Measuring RFID Adoption Factors with Cognitive Styles : A Preliminary Examination of Consumers' Perceptions

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Abstract

The Radio Frequency IDentification (RFID), once used widely, is expected to provide improved convenience in our everyday life. Crude observations of RFID consumption show that there is a wide variation in the adoption of this technology across different individuals. One plausible explanation is that consumers with challenging mind who seek for new technologies and have a good grasp of the new RFID technology should have higher propensity to use the technology. A better understanding of such acceptance pattern of RFID is of high importance in establishing technology providers' marketing strategies. This study is aimed to explain differences in the level of RFID acceptance focusing on cognitive styles of potential RFID users. By presenting potential RFID users' discriminative propensity toward RFID technology, this study hopes to provide guidelines for the design of service strategies that facilitate consumers' acceptance of RFID.

Keywords : Cognitive Styles, RFID, Technology Acceptance, Comparison

1. Introduction

RFID, which made its appearance for the first time in 1948, has been continuously developed, keeping a close relationship with our actual lives [AMI Inc, 2001]. Enterprises have been providing consumers with diverse services using RFID. For example, the Korea Expressway Corporation is currently providing an expressway toll payment system, named Hi-pass, which employs an RFID system in which vehicles with an on-board unit installed can pay expressway tolls automatically. Despite the merits of Hi-pass, such as a toll discount and other conveniences, there are some consumers who do not use Hi-pass. Of course, it is true that they need to pay an additional expense to purchase the on-board unit to use the Hi-pass system, but the toll payments made through Hi-pass will save transportation costs in terms of economy in the long run. On the basis of this fact, it may be concluded that, although most consumers are aware of the usefulness of Hi-pass, there is a variation in the actual application of Hi-pass based on whether the consumers accept RFID or not.

Thus, when it is said that enterprises are providing consumers with services through enormous investment in RFID, it is important to provide diverse consumers with utilities [Eckfeldt, 2005]. However, there is a difference in the level of acceptance among consumers who receive RFID services. Therefore, the recognition of differences in consumers' RFID acceptance, aimed at the activation of RFID on the enterprise side, is a very important management problem [White et al., 2003]. Of course, some studies on RFID acceptance have been carried out in order to present preferential marketing strategies [Huber, Michael, McCathie, 2007; Yang, Jarvenpaa, 2005; Hussain, Prybutok, 2008], but no studies on RFID acceptance in which the types of consumers are classified have been carried out. Thus, it is estimated that the studies on RFID acceptance based on consumers' characteristics shall be carried out as soon as possible so that RFID may be activated.

Taking a look at the characteristics of preceding studies, we can see that the studies dealt with RFID acceptance with respect to customers and enterprises, but the studies were unable to present any suggestions at the level of concrete customer relation management aimed at the establishment of differentiated marketing strategies. As the importance of customer relations management (CRM) began to be emphasized, most working-level teams and researchers agreed on the fact that the analysis on individual variation of information technology acceptance is very important for the creation of successful informatization results for enterprises.

The results of major preceding studies, to which recently formed typical cognitive styles were applied, are as follows. Chakraborty, Hu, and Cui [2008] argued that cognitive styles had a great effect on decision-making when an individual person decided to make use of a certain technology. Lu, Yu, and Lu [2001] also argued that an approach based on a cognitive style could raise acceptance of a decision-making support system, analyzing the relationship between the acceptance type of a decision-mak-

ing support system and cognitive styles. Accordingly, in this study, based on the premise that there is a difference in RFID acceptance factors based on a consumer's cognition difference regarding RFID; the difference in RFID acceptance factors will be analyzed by introducing Myers-Briggs Type Indicator (MBTI),[1] which has been most often used in classifications of consumers' cognitive styles. The result of this study will provide enterprises that hope to expand RFID acceptance with useful guidelines that help to set up preferential marketing strategies.

This study comprises five units. In the first unit, the purpose and necessity of this study are explained. In the second unit, the theoretical background is explained. The third unit focuses on the study model and methodology. In the fourth unit, the empirical analysis is carried out to explore alternative plans with respect to the study problems, and in the fifth unit, the practical and theoretical suggestions of the study

that are expected to occur are presented.

2. Theoretical Background

Since the Technology Acceptance Model (TAM) was presented by Davis [1989], various application studies have been carried out as technology acceptance studies in the IT field [Wang, Wang, Lin, Tang, 2003; Zhang, Prybutok, 2003; Zhang, Prybutok, Koh, 2006]. TAM is a model that explains the process by which the recognized preparedness and utility exert influence on the intention to accept a technology.

As for the difference in consumers' technology acceptance, research studies have been carried out in various IT fields since the 1970s. Zumd [1979] emphasized the fact that the recognition of individual variation is important when planning to construct a successful management information system. Afterwards, adopting the concept of cognitive styles from psychology, research studies on individual variation in the application of information systems began to be carried out vigorously [Agarwal, Prasad, 1999; Keen, Bronsema, 1981; Agarwal, Karahanna, 2000; Kilmann, Mitroff, 1976; Benbasat, Taylor, 1978; Blaylock, Rees, 1984].

The core concept of cognitive styles is divided into the recognition, judgment, and conduct of an individual person, and such concepts were applied to Davis' TAM [1989] and the Theory of Reasoned Action (TRA) proposed by Ajzen and Fishbein [1980] and Ajzen [1991], so the individual variations could have been dealt with in many later studies. In order to classify people's personal propensities, Myers [1980] ex-

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1) According to Wikipedia Encyclopedia, "The Myers-Briggs Type Indicator (MBTI) is the index of personality type preference, which was developed by Katharine C. Briggs and her daughter, Isabel B. Myers, on the basis of Carl Gustav Jung's personality type theory. The test tools of MBTI was developed at the time of World War II. In the MBTI system, individual personalities are indicated based on the following four scales. Each scale is composed of two characters as each character takes one opposite end respectively. The extroversion and introversion are used to grasp the point of attention, that is, "Which direction is the energy moving?." The sensing and intuition are used to grasp the recognition function, that is, "What shall be recognized?." The thinking and feeling are used to grasp the judgment function, that is, "How can it be judged?." The judging and perceiving are used to grasp the life style, that is, "What life style shall be adopted?.""

plained the individual variations by dividing personal propensities into sensing, intuition, thinking, feeling, judging, perception, extraversion, and introversion [Myers, Myers, 1980].

The importance of personal propensity began to draw interest in various fields. In particular, the cognitive style was applied to the development and use of information systems as the difference in the individual recognition exerted influence directly on the decision-making process even in the application of information systems. Benbasat and Taylor [1978] made a close inquiry into the difference in personal influences based on the cognitive styles when designing a management information system. And Huber [1983] argued the importance of a reflection of a cognitive style not only in a management information system but also in the design of a decision support system by expanding the study of Benbasat and Taylor [1978].

The studies of Benbasat and Taylor [1978], Huber [1983], and Rao et al. [1992] also presented suggestions for a decision-making support system design through the difference of cerebral hemispheric specialization and cognitive styles. In the research studies of Blaylock and Rees [1984], through a difference analysis according to the utility of information and cognitive styles, it was proved that the intention to receive information well and use it positively occurs differently based on one's personal cognitive style.

White et al. [2003] argued that the difference in personal recognition exerts an important influence regarding the achievements of an organization by analyzing the discriminative influence of cognitive styles, organizational culture, and information use on market situations and the attitudes of marketing managers.

As mentioned previously, Chakraborty et al. [2007] investigated the impact of learning styles on the acceptance of general technology use by providing evidence that an innovative cognitive style had significant direct effects on perceived ease of use, perceived usefulness, and subjective norms in decision-making regarding the use of new technologies.

Lu et al. [2001] evaluated the decision support system (DSS) acceptance using different cognitive styles of decision-makers. In an experiment, they revealed that DSS (and the underlying rational decision-making process) are preferred by "sensation-style" and "thinking-style" people, while "intuitive-style" and "feeling-style" people feel rather unnatural and uncomfortable when applying a DSS. While "intuitive-style" people like to solve new problems and are impatient with routine, "sensation-style" people do well with an established routine. "Feeling-style" people use subjective impressions and are highly personal in their judgments, while "thinking-style" people prefer a rational approach and logical, objective analysis, and their judgments are highly impersonal. In many studies like these, the individual variation based on cognitive styles is emphasized as the study theme in the application of very important information systems.

In the RFID adoption research area, Lin et al. [2006] analyzed an RFID business adoption and the relationship between RFID and customer relationship management (CRM). They pro-

posed an RFID-CRM model in supply chain management and showed that RFID technologies can improve customer satisfaction. Huber et al. [2007] focused on the impact of RFID on the shrinkage problem in tracking goods, in particular at case level and item level. They analyzed the challenges and the difficulties of the adoption of RFID technologies in supply chains using interviews of RFID vendors.

Chuang and Shaw [2007] focused on the RFID integration in supply chains. Three different stages of RFID implementation were proposed : functional, business, and inter-company RFID integration. They indicated that these stages have different degrees of risk and benefit. For each stage, they analyzed a company's RFID adoption case in order to demonstrate the difficulties and the benefits of a real deployment.

Bottani and Rizzi [2008] analyzed the economic impact of RFID technology on the fast-moving consumer goods (FMCG) supply chain. They focused on a three-echelon supply chain containing manufacturers, distributors, and retailers of FMCG. They collected quantitative and qualitative data regarding the logistics processes of each actor through a questionnaire in order to examine the feasibility of RFID and EPC adoption, Hossain and Prybutok [2008] analyzed the factors of consumer acceptance of RFID technology. They developed and tested a theoretical model with a technology acceptance model. Through interviews of consumers, they indicated that convenience, culture, and security are significant elements of the consumer acceptance of RFID. They revealed the following findings : (1) increased perceived convenience

of RFID technology leads to greater acceptance of this technology; (2) societal beliefs, value systems, norms, and/or behaviors influence the extent of consumer acceptance of RFID technology; and (3) higher perceived importance and less willingness to sacrifice personal information security reduce intention to use RFID technology.

Chae and Koh [2006] also practically asserted the existence of differences with respect to the level of recognition and decision-making attitude in students' acceptance of RFID at schools according to the feasibilities and utilities related to consumers' cognitive styles.

Accordingly, in this study, it is assumed that consumers will be provided with diverse services through the introduction of RFID at enterprises. Thus, in order to obtain information regarding efficient customer relations management at enterprises, this study was designed to look into the differences in RFID acceptance factors according to consumers' cognitive styles.

3. The Research Problems

3.1 Research Problems

In this study, as for RFID acceptance factors, the consumers' cognitive difference was explored based on cognitive styles. For this exploration, among the items of consumers' MBTI cognitive style included in RFID acceptance factors proposed by the models of Hossain, Prybutok [2008], (1) information recognition, (2) decision-making, (3) recognition difference based on attitudes were analyzed.[2] We propose the following the research problems and hypo-
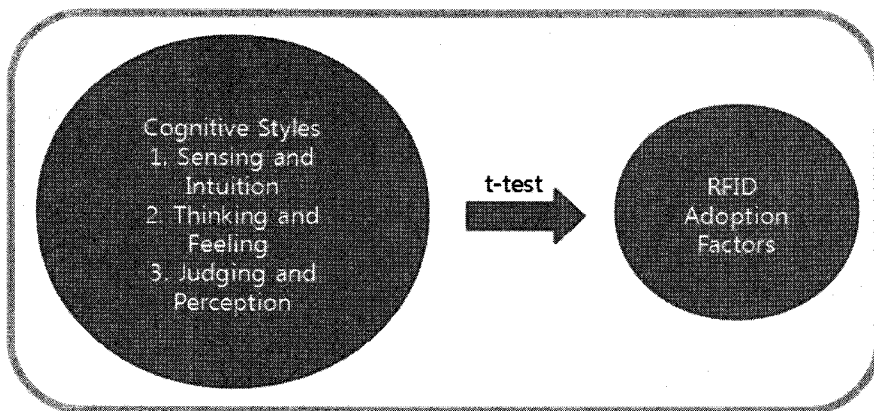
〈Figure 1〉 Research Model

thesis.

[Research question] It will be the difference in the acceptance factors and acceptance intention according to consumers' cognitive styles.

[Hypothesis 1] It will be the cognitive difference in RFID acceptance factors according to the function of consumers' information recognition (Sensing and Intuition).

[Hypothesis 2] It will be the cognitive difference in RFID acceptance factors according to the function of consumers' decision-making (Thinking and Feeling).

[Hypothesis 3] It will be the cognitive differ-

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2) Because whether or not to accept the introversion and extraversion of the RFID acceptance in the study of Chae, Koh [2006] are decided based on the prior interest of the RFID user, they are not suitable as the items to grasp the characteristics of decision-making process. So the items (introversion and extraversion) were not used to grasp the characteristics of RFID technology acceptance in this study.

ence in RFID acceptance factors according to the attitude toward external world (Judging and Perception).

3.2 Measuring Tools

In this study, the measuring tools were designed based on preceding studies in order to look into the differences in RFID acceptance intention based on cognitive styles. In the case of cognitive style measurement, a person who is answering the questionnaire might give up answering due to the excessive number of items on the MBTI measurement tools. Therefore, in this study, the measurement tool was designed such that the comprehensive measurement items were explained in accordance with personal cognitive styles, and then the respondent was asked to choose cognitive style items that were suitable for himself or herself.

The variables of the cognitive styles were derived from three of the four parts of MBTI. First, according to the propensity, the selected questions regarding extraversion and intro-

version were excluded from this analysis, as they were discussed in the study of Chae and Koh [2006] [Myers, Myers, 1980; Chae, Koh, 2006]. Second, the selected questions were employed based on sensing and intuition according to the function of information recognition. Third, selected questions were used based on thinking and feeling according to the function of decision-making. Fourth, selected questions were included based on judging and perception according to the attitude toward the external world.

As for the factors that affected RFID accept-

ance, the measurement tool was designed using items that represented the study variables, which were modified and adopted from the variables used in the study of Hossain and Prybutok [2008] by excluding the overlapping parts of individual items that formed each study variable. In the measurement of the questionnaire items, seven-point Likert-type scales were used. In this case, 1 point means "Absolutely no", but 7 points means "Absolutely yes." The measurement items used in this study are shown in <Table 1> and <Table 2>.

<Table 1> Study Variables-Cognitive Styles

Study variables	Study items
Information recognition	■ How is your information recognition function? ☐ Sensing ☐ Intuition ① Sensing : I receive external information through my eyes, ears and other senses. I accept the currently given situation, receive it, and I have an inclination to solve problems based on the situation. I am realistic and practical. However, I also tend to be unable to grasp the whole, sticking to details from time to time. ② Intuition : I recognize information by integrating entire relations rather than feeling information through senses. In short, I recognize information through institution. I have a strong inclination to grasp the whole and the essence. I seek for the accomplishment and change in the future rather than the present time, and enjoy the diversity.
Decision-making	■ How is your decision-making function? ☐ Thinking ☐ Feeling ① Thinking : I analyze and compare information based on the objective standards. I take a logical countermeasure against an unusual activity, and take a serious view of consistency and propriety in dealing with works based on principles. I lay emphasis on objective standards rather than personal values by and large. ② Feeling : When making a decision, I carry out the subjective judgment based on the human-centric value. I carry out human-centric decision-making, in consideration of things important to me and others. I like people, and I am very sympathetic and warmhearted. I would rather seek for the harmonious life of humans, which is accepted universally, than the objective truth.
Attitude	■ What is your attitude toward the external world? ☐ Judging ☐ Perception ① Judging : I live an intentional life, with temperance and control. It is said that common people like structuralization and systematization. I deal with works according to plans, and prefer to complete works within due time. ② Perception : I adapt myself to situations, and I prefer self-regulating styles. I prefer the understanding and adaptation based on situations to the control of life. I cope with all situations voluntarily, and I am open-minded.

⟨Table 2⟩ Study Variables-RFID Acceptance Factors

Study variables	Questionnaire items
Convenience (CON)	[CON 1] I think it is convenient to pay tolls through the system using RFID like Hi-pass in expressways. [CON 2] I think it brings convenience to consumers that shopping and calculating daily necessities purchase by using RFID at shopping malls. [CON 3] I will use RFID system even in the future as the Hi-pass function using RFID in expressways raise convenience. [CON 4] I think RFID will provide convenience in obtaining diverse information from the tags attached on commodities.
Cultural Influence (CI)	[CI 1] My attitude toward using RFID is affected by the opinions about RFID proposed by the people around me. [CI 2] I feel comfortable when using RFID rather than using other technologies. [CI 3] I will use RFID systems because it is more useful than other technologies.
Unwillingness to sacrifice of Perceived Personal Security (UPPS)	[UPPS 1] When using network systems connected to the Internet, I am willing to take the risk that may occur at the backup and restoration system based on my own decision. [UPPS 2] When using network systems connected to the Internet, I am willing to take the risk that may occur at the security program using process based on my own decision. [UPPS 3] When using network systems connected to the Internet, I am willing to take the risk that may occur at the user authentication process based on my own decision. [UPPS 4] When using network systems connected to the Internet, I am willing to take the risk that may occur at the ill-intentioned programs based on my own decision. [UPPS 5] When using network systems connected to the Internet, I am willing to take the risk(make the sacrifice) that may occur at the client/server system backup and restoration system based on my own decision. [UPPS 6] When using network systems connected to the Internet, I am willing to take the risk(make the sacrifice) that may occur at my own computer and network system based on my own decision. [UPPS 7] When using network systems connected to the Internet, I am willing to take the risk(make the sacrifice) that may occur at the security application based on my own decision.
Perceived Regulations (PR)	[PR 1] I support RFID regulations set up by the government in order to protect citizens' privacy. [PR 2] I think the regulations of RFID help protect human rights. [PR 3] I think the proper level of information utility shall be carried out through regulations of information obtained from RFID tags.
Importance of Perceived Security (IPS)	[IPS 1] I think the security system for personal information protection is important when using network systems connected to the Internet. [IPS 2] I think the security system for clients and servers is important when using network systems connected to the Internet. [IPS 3] I think the security for network system is important when using network systems connected to the Internet. [IPS 4] I think the user recognition and authentication are important when using network systems connected to the Internet. [IPS 5] I think the protection from ill-intentioned software is important when using network systems connected to the Internet. [IPS 6] I think the security programs are important when using network systems connected to the Internet. [IPS 7] I think the backup and restoration system are important when using network systems connected to the Internet.

Importance of Perceived Privacy (IPP)	[IPP 1] It is important that ins range companies control connections to personal information. [IPP 2] It is important that insurance the government regulates connections to personal information. [IPP 3] It is important that connections to my daily necessities and service purchase information performed by companies shall be under government control. [IPP 4] It is important that personal information shall be protected at companies/schools.
Unwillingness to sacrifice of Perceived Personal Privacy (UPPP)	[UPPP 1] I have agreed that insurance companies may share my own personal information. [UPPP 2] I have agreed that public agencies may share my own personal information. [UPPP 3] I am willing to agree that enterprises/schools may share my own personal information. [UPPP 4] I have agreed that companies may use the information occurring during daily necessities and service purchase process.

3.3 Survey

The questionnaire survey of this study was executed for 2 months from September through October 2008. The questionnaire survey was carried out with the students who understood what RFID was. The students, who participated in the questionnaire, had sufficient understanding of the technical concept and convenience of RFID, which was obtained through classes at schools. So, it may be considered that the respondents of the questionnaire survey satisfied the required conditions sufficiently in order to achieve the purpose of this study. The ques-

tionnaire survey in this study was carried out through offline at lecture rooms. The 50 copies of questionnaire among 70 copies handed out were retrieved. The practical analysis in statistic process for the questionnaire was carried out by using the SPSS 12.0, which is known as a statistic package.

4. Empirical Analysis

4.1 Basic Statistics

The characteristics of sampling in this study are presented in <Table 3>. 37 males took part

<Table 3> Characteristics of sampling

Type1	Type2	Frequency	Percent	Valid Percent	Cumulative Percent
Gender	Male	37	74.0	74.0	74.0
	Female	13	26.0	26.0	100.0
Age	Under 20	3	6.0	6.0	6.0
	20~25	46	92.0	92.0	98.0
	Upper 25	1	2.0	2.0	100.0
Information recognition	Sensing	39	78.0	78.0	78.0
	Intuition	11	22.0	22.0	100.0
Decision-making	Thinking	21	42.0	42.0	42.0
	Feeling	29	58.0	58.0	100.0
Attitude	Judging	16	32.0	32.0	32.0
	Perception	34	68.0	68.0	100.0

in the questionnaire survey, occupying 74% of total participants, and 13 females took part, occupying 26%. As for the rang of age, 3 participants were under the age of 20, occupying 6%, 46 participants were between 20 and 25 in age, occupying 92%, and one participant was over 25, occupying 2% of the total participants. As for the characteristics of cognitive styles toward samples, the 39 participants, occupying 78% of the total, chose 「Sensing」, and 11 participants, occupying 22%, chose 「Intuition」 in the aspects of information recognition. In the type of decision-making, 21 participants, occupying 42%, chose 「Thinking」, and 29 participants, occupying 58% chose 「Feeling」. In the type of attitude, 16 participants, occupying 32%, chose 「Judging」, and 34 participants, occupying 68%, chose 「Perception」.

4.2 Validity and Reliability of Study Variables

In this study, the validity and reliability were analyzed using the 7 factors discovered through the exploratory study of Hossain and Prybutok [2008] that affected RFID acceptance, and these factors, including convenience (CON), cultural influence (CI), perceived regulations (PR), unwillingness to sacrifice perceived personal security (UPPS), importance of perceived security (IPS), unwillingness to sacrifice perceived personal privacy (UPPP), and importance of perceived privacy (IPP), were used as the study units.

First, the factors were analyzed in order to test the validity of RFID acceptance factors, and the validity of the measurement tools was analyzed. As for the validity, the variables for which the value of factor loading was higher than 0.5 and the Eigen value was higher than 1 were derived. In this research, we didn't use reverse coding technique for the questionnaire replies regarding unwillingness to sacrifice perceived privacy and unwillingness to sacrifice perceived security, as suggested by Hossain and Prybutok [2008] because we compared the highs and lows of cognitive style indicators. In order to analyze the validity, the factors were analyzed with respect to the study items, and the results are shown in <Table 4>.

Taking a look at the characteristics, we can find out that UPPS, PR, IPS, IPP, and UPPP are bound together as it was intended. However, due to low factor loading values of CON and CI, the factors were re-analyzed after CON and CI item were excluded. According to the results of new factor analysis (<Table 5> and <Table 6>), 5 factors (CI, UPPS, IPS, UPPP, and IPP) were correctly bound together as shown in <Table 6>. Thus, in this study, RFID acceptance factors corresponding to cognitive styles were analyzed on the basis of the 5 factors derived through the factor analysis.

In this study, the validity of the variables suggested and confirmed in the study of Hossain and Prybutok [2008] was analyzed. As showed in <Table 7>, The Cronbach α value of UPPS (Unwillingness to sacrifice of Perceived Personal Security) was 0.945, the Cronbach αvalue of PR (Perceived Regulations) was 0.898, the Cronbach αvalue of IPS (Importance of Perceived Security) was 0.978, the Cronbach αvalue

⟨Table 4⟩ Factor Analysis

Variable	Factor						
	1	2	3	4	5	6	7
CON1	.734	.291	.028	-.020	.081	.457	.045
CON2	.703	.336	.105	.110	.170	.421	.190
CON3	.655	.375	.142	-.013	.046	.510	-.136
CON4	.641	.317	.143	-.012	.234	.546	-.041
CI1	.252	-.271	.227	.014	.111	.765	.031
CI2	.374	.125	.511	-.100	.253	.457	.224
CI3	.399	.189	.542	-.042	.391	.396	.113
UPPS1	.217	.625	.067	.066	.264	.066	.624
UPPS2	.121	.745	.095	-.018	.265	.091	.480
UPPS3	.206	.770	-.056	.131	.199	.082	.317
UPPS4	.085	.859	.127	.158	.031	.092	.085
UPPS5	.155	.935	-.091	.018	.071	.010	-.064
UPPS6	.251	.848	.114	.102	.170	-.174	-.016
UPPS7	.194	.897	.186	.087	.074	.011	-.200
PR1	.405	.078	.711	.123	.150	.058	-.048
PR2	.342	.093	.790	.206	.084	.152	.107
PR3	.360	.028	.804	.193	.158	.081	-.064
IPS1	.895	.119	.257	-.001	.168	.035	-.053
IPS2	.878	.108	.275	-.053	.203	.095	-.038
IPS3	.897	.123	.208	-.083	.229	.081	.124
IPS4	.853	.136	.336	.027	.115	.009	-.009
IPS5	.811	.114	.198	-.005	.312	.073	.249
IPS6	.874	.132	.218	.036	.162	.115	.131
IPS7	.855	.144	.208	.027	.268	.121	-.038
IPP1	.400	.311	.224	-.094	.760	.077	.048
IPP2	.441	.124	.185	.060	.797	.174	-.071
IPP3	.323	.286	.185	.121	.755	.010	.208
IPP4	.610	.124	.062	.008	.576	.298	.172
UPPP1	.065	.115	-.065	.890	.020	.025	.103
UPPP2	-.041	-.068	.279	.855	.029	-.153	.124
UPPP3	-.012	.071	.172	.902	-.048	.103	-.016
UPPP4	-.075	.329	.005	.748	.077	-.012	-.248
Eigen value	9.170	5.824	3.181	3.180	3.133	2.104	1.180

※ Factor extraction method : Principal component analysis.
※ Rotation method : Varimax to using Kaiser nomorization.
※ This results converged factor rotation to using repetition calculation of 7 times.

⟨Table 5⟩ Factor Analysis After Remove of Cultural Influence Variables

Variable	Factor					
	1	2	3	4	5	6
CON1	.712	.252	-.029	.097	.062	.522
CON2	.654	.298	.090	.254	.157	.537
CON3	.643	.316	-.032	.000	.223	.570
CON4	.644	.262	-.030	.208	.209	.559
UPPS1	.142	.636	.066	.516	.032	.232
UPPS2	.078	.759	-.021	.453	.070	.179
UPPS3	.131	.752	.121	.329	-.026	.296
UPPS4	.085	.859	.162	.063	.118	.123
UPPS5	.161	.926	.031	.022	-.102	.077
UPPS6	.290	.874	.128	.121	.035	-.189
UPPS7	.232	.893	.094	-.028	.180	-.001
PR1	.405	.068	.103	.145	.750	.069
PR2	.332	.086	.184	.158	.822	.152
PR3	.399	.026	.182	.136	.807	-.002
IPS1	.926	.131	.012	.112	.195	.001
IPS2	.914	.119	-.045	.154	.222	.034
IPS3	.899	.136	-.077	.251	.157	.088
IPS4	.869	.150	.036	.090	.282	.001
IPS5	.810	.135	-.002	.382	.138	.069
IPS6	.862	.144	.033	.203	.190	.135
IPS7	.880	.145	.028	.217	.181	.092
IPP1	.463	.309	-.099	.700	.207	-.021
IPP2	.518	.107	.049	.685	.194	.045
IPP3	.345	.282	.115	.773	.173	.009
IPP4	.611	.092	-.001	.596	.074	.334
UPPP1	.038	.101	.894	.068	-.062	.109
UPPP2	-.044	-.054	.861	.087	.247	-.144
UPPP3	-.007	.064	.896	-.038	.192	.077
UPPP4	-.033	.315	.752	-.040	.023	-.056
Eigen value	8.821	5.480	3.106	3.050	2.573	1.653

※ Factor extraction method : Principal component analysis.
※ Rotation method : Varimx to using Kaiser nomorization.
※ This results converged factor rotation to using repetition calculation of 6 times.

⟨Table 6⟩ Factor Analysis After Remove of Convenience and Cultural Influence Variables

Variable	Factor				
	1	2	3	4	5
UPPS1	.159	.667	.059	.505	.031
UPPS2	.078	.781	-.028	.443	.077
UPPS3	.140	.780	.116	.351	-.027
UPPS4	.077	.867	.158	.059	.120
UPPS5	.135	.928	.029	.027	-.093
UPPS6	.265	.865	.126	.071	.043
UPPS7	.205	.888	.095	-.031	.186
PR1	.403	.076	.102	.155	.755
PR2	.344	.102	.181	.163	.820
PR3	.396	.026	.186	.140	.802
IPS1	.923	.145	.010	.111	.196
IPS2	.912	.136	-.047	.155	.224
IPS3	.904	.161	-.083	.250	.160
IPS4	.869	.165	.031	.082	.286
IPS5	.817	.162	-.009	.366	.143
IPS6	.866	.171	.024	.209	.196
IPS7	.881	.165	.025	.231	.179
IPP1	.436	.316	-.100	.693	.222
IPP2	.495	.116	.050	.700	.200
IPP3	.324	.291	.114	.767	.181
IPP4	.617	.125	-.001	.653	.065
UPPP1	.054	.114	.896	.080	-.076
UPPP2	-.044	-.060	.861	.057	.250
UPPP3	.003	.070	.896	-.027	.184
UPPP4	-.062	.307	.750	-.039	.042
Eigen value	7.004	5.334	3.093	2.990	2.468

※ Factor extraction method : Principal component analysis.
※ Rotation method : Varimx to using Kaiser nomorization.
※ This results converged factor rotation to using repetition calculation of 6 times

⟨Table 7⟩ Reliability of Variables

Research variables	Cronbach's Alpha
Unwillingness to sacrifice of Perceived Personal Security (UPPS)	0.945
Perceived Regulations (PR)	0.898
Importance of Perceived Security (IPS)	0.978
Importance of Perceived Privacy (IPP)	0.928
Unwillingness to sacrifice of Perceived Personal Privacy (UPPP)	0.887

of IPP (Importance of Perceived Privacy) was 0.928, and the Cronbach avalue of UPPP (Unwillingness to sacrifice of Perceived Personal Privacy) appeared to be 0.887. The RFID acceptance factors presented in this study appear to have secured the sufficient validity.

4.3 Comparison of difference according to cognitive styles

This study analyzed the differences in attitudes, decision-making, and information recognition of users' perception with respect to RFID adopting factors. An independent sample t-test was used in testing each research variable consisting of a group of research items.

When taking a look at the difference in attitudes among the consumers' cognitive styles toward the factors having effects on RFID acceptance, it is identified that the characteristics of 「Judging」 and 「Perception」 types are as follows. Like what is appeared in <Table 8>, 「Judging」 and 「Perception」 types showed the si-

milar forms in the aspects of recognition of RFID acceptance, and in the case of the IPS, 「Judging」 type appeared to be 5.571 and 「Perception」 type appeared to be 5.971. In the case of UPPS, 「Judging」 type appeared to be 3.3907 and 「Perception」 type appeared to be 3.2868. In the case of the IPP, 「Judging」 type appeared to be 5.406 and the 「Perception」 type appeared to be 5.596. In the case of UPPS, 「Judging」 type appeared to be 3.8031 and 「Perception」 type appeared to be 4.1385, and in the case of the PR, 「Judging」 type appeared to be 4.979 and 「Perception」 type appeared to be 4.932, as they appeared to have effects on the intention of RFID acceptance in order.

Taking a close look at the important characteristics, it was identified that the more UPPS decreased, the lower its effect appeared to be with respect to intention regarding RFID acceptance. On the other hand, as the recognition of IPP was relatively high, it appeared to have greater effects on intention regarding RFID acceptance. However, with respect to the con-

<Table 8> Cognitive Styles : Attitude (Judging and Perception)

Variables	Attitude	N	Mean	Std. deviation	S.E of Ave.	p-value
UPPS	Judging	16	3.8031	.96200	.24050	.296
	Perception	34	4.1385	1.19623	.20515	
PR	Judging	16	4.979	1.4157	.3539	.909
	Perception	34	4.932	1.1711	.2008	
IPS	Judging	16	5.571	1.7189	.4297	.406
	Perception	34	5.971	1.1369	.1950	
IPP	Judging	16	5.406	1.6829	.4207	.690
	Perception	34	5.596	1.1950	.2049	
UPPP	Judging	16	3.3906	.97026	.24257	.763
	Perception	34	3.2868	1.40499	.24095	
※ * p < 0.1, ** p < 0.05.						

sumers' RFID acceptance, the difference in the factors of RFID acceptance by both the 「Judging」 and 「Perception」 types appeared not to be supported by statistics.

The difference between 「Thinking」 and 「Feeling」 types, which is the characteristics of consumers' decision-making based on 6 factors having effects on RFID acceptance, is as follows. Like the result of analysis, the characteristics of RFID acceptance factors of 「Thinking」 and 「Feeling」 types showed similar forms. IPS (「Thinking」 type : 6.347, 「Feeling」 type : 5.478), UPPS (「Thinking」 type : 3.1429, 「Feeling」 type : 3.4483), IPP (「Thinking」 type : 6.155, 「Feeling」 type : 5.086), UPPS (「Thinking」type : 4.1767, 「Feeling」 type : 3.9259), PR (「Thinking」 type : 5.316, 「Feeling」 type : 4.697) appeared to have great effects on RFID acceptance. However, the difference in RFID acceptance by 「Thinking」 and 『Feeling』 types according to consumers' decision-making appeared to have a difference in terms of statistics in the factors of PRS, IPS and IPP.

In consideration of the characteristics of 「Thinking」 and 「Feeling」 types, it may be concluded that 「Feeling」 type is more positive in RFID acceptance than 「Thinking」 type. The convenience was more favored by 「Thinking」 type, and IPS was less recognized by 「Thinking」 type as it was identified that 「Thinking」 type was favor of RFID acceptance. On the other hand, in the case of UPPS, 「Thinking」 type appeared to be less concerned about RFID. And in the case of PR, the value of 「Thinking」 type appeared to be higher, so it could be concluded that 「Thinking」 type is more likely to accept RFID. Accordingly, in the case of 「Feeling」 type, the efforts to complement PR, IPP, and UPPS will promote RFID acceptance.

The results of inquiry into the difference in decision-making of 「Sensing」 and 「Intuition」 types of consumers according to RFID acceptance factors are as follows. As shown in <Table 10>, the characteristics of RFID acceptance factors of the 「Sensing」 and 「Intuition」 types are showing the identical forms. IPS, (「Sensing」

<Table 9> Cognitive Styles : Decision-making (Thinking and Feeling)

	decision-making	N	Mean	Std. deviation	S.E of Ave.	p-value
UPPS	Thinking	21	4.1767	1.21890	.26599	.454
	Feeling	29	3.9259	1.06648	.19804	
PR	Thinking	21	5.316	.9686	.2114	.059*
	Feeling	29	4.679	1.3580	.2522	
IPS	Thinking	21	6.347	.7332	.1600	.005**
	Feeling	29	5.478	1.5671	.2910	
IPP	Thinking	21	6.155	.7924	.1729	.002**
	Feeling	29	5.086	1.5063	.2797	
UPPS	Thinking	21	3.1429	1.43521	.31319	.426
	Feeling	29	3.4483	1.15027	.21360	

※ * p < 0.1, ** p < 0.05.

⟨Table 10⟩ Cognitive Styles : Recognition (Sensing and Intuition)

	Recognition	N	Mean	Std. deviation	S.E of Ave.	p-value
UPPP	Sensing	39	4.1133	.93876	.15032	.489
	Intuition	11	3.7400	1.66263	.50130	
PR	Sensing	39	5.009	1.0497	.1681	.631
	Intuition	11	4.727	1.8109	.5460	
IPS	Sensing	39	5.948	1.0522	.1685	.480
	Intuition	11	5.467	2.1132	.6372	
IPP	Sensing	39	5.564	1.1235	.1799	.840
	Intuition	11	5.432	2.0466	.6171	
UPPS	Sensing	39	3.4936	1.22808	.19665	.090*
	Intuition	11	2.7045	1.29334	.38996	

※ * $p < 0.1$, ** $p < 0.05$.

type : 5.948, 「Intuition」 type : 5.467), UPPP (「Sensing」 type : 4.1133, 「Intuition」 type : 3.7400), the IPP (「Sensing」 type : 5.564, 「Intuition」 type : 5.432), UPPS (「Sensing」 type : 3.4936, 「Intuition」 type : 2.7045), and PR (「Sensing」 type : 5.009, 「Intuition」 type : 4.727) appeared to have effects on decision-making. The difference in RFID acceptance by the 「Sensing」 and 「Intuition」 types according to consumers' decision-making appeared to have a difference in terms of statistics in the factors of UPPS. In consideration of the characteristics of the Sensing and Intuition type, it may be concluded that the Intuition type is more positive with respect to RFID acceptance than the Sensing type. In addition, even in the case of UPPS, the value of the Sensing type appeared to be higher, causing the researcher to conclude that the Intuition type is more likely to accept RFID.

In summary, the consumers' cognitive styles, such as 「Judging」, 「Perception」, 「Thinking」, 「Feeling」, 「Sensing」 and 「Intuition」 are showing similar forms as a whole. Therefore, as mentioned above, enterprises shall make efforts to raise the consumers' trust in the RFID through reinforcing strategies for protection of consumer information and privacy, so that the RFID acceptance may be expanded.

5. Conclusion

In this study, the differences in RFID acceptance factors based on cognitive styles were analyzed in order to analyze consumers' RFID acceptance in Korea. The suggestions proposed in this study are as follows.

First, in this study, the differences in RFID acceptance factors based on consumers' cognitive styles were analyzed by using the RFID acceptance model proposed by Hossain and Prybutok [2008]. As for the factor analysis, unlike American consumers, in the case of Korean consumers, the cultural influence factors related to RFID acceptance were not derived through the factor analysis [Hossain and Prybutok, 2008]. This may have been caused by the fact that the

technology and convenience of RFID do not have a strong influence on Korean consumers, unlike American consumers. Therefore, enterprises planning to provide consumers with services through an RFID system shall set up expansion strategies for RFID acceptance in consideration of the characteristics of both Korean and American consumers.

Second, the study reported that consumers' RFID acceptance will increase convenience and utility of our daily lives and business sites [Chae and Koh, 2008]. In this study, the importance of factors having an influence on consumers' RFID acceptance through an empirical analysis was proposed, and the differences in acceptance factors were presented according to consumer cognitive styles. As for the characteristics of consumer cognitive styles (information perception, decision-making, and attitude) with respect to RFID acceptance factors (UPPS, IPS, IPP, UPPP, and PR), Korean consumers appeared to have similar patterns as a whole. The results of this study suggest that though the preferential recognition of consumers is important in the establishment of expansion strategies of diverse levels of RFID acceptance when enterprises are setting up such strategies, there is a certain commonality in the consumers' recognition of RFID.

And, according to the characteristics of RFID acceptance factors, in the case of attitude, there were no factors that showed a statistical difference based on the 「Judging」 and 「Perception」 types. Thus, with respect to attitude, it was determined that preferential RFID acceptance expansion strategies aimed at the 「Judging」 and

「Perception」 types consumers are not necessary. As for the decision-making styles of consumers, the 「Thinking」 and 「Feeling」 types appeared to have statistical differences in the categories of PR, IPS, and IPP. According to the two factors, it appeared that the 「Thinking」 type more highly recognizes the importance than the 「Feeling」 type. Thus, enterprises should give preferential consideration at the level of information protection and privacy when planning to expand RFID acceptance. With respect to recognition, the 「Sensing」 and 「Intuition」 types appeared to have a statistical difference only in the aspect of UPPS. In the category of privacy, the 「Intuition」 type appeared to accept RFID better, as it showed less UPPS. Therefore, enterprises should set up strategies such that the degree of UPPS is reflected when they set up RFID acceptance expansion strategies.

On the other hand, this study has several limitations. First, in this study, the cognitive style variables were used in the difference analysis of RFID acceptance factors. During the measurement of consumer cognitive styles, there might have been limitations to measure the correct cognitive styles of consumers because the measurement was carried out with single-variable MBTI items in order to get efficient replies from the questionnaire respondents. Therefore, schemes to measure the correct cognitive styles of consumers should be established in future studies.

Second, in this study, for the scale of consumers according to cognitive style, the t-test analysis was carried out using the data with smaller samples. In reality, the scale of samples

for attitude (the 「Judging」 and 「Perception」 types), decision-making (the 「Thinking」 and 「Feeling」 types), recognition (the 「Sensing」 and 「Intuition」 types) toward cognitive styles appeared to be different. Therefore, a limitation exists in the generalization of the difference analysis results that were obtained for the sample scale with gaps. Accordingly, in future studies, larger samples should be secured before carrying out empirical analysis, and furthermore, the efforts to carry out empirical surveys should be made using identical scales according to the characteristics of cognitive styles through the respondent control before the survey.

Third, RFID acceptance is an issue that draws the interest of many enterprises. In this study, the research variables proposed by Hossain and Prybutok [2008] was modified and used in the measurement of consumer RFID acceptance. In reality, RFID acceptance varies according to the informatization mindsets that exist in diverse countries and the consumers' recognition level with respect to information technology. Nevertheless, in this study, RFID acceptance variables developed in the U.S. were applied to the Korean context. As shown in the factor analysis result, cultural influence in Korea was not derived as a factor that had effects on RFID acceptance. Consequently, the development of an RFID acceptance model should be carried out in consideration of the characteristics of nations and consumers in future studies, and studies in which the differences in cognitive styles with respect to newly developed RFID acceptance models should be carried out as well.

Fourth, in the recognition aspects of cognitive styles, the 「Intuition」 type was expected to accept RFID better than the 「Sensing」 type in terms of RFID acceptance. However, according to the empirical analysis result of this study, the 「Sensing」 type appeared to recognize the convenience of RFID acceptance more highly than the 「Intuition」 type, in contrast to expectations, showing the existence of limitations in this study. Such limitations may have been caused by many factors, such as the fact that the sample scale was small and the objects of the sample were not diversified, as well as the failure to consider diverse characteristic variables in recognition of convenience. In the studies to be carried out in the future, diverse analyses should be carried out through picking up diverse samples and expanding the sample size.

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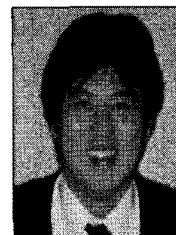Dr. Kim is an associate professor of Accounting Information Systems Department at the Sangji University. She received Ph.D. degree at the Kookmin University. Dr. Kim's research interests include Enterprise Resource Planning, Accounting Information Systems, and e-Learning.

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