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Influence of Public R&D Information Service Image on the Value and Satisfaction of Users

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Abstract The aim of this study is to investigate the relative impact of the image of information service on customer's perceived value and satisfaction of R&D information. It also seeks to assess the moderating effect of service users' skills on the value of the service image on the customer. For this purpose, a field study was conducted on users of a public R&D information service called NTIS (National Technology Information Service) in Korea. The findings show that the information service image has a significant impact on customers' perceived value and satisfaction. In addition, customers' perceived value is found to be an important indicator in strengthening customer satisfaction. Findings also reveal that individual personal computer skills moderate the relationship between service image and information value. Further research is needed to strengthen the independent variable in view of the increasing pressure to improve public service quality and customer management.

Keywords Information service image, customer value, satisfaction, information user skill

I. Introduction

The growth of the Internet over the recent years has triggered major changes in business relationships and in the processes of communicating and transmitting information between organizations and their customers. The scientific and technical information services are especially important for SMEs that rely on them for successful research. The knowledge and strategy derived from information services can help small firms to prioritize among those services. Many government agencies rely on R&D information services relevant to their researchers and SMEs, but they have to pay attention to the needs of customers in the public sector.

The value of such information varies according to external elements such as the environment in which it is provided, the methods of utilization, and the level and purpose for the user, among other elements.

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Given the global nature of the market, competing firms are constantly seeking to project their superior quality of service, customer-perceived value, and brand image in order to gain customer loyalty. Previous research has indicated that service quality, image, customer-perceived value, and satisfaction are some of the key success factors in gaining a competitive advantage among service providers (e.g. Bolton and Drew, 1991; Parasuraman, Berry and Zeithaml, 1991; Parasuraman, Zeithaml and Berry, 1988; Zeithaml, Berry and Parasuraman, 1996). According to research related to information activities and needs, the focus is on such aspects as information and environment scanning (Hartman et al, 1994; Choo, 2001; Yunggar, 2005), information behaviour (Wilson 2000; Huotari and Wilson, 2001), relations between availability and usage of information (Varian, 1998).

II. Theoretical Background

1. Information Service Image

Image has been described as a subjective knowledge, an attitude, and a combination of product characteristics that are different from a physical product, but are nevertheless identified with the product (Nguyen and LeBlanc, 1998). Image has also been described as the overall impression left on the minds of customers (Zimmer and Golden, 1988). MacInnis and Price (1987) describe image formation as a procedure by which ideas, feelings, and previous experiences with an organization are stored in memory and transformed into meaning based on categories. Image serves as an important factor influencing customer satisfaction and loyalty, so a favourable image can influence repeat patronage (Andreassen and Lindestad, 1998; Dick and Basu, 1994). Corporate image may be considered as ‘'a function of the accumulation of purchasing/consumption experience over time’' (Andreassen and Lindestad, 1998), or a function of the cumulative effect of customer (dis)satisfaction (Bolton and Drew, 1991; Fornell, 1992; Johnson and Fornell, 1991). Image affects users’ intention to use ISs in a significantly manner through the mediating effect of emotional value and social value (Fang-Ming Hsu et al., 2010). Some authors stated that corporate image has a filtering effect that impacts on a customer’s perceived value and satisfaction for the industry.

Based on the review of the literature related to the concept of image and perceived value the following hypotheses are proposed:

H1: Information image has a positive impact on perceived value.

2. Perceived Value and Satisfaction

Perceived value can be defined as the benefits provided to a customer relative to the cost. Zeithaml (1988) defines value as the consumer's overall assessment of the utility of a product based on the perception of what is received and what is given. Woodruff (1997) defines customer value as a customer's perceived preference for, and evaluation of, those product attributes, performance attributes, and consequences arising from use that facilitate the achievement of the customer's goal and purchase in usage situation. It is the value customers perceive they gain or experience by using a service (Bettman, Luce and Payne, 1998). According to Vandermerwe (2003), the value should be defined by the customers, when the customers are satisfied with the total experience. McDougall and Levesque (2000) propose that perceived value contributes directly to customer satisfaction, which, in turn, leads to future intentions. High external service value leads to customer satisfaction, which ultimately leads to service loyalty (Heskett, Sasser and Schlesinger, 1997).

Customer satisfaction is the response of a customer regarding the value gained from a product or service provided, as well as the positive or negative emotions of a customer regarding the value gained as the result of using what is provided. Thus, customer satisfaction is recognized as one of the important antecedents of loyalty and hence both academics and practitioners have considerable interest in gaining a better understanding of customer satisfaction. Research conducted by Kim, Lee and Yoo (2006) found that satisfied customers exhibit loyalty and provide positive word-of-mouth. It is also viewed as the overall assessment of the service provider while future intentions are the stated likelihood of returning to the service provider (McDougall and Levesque, 2000). The concept of 'marketing' in services is primarily concerned with satisfying customers' needs and wants, hence customer satisfaction can be regarded as the heart of all marketing activities (Machleit and Mantel, 2001). The link between perceived value and customer satisfaction has been debated in the services marketing literature. Fornell, Johnson, Anderson, Cha and Bryant (1996) also support the notion of a positive influence of the perceived value on customer satisfaction

Based on the review of the literature with regard to the concept of perceived value and customer satisfaction, the following hypotheses are proposed:

H2: Perceived value has positive impact on customer satisfaction.

H3: Perceived value mediates between information image and customer satisfaction

3. Skill Level of e-customers

Prior research points to the factors that affect the success of information systems implementation such as support of the executive management, user ability, involvement of the end user, clear use of the company needs, careful planning, and the expectations of a real company. Amorso (1989) says that the user quality is a factor that plays an important role in the successful implementation of accounting information systems (Lilis Puspitawati, 2015). Meanwhile, Soegiharto's research (2001) concludes that personal capability does not influence positively the effectiveness of Accounting Information Systems both in terms of user satisfaction and system usage.

For the use of E-service, e-customers often rely on their own ability to use technology to obtain the service. A greater awareness of the specific technological skills would influence the use of the technology and provides an enhanced sense of security, freedom and control.

In conclusion, depending the individual PC skills, information performance would differ. Thus, we propose the following hypothesis.

H4: Individual PC skills have a moderating impact between information image and perceived value.

III. Research Methods

The research framework of this study is based on the modified theory of Information image, the individual PC skills were added based on a previous study and is shown in Figure 1.

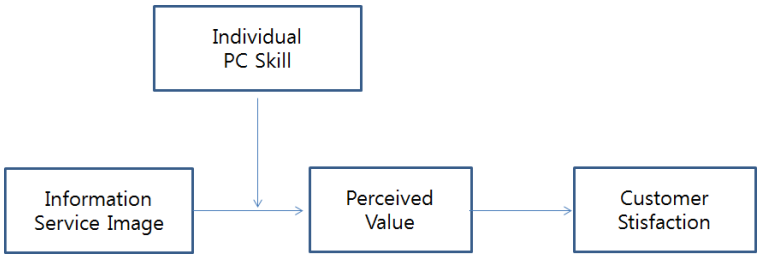

Figure 1 Research model

For this study, 142 types of data were collected on the R&D information users in SME using NTIS (National Technology Information Service) in Korea. Exploratory factor analysis was used to assess the validity of the measurement employed in this study, and Hierarchical regression technique was used to analyze the data.

1. Measurement

The dependent variable in this study is *customer satisfaction* which is assessed by five items - intention of recommendation, frequent use, priority, overall satisfaction and intention to reuse. The mediating variable is *perceived value*; it was measured using seven items - reduction of effort, time saving, cost savings, enhanced R&D performance, convenient using of facilities, cost-benefit ratio, administrative efficiency.

With regard to the independent variables, the *information service image* was assessed by eight items - efficiency, reliability, degree of assistance, kindness, familiarity, inventive step, good feeling, and simplicity.

Lastly, individual PC skills, the moderating variable between information service image and perceived value, were assessed by two items - information retrieval preference and information processing speed. For each of the multi-item measurements, responses were reported on the 5-point scales with verbal anchors (ex: 1-strongly disagree to 5-strongly agree), and the sum of the scores divided by the number of items was used as a scale value for each respondent.

An exploratory factor analysis is carried out to assess the validity of the measurements used in this study. Four multi-item measures – customer satisfaction, information service image, perceived value, individual PC skill – were subjected to the factor analysis utilizing maximum likelihood factoring where direct Oblimin rotation was used to determine the factor structure. As shown in Table 1, four factors were extracted from the input data and they explained 70.14% of variance. In addition, items from each of the five measurements factored together respectively with factor loadings greater than .60. These results show that the multi-item measurements used in this study have satisfactory convergent and discriminant validity.

The reliability of the five multi-item measurements was also assessed based on the Cronbach's alpha coefficients. Descriptive statistics and Cronbach's alpha coefficients are also presented in Table 1. Cronbach's alphas for the multi-item measurements are all above .70, which indicate that all the multi-item measured have a satisfactory level of reliability.

Table 1 Factor analysis results for the five multi-item measures

Pattern Matrixa						
variables	items	Factor				Cronbach's Alpha
		factor1	factor2	factor3	factor4	
Inform_skill	V39	.986				0.864
	V38	.764				
inform_service image	V52		.857			0.945
	V49		.843			
	V53		.841			
	V54		.801			
	V57		.800			
	V55		.793			
	V56		.746			
	V50		.739			
customer satisfaction	V43			-.933		0.941
	V44			-.920		
	V45			-.790		
	V42			-.707		
	V41			-.695		
inform_cus_value	V27				.878	.914
	V28				.864	
	V26				.794	
	V25				.713	
	V23				.676	
	V24				.645	
	V21				.609	
Eigenvalue		10.525	2.746	1.921	1.334	
% of variance		11.689	42.168	8.373	7.916	
Cumulative % of variance		11.689	53.856	62.229	70.146	
KMO(Kaiser-Meyer-Olkin)						0.911
Bartlett's Test of Sphericity				Approx. Chi-Square		2324.334
				df(p)		231(.000)

2. Data Analysis Method

A hierarchical regression analysis was conducted for two kinds of analyses. First, to validate the effects of the moderating variable, namely, individual PC skills between information service image and perceived value. In stage 1, the perceived value was regressed on information service image. In stage 2, in addition to the independent variables, individual PC skills as the moderate variable was entered into the regression equation. In stage 3, two interaction terms between the independent variables and individual PC skills were added to the regression equation in order to test the moderating effects exercised by individual PC skills.

In order to avoid the multicollinearity problem, as suggested by Jaccard et al. (1990), all the theoretical variables were standardized so that they had means of zero and a standard deviation of one, and then five interaction terms were created using those standardized variables.

Regression analysis assumes linearity and the absence of high multicollinearity. The linearity assumption was examined for the dependent variable with each of the independent variables using the SPSS MEANS procedure. For those relationships that were found to show significant deviations from linearity, R^2 s were compared with $Eta^2 s$, along with graphical examination of the relationships. These test results indicated that deviations from linearity were either non-significant or minor, and that no transformation was required for the variables included in this study.

Multicollinearity problems were also checked employing two methods. Correlations among variables were examined to detect this multicollinearity problem. Correlations exceeding .80 are considered to indicate the existence of a serious multicollinearity problem. As shown in Table 4, none of the correlations exceed .80. The eigenvalues of the independent variable correlation matrix were broken down and examined to further check the multicollinearity. Generally, eigenvalues less than .05 are considered indicative of high multicollinearity. None of the broken down eigenvalues were found to be less than .05 in this analysis. These results indicate that a serious multicollnearity problem does not exist in this study.

The second kind of analysis conducted by hierarchical regression analysis is to verify the mediating effect of perceived value between the information image of independent variable and service satisfaction of dependent variable. For this, a regression analysis was conducted in Step 3. In stage 1, the perceived value was regressed on information service image of independence variable. In stage 2, service satisfaction was also regressed on the independent variable, information service imaged. In stage 3, in addition to the independent variable, perceived value of mediating variable was entered into

the regression equation. After verifying the significance, the independent variable beta values for Model 2 and Model 3 was compared.

IV. Result

1. Correlation Analysis Results

Correlations among the variables included in this study are presented in <Table 2>. As shown in the table, the independent variables have significant relationships with perceived value and customer satisfaction. Moderating value individual PC skill have significant relationships with perceived value and customer satisfaction except information service image.

And then, mediate valuable perceived value has significant relationships with service satisfaction.

Table 2 Correlations among variables

	1	2	3	4
1. Individual PC skill	1			
2. information service image	.085	1		
3. customer satisfaction	-.328***	-.579***	1	
4. perceived value	.206**	.526***	-.607***	1

note: * p<.1, ** p<.05, *** p<.01

2. Verification of Perceived Value and Customer Satisfaction

Regression analysis of the effect of the information service image on the perceived value reveals that the F value of the variance analysis showing significance of the regression equation is 46.723, which is significant at the significance level of .01 or less. The explanatory power of the model (R^2 value) was .277 <Table 3>.

Table 3 Verification of perceived value

dependent variable	independent variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	R^2	adjusted R^2	F	Durbin-Watson
		B	Std. Error	Beta						
perceived value	(Constant)	.000	.074		.000	1.000	.277	.271	46.723 (p=.000)	2.101
	information SV image	.520	.076	.526	6.835	.000				

In the regression analysis of the effect of the information customer value on customer satisfaction, the F value of the variance analysis showing significance of the regression equation is 71.300, meaning that the significance level is less than 0.01, so the regression equation is meaningful. The explanatory power of the model (R^2 value) was .369 <Table 4>.

Table 4 Verification of customer satisfaction

dependent variable	independent variable	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	R^2	adjusted R^2	F	Durbin-Watson
		B	Std. Error	Beta						
satisfaction	(Constant)	.000	.070		.000	1.000	.369	.3641	71.300 (p=.000)	1.634
	perceived value	.-.617	.073	-.607	-8.444	.000				

3. Verification Result of Moderating Effect

Data presented in Table 5 are standardized coefficients. First, consider the results for Model 1 where two control variables were regressed on the perceived value. As shown in the forth column, Model 1 explains 5.5% of the variation of perceived value, which is not significant at .461. Next, to consider the hierarchical regression results in stage 2, the information service image was added to Model 1. As shown in the fifth column, the variable further explains the variation of perceived value by 26.6%, which is significant at .000. As presented in Model 2 of the table, information service image is significant. In stage 3, the individual PC skills variable was added to Model 2. As shown in the sixth column, it additionally explains the variation of perceived value by 2.8%, which is significant at .029. Lastly, to consider the results for Model 4 where the interaction terms between information service image variable and individual PC skills were entered into the regression equation. As presented in the seventh column of the table, those interaction terms additionally explain the variance of perceived value by 5.4%; it is significant at .002. This indicates that the addition of the interaction terms make a significant contribution to the explanation of the perceived value. Therefore, the individual PC skills to utilize the information technology have been shown to moderate the relationship between service image and perceived value.

Table 5 Verification of moderation effect of PC skill

Dependent variable = perceived value			regression coefficients(β)			
			Model1	Model2	Model3	Model4
control variables	(Constant)		.003	-.091	-.140	-.291
	age1	Age dum1	.482	.010	.109	.239
		Age dum2	-.342	-.355	-.315	-.040
		Age dum3	-.256	-.307	-.246	-.022
	career2	Career dum1	-.452	.147	-.023	-.021
		Career dum2	-.036	.272	.224	.218
		Career dum3	.449	.614	.612	.498
		Career dum4	.109	.342	.390	.274
independent variables	inform-SV image			.526***	.510***	.444***
moderating variable	inform_PC skill				.168**	.165**
interaction terms	SV Image* PC Skill					.215***
R^2 (adjusted R^2)			.055(-.002). F=.964 p=.461	.321(.273), F=.6.784 p=.000	.349(.297), F=6.766 p=.000	,402(.349) F=.7.604 p=.000
ΔR^2 (ΔF)			.055(.964) p=.461	.266(44.965) p=.000	.028(4.879) p=.029	.054(10.158) p=.002
df1			7	1	1	1
df2			116	115	114	113

4. Mediating Effect

In order to verify the mediating effect, the regression analysis was performed by Baron and Kenny (1986). The authors suggested that the following four conditions must be satisfied in order for the mediation effect to be established.

First, the independent variable has a significant effect on the dependent variable. Second, the independent variable has a significant effect on the mediating variable. Third, the mediating variable has a significant effect on the dependent variable. Finally, in the multiple regression analysis in which the independent variable and the mediating variable are simultaneously entered, the mediating variable should have a significant effect on the dependent variable. In this case, the influence of independent variables on

the dependent variable is partially mediated when the effect is less than that of the two-step analysis.

Table 6 Significance verification of mediating variable

independent variable	Model	Sum of Squares	df	Mean Square	F	Sig.
inform image	Regression	31.587	1	31.587	46.723	.000
	Residual	82.478	122	.676		
	Total	114.064	123			

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	.000	.074		.000	1.000
inform_ SV image	.520	.076	.526	6.835	.000

Table 7 Significance verification of dependent variable and mediating effect

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.000	.072		.000	1.000
	inform SV image	-.581	.074	-.579	-7.852	.000
2	(Constant)	.000	.065		.000	1.000
	inform SV image	-.360	.079	-.359	-4.583	.000
	perceived value	-.425	.080	-.418	-5.335	.000

In terms of the mediating effect of hypothesis 3, the information service image (β = .520, $p < 0.01$) showed significant positive effect on perceived value in the first step. And also the information service image (β = -.581, $p < 0.01$) showed significant positive effects on customer satisfaction in the second step. In the multiple regression analysis, in which information service image and perceived value variables are simultaneously entered, perceived value has a negative (-) effect on service satisfaction (β = -.425, $p < 0.01$). In addition, the absolute value of β, which is the independent variable effect (β=-.360) in the third stage is smaller than the independent variables effect (β=-.581) in the second stage. Therefore, the perceived value has a partial mediating effect in relation to information service image and customer satisfaction.

V. Discussion and Conclusion

The results of this study propose the importance of public information service image to maximize the information customer values and satisfaction.

The study findings show that has a significant effect on perceived value and customer satisfaction. In addition, the perceived value is found to be an important indicator of the strengthening of customer satisfaction in the management of information service image. Public information service image is a result of accumulated experience and feelings expressed by the customers. Therefore, how to identify service image and to improve it as well as to effectively integrate the service content and delivery are crucial tasks for public service providers.

It also turns out that individual PC skills have a moderating effect between the service image and information value. The results suggest that the public service providers need to supply a positive service image to the service users, as in the private service industry, in order to create for them a better value and satisfaction and to help them produce a better outcome. The findings suggest that the skill level of e-customers in manipulating the prevailing technology will affect the outcome of the service experience as it moderates the influence of service image on customer value. This points to the necessity for customer education to improve personal abilities. The users' personal capabilities and user involvement will determine the success of the implementation of information systems as well as the interaction among the people involved in the implementation of the system. The results of this study are expected to have an impact on the growing public service users' interests.

Yet this study also has several limitations that should be considered when interpreting our results. First, we obtained out data mostly from the researchers in SMEs. Second, the information services we studied are specific to KISTI (Korea Institute of Science and Technology Information). Therefore our findings might not be generalizable to other information services. This research needs to be duplicated in the private organizations or other public institutions to get a more comprehensive external validity of the study. It should be also noted that the model should be further developed and tested to explore the variables to improve the customer value and the satisfaction of the public information services.

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