security, perceived ease-of-use, perceived enjoyment, and perceived enjoyment. In this study, the effects of the technological factors of SST features such as functionality and security on the intention of using SES were analyzed. Security is a decisive factor in SST evaluation, which is the level of privacy or data security perceived by SES users. The importance of security is growing with the increase in the use of technology-based services (Gunasekaran & Ngai, 2003; Buellingen & Woerter, 2004). Most recently, privacy-related damage is more and more common, and accordingly, the importance of information security is increasing (D'Souza & Nowak, 2001; Horne & Horne, 1997; Milne, 2000; Phelps, Sheehan, & Hoy, 2000). These issues must be considered in the aspect of companies that use SST (Buellingen & Woerter, 2004; Chae & Kim, 2003). Functionality is the process or movement that occurs according to customers' requests, and includes accessibility, responses, and the speed of service (Collier & Bienstock, 2006). Since one of purposes of using SST is to secure the efficiency through the increase in the processing speed, functionality should be seriously considered for fast and efficient services.

TAM is modified from Theory of Reasoned Action (TRA), and can explain and predict the IT acceptance behaviors of users. Since 1990, TAM has been discussed in many IT studies. In TAM, perceived enjoyment and perceived ease-of-use are most important parameters, and they are also practically important (Moon & Kim, 2001). Perceived usefulness is "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis et al., 1989). Perceived ease-of-use, defined as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989). The positive correlations between perceived enjoyment and perceived ease-of-use have been proved in most studies. This means that users feel the technology they use is useful when it is perceived easy to use (Davis, 1989). Similarly, perceived ease-of-use is associated with perceived enjoyment. When users can use a system more easily, they have more perceived enjoyment (Igarria et al., 1996). According to previous studies on TAM, when users have a perceived enjoyment like amusement, they voluntarily use IT, and who have a high level of the same have perceived enjoyment of the technology they use (Davis et al., 1992; Venkatsh, 2000; Moon & Kim, 2001). Most recently a technology acceptance model that is added with perceived enjoyment as a belief variable is suggested. In the studies that are focused on perceived enjoyment these days, its parameter function as a belief variable is drawing attention (Moon & Kim, 2001; Koufaris, 2002; Heiden, 2000). Most of the IT users tend to use technologies for fun, and enjoyment results in the increase in the intention of use (Bruner & Kumar, 2005; Venkatsh, 1999). In this study, perceived enjoyment is defined as the level of fun obtained from the use of the SES system. The intention of use is the variable that is affected by various external variables and belief variables, and it decides users' activities. The intention of use in this study can be defined as the level of the will to use the SES system in the future. SST intention is operationalized as the likelihood of choosing to use SSTs instead of the service staff for a service transaction.

2.3 Research Model and Hypotheses

The research model is presented in Figure 1. The research model is based on a review of previous research that has looked at SST and TAM. Airport user's intention to use of SES are investigated by testing a research model that considers functionality, security, perceived usefulness, perceived ease-of-use, perceived enjoyment, and intention to use simultaneously. The research hypotheses are shown in Table 1 and all the paths are hypothesized

to be positive.

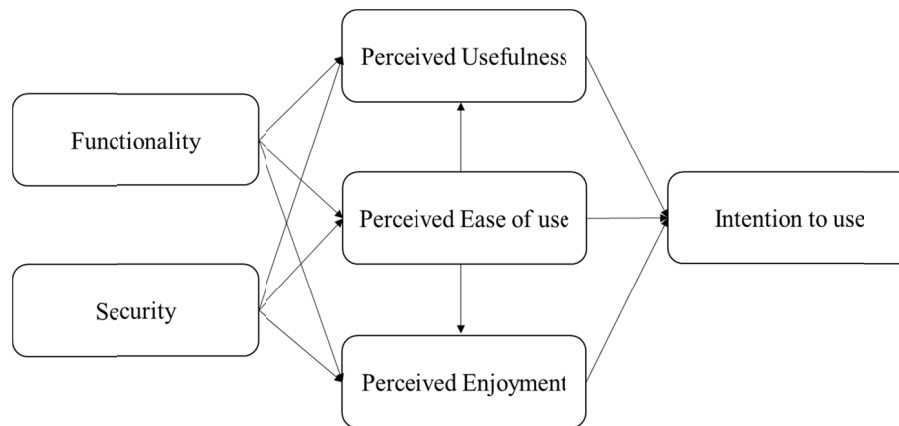


Figure 1. Conceptual model

Table 1. Research hypotheses

Hypotheses	
H ₁	Functionality has a positive effect on perceived enjoyment.
H ₂	Functionality has a positive effect on perceived ease-of-use.
H ₃	Functionality has a positive effect on perceived usefulness.
H ₄	Security has a positive effect perceived enjoyment.
H ₅	Security has a positive effect on perceived ease-of-use.
H ₆	Security has a positive effect on perceived usefulness.
H ₇	Perceived ease-of-use has a positive effect on perceived enjoyment.
H ₈	Perceived ease-of-use has a positive effect on perceived usefulness.
H ₉	Perceived enjoyment has a positive effect on intention to use.
H ₁₀	Perceived ease-of-use has a positive effect on intention to use.
H ₁₁	Perceived usefulness has a positive effect on intention to use.

3. Methodology

The questionnaire was prepared with the measuring tools that were recognized to have had validity and reliability through previous studies and pre-investigation. These items were measured on a seven-point Likert scale where 1=strongly disagree and 7=strongly agree). The measurement variables and measurement items that were used in this study are shown in Table 2. The survey was conducted at the departure hall of IIA in July 2013 for a month targeting the passengers who once used SES. Of the 400 distributed, 316 questionnaires were returned to the researchers. After cases with missing data had been eliminated, 276 questionnaires were collected and used for further analysis. The demographic characteristics of the 276 respondents are summarized in Table 3. By gender, male passengers accounted for 64.1%, and female, 35.9%. The male dominance was due to the majority of the passengers who were males on business trips. By age, 20–29 years old passengers accounted for 42.4% reflecting the active use in the younger population.

4. Empirical Results

To test the unidimensionality of the measurement items, confirmatory factor analysis was conducted in this study. The measurement model showed an acceptable fit ($\chi^2(153)$ of 596.538, $p = .000$; RMR = .078; GFI = .821; AGFI = .754; TLI = .901; CFI = .921). The loadings, their corresponding critical ratio, standardized loadings are presented in Table 4. When the standardized loading was higher than 0.5, a convergent validity was confirmed (Anderson & Gerbing, 1988). In this study, all items showed 0.5 or higher levels, so the convergent validity was secured (Table 4).

Table 2. Measurement items

Measures	Variables ^a
Functionality	SES system can complete entry service quickly.
	SES system can quickly complete the procedures of passport screening and fingerprinting identification.
	SES system is not complicated.
	SES system is well organized in overall.
Security	SES system hardly leak personal information.
	SES system is believed to safely protect my personal information.
	SES system does not share my personal information with other systems.
Perceived ease-of-use	SES system is easy to use.
	It is easy to understand how to use SES.
	The process of using SES is convenient.
Perceived enjoyment	SES system is amazing.
	SES system stimulates my curiosity.
	It is interesting to use SES system.
	The process of using SES is pleasant.
Perceived usefulness	SES system is useful.
	SES system can save my time.
	SES system will improve the entry service procedure.
Intention to use	I will continue to use SES.
	I will tell other people positively about SES.
	I will recommend other people to use SES.

* Note: a seven-point Likert scale.

Table 3. Demographic information of the participants

Item		Number	Percentage (%)
Gender	Male	177	64.1
	Female	99	35.9
Age category	< 20	1	0.4
	Between 20 and 29 years	117	42.4
	Between 30 and 39 years	74	26.8
	Between 40 and 49 years	75	27.2
	Between 50 and 59 years	8	2.9
	> 60	1	0.4
Education level	High school or less	2	0.7
	2 years college	9	3.3
	4 year college	171	62.0
	Post graduate	94	34.1
Occupation	Company staff (businessmen)	143	51.8
	Private business	7	2.5
	Government employee	14	5.1
	housewife	1	0.4

	Student	84	30.4
	Others	27	9.8
Income (in won)	< 1,000,000	87	31.5
	Between 1,000,000–2,000,000	24	8.7
	Between 2,010,000–3,000,000	58	21.0
	Between 3,010,000–4,000,000	42	15.2
	> 4,000,000	65	23.6

Note: 1080 Korea won is equivalent to \$1 USD (in September, 2013).

Table 4. Confirmatory factor loadings and fit statistics

Factor	Variables ^a	Loadings	Standardized loadings
Factor 1 Functionality	SES system can complete entry service quickly.	.864(16.939)	.815
	SES system can quickly complete the procedures of passport screening and fingerprinting identification.	.849(17.518)	.831
	SES system is not complicated.	.934(17.476)	.828
	SES system is well organized in overall.	1.000	.865
Factor 2 Security	SES system hardly leak personal information.	1.000	.883
	SES system is believed to safely protect my personal information.	.961(16.770)	.897
	SES system does not share my personal information with other systems.	.736(12.201)	.667
Factor 3 Perceived ease-of-use	SES system is easy to use.	1.185(21.781)	.932
	It is easy to understand how to use SES.	1.050(21.048)	.914
	The process of using SES is convenient.	1.000	.854
Factor 4 Perceived enjoyment	SES system is amazing.	1.022(15.710)	.915
	SES system stimulates my curiosity.	.983(17.540)	.961
	It is interesting to use SES system.	1.042(17.487)	.859
	The process of using SES is pleasant.	1.000	.842
Factor 5 Perceived usefulness	SES system is useful.	1.000	.861
	SES system can save my time.	.862(16.686)	.807
	SES system will improve the entry service procedure.	.959(16.669)	.806
Factor 6 Intention to use	I will continue to use SES.	1.000	.925
	I will tell other people positively about SES.	.970(32.428)	.966
	I will recommend other people to use SES.	1.018(30.019)	.945

*Note: Values in parentheses are critical ratios and all the values are significant ($p < 0.001$).

The model fits in this study were: $\chi^2(156)$ of 619.711, $p = .000$; RMR = .085; GFI = .814; AGFI = .750; TLI = .899; CFI = .917; RMSEA = .104. RMSEA was slightly out of the fit boundary, but others were close to the optimal fit index, so the model that was used in this study was satisfactory. Except for four causal paths, all the other hypothesized relationships were statistically significant. The three statistically insignificant paths were the effect of functionality on perceived enjoyment, the effect of security on perceived ease-of-use, the effect of security on perceived usefulness and the effect of perceived ease-of-use to intention to use (Table 5). As hypothesized, functionality was found to have a positive effect on perceived ease of use and perceived usefulness. Security had a positive effect on perceived enjoyment and perceived ease-of-use had a positive effect on perceived enjoyment and perceived usefulness. Perceived enjoyment and perceived usefulness were found to

have a positive effect on intention to use.

Table 5. Test results

Hypothesis	Path	Estimates	Standard error	t-value	Test results
H ₁	Functionality → Perceived enjoyment	.222	.151	1.468	Not Supported
H ₂	Functionality → Perceived ease-of-use	.839	.059	14.261***	Supported
H ₃	Functionality → Perceived usefulness	.532	.126	4.233***	Supported
H ₄	Security → Perceived enjoyment	.089	.048	1.872*	Supported
H ₅	Security → Perceived ease-of-use	-.036	.035	-1.019	Not Supported
H ₆	Security → Perceived usefulness	.016	.038	.434	Not Supported
H ₇	Perceived ease-of-use → Perceived enjoyment	.495	.155	3.198***	Supported
H ₈	Perceived ease-of-use → Perceived usefulness	.365	.126	2.892***	Supported
H ₉	Perceived enjoyment → Intention to use	.246	.057	4.334***	Supported
H ₁₀	Perceived ease-of-use → Intention to use	-.053	.118	-.451	Not Supported
H ₁₁	Perceived usefulness → Intention to use	.939	.115	8.182***	Supported

*p < .10 / ***p < .01.

5. Conclusions

This paper has examined the effects of functionality, security, perceived ease-of-use, perceived enjoyment, and perceived ease of use on airport users' intentions of SES. As a result of analyzing the study model, following implications were confirmed. First, among the SST features, functionality was confirmed the most influential on perceived ease-of-use. This means when the connection speed is higher and the overall structure is better, users think the system is more convenient and useful. Accordingly, effort should be made to improve the functional aspects of the SES system. Second, security was confirmed to influence on perceived enjoyment. This was due to the consumers' lack of confidence on the personal information protection in SES. It is necessary to inform passengers about their personal information protection, and to convince them to feel interesting while they are using SES. Third, perceived ease-of-use was confirmed to positively influence on both perceived enjoyment and perceived usefulness. The reason why perceived ease-of-use did not influence on the intention of use was due to this diverse world which is in the mix of analog and digital. Despite of the inconvenience of not using SES, some passengers may still want entry permit stamps on their passports. Nevertheless, airports may need to develop technologies that can satisfy both functionality and security to facilitate the use of the SES system. By doing so, the services that are added with not only perceived ease-of-use and perceived usefulness but also perceived enjoyment can be provided to passengers.

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