

# A Study on the Effect of User Characteristics on User Involvement in the Practical Use of Enterprise Architecture: The Cases of the Public Sector in South Korea

SoYun Cho\*, JungHoon Lee, JungHyun Kim  
 Graduate School of Information, Yonsei University, Seoul, South Korea  
 \*EMAIL: soyun11@gmail.com

**Abstract:** In order to manage Information Technology resources effectively, EA (Enterprise Architecture) has emerged, and it was mandatory to introduce in South Korea [31]. However, the research on how to adopt and manage EA effectively and enhance the practical use of EA was not conducted frequently for the past few years. For improving EA implementation, it is critical that users should be aware of the EA value and participate in the practical use of EA. Hence, for identifying factors to influence on User Involvement in the practical use of EA, we proposed a research model based on literature reviews, and conducted an empirical study of the practical use of EA in the public sector of South Korea.

**Keywords:** Enterprise Architecture, User Involvement

## I. Introduction

### Background and Purpose of the Study

In the early function-oriented enterprise IS (Information System), it was difficult to interact between functions and to do integration. Thus, enterprise integration system, followed by emergence of EA (Enterprise Architecture) that supports effectively IT (Information Technology), appeared. South Korean Government made EA implementation mandatory by enacting "Legislation on Adopting and Managing Effective Information System (2005)". However, overall the practical use of EA was low '1-level', and the domain of 21 government institutions (78%) showed below '1-level (perception level)' [31]. This clearly indicates that EA is not actually useful in public sectors.

To date, previous researches of EA were mainly focused on either studying impacts of EA implementation or developing EA framework. In other words, it needs researches for validating the impact factors or improving the practical use of EA on the organization which is already implemented with EA. In particular, it is urgent to identify how individual ability has impact on the practical use of EA.

The purpose of this study is to propose and to prove practically a research model for EA implementation. More specifically, we investigate relationship of User Involvement on the practical use of EA. User Involvement is defined as connection that aligns among individual needs, goals, values and knowledge [12]. In fact, the result of substantial research on the relationship between User Involvement and the system implementation demonstrated that it has a significant influence in the field of IS [5] [29] [33]. This

study will provide a foundation of studies on the practical use of EA. In addition, developing antecedent factors of User Involvement as variables can support the theoretical expansion about User Involvement in IS field.

### Scope of the study

This study is a practical research if users' inherent motivation or cognitive circumstances are influencing factors on the practical use of EA, and verifies causal relationship between the factors in terms of user's capacity under the assumption that User Involvement affects the successful implementation of EA. The research questions of this paper are as follows.

Q1: What are the individual factors having influence on the practical use of EA as an external factor?

Q2: What are the relations among individual factors that affect the practical use of EA and User Involvement?

The composition of this study is as follows. Following section shows literature reviews and suggests theoretical background. Subsequently, research model, concepts for developing hypothesis, and operational terms for measuring variable will be defined. The next section mentions the research methodology and validates research hypothesis. Final section will suggest further study based on the result of the study.

## II. Literature Review

### Enterprise Architecture

In 2005, South Korean government mandate adaptation of EA [31]. The targets of EA adoption are 135 public institutions. The target criteria are as follows: (1) companies with information budget for the previous 3 years, 2 billion KRW in average, (2) institutions with total investment size over 10 billion KRW for new information projects. Currently, it is estimated about 56% of those institutions (76) have introduced the EA [31].

After EA was introduced to South Korea in 2002, there have been a number of researches on how to implement and diffuse EA [14] [21] [23] [40] [41]. Most of these studies were about concepts, necessity, introduction, architecture, methods of approach on EA. Relatively, the empirical research on EA has been done limitedly [40]. Chang (2008) studied relationship between characteristics of organization and responsibilities of EA organization. Hong (2008)

conducted an empirical research on influential factors on the level of architecture adaptation. Another researches, concern these limited research on EA, suggested and emphasized critical factors, the organization culture, the education for training and awareness of senior manager, and the participation of organization members for introducing and implementing EA successfully [14] [23] [35] [40].

### Success Implementation of IS

In general, 70% of IS development projects were estimated to be failed by the organizational dimension [18] [25]. Bostrom and Heinen (1977) said that developing a new information system generally triggers changes in both technological and social system areas. However, most failure cause of new IS might be resistance to the change by organization members [25].

In IS research field, there are a variety of methods to measure the success of IS development. However, the success of involuntary IS cannot be measured by the use of system. Seddon and Kiew (1997) insisted that number of use and duration are successful only for voluntary use. One research shows that use of system can vary depending on user, organization, and tasks and characteristics of the developed information system so that it cannot be perceived as a valid measurement tool [4].

### User Involvement in IS Research

The interaction between three factors, human, task, and information, to impact on the IS operation is a reason of considering User Involvement [24]. Montazemi (1988) defined user characteristics of IS as follows: User Participation, User Involvement, User Attitude, and Population Statistical Variable.

In IS field, User Participation and User Involvement are similar and they are used without dividing the two. However, Barki and Hartwick (1994) stated that these two concepts are divided. In principle, User Involvement is classified into two categories; User Participation during system development stage [22], user's psychological state on the significance of system [5]. User Involvement motivates object based on needs, values and interest. Besides, degree of involvement in object, situation and action depends on the degree of recognizing self-relevance [42]. Based on the previous study on the effect to the system success, the effect of User Participation is not clearly shown. Dickson and Powers (1973) analyzed the impact of system success and the difference among groups participating in each stage of system development, where some behavior of participants has shown a significant impact on the user satisfaction. However, participating behavior of project team showed insignificant. In addition, Ives and Olson (1984) showed the relevance of system success varying the types of system development participation. Apart from few cases, participation is not directly related to the system use, rather a factor having influence on User Involvement.

User Involvement is a motivational state, where users gets

attention from an object and has influence on the process understanding the object. For this reason, User Involvement has both direct and indirect influence on the behavioral intention [2]. The empirical researches on the relational influence of User Involvement and the system implementation show statistically significant relation [5] [29] [33].

### Antecedent Factors for User Involvement

A factor that can have influence on User Involvement level is external circumstantial factor, connecting circumstances and internal factors that motivate user and individuals.

Celsi and Olson (1988) indicated Felt Involvement as personal feeling about personal relevance of user. They said that Felt Involvement is a motivational state influencing a range and focus of user attention and comprehension process. Also they indicated intrinsic motivators and situational motivators as preceding factors of Felt involvement. They studied that these factors are mixed to build general level of involvement and to act as a motivational role of the process information. As a result, they proved a significant relation among intrinsic motivators, situational motivators and the involvement. And they also showed that intrinsic motivators have more influence than situational motivators [12].

Intrinsic motivators are one of individual level variables that determine productivity [43]. It can also be seen as individuals' motivation through enjoying work, learning new knowledge or skill [33]. In contrast, Celsi and Olson (1988) defined that situational motivators shape various forms by certain stimulus and signals, connecting environment. This means that circumstances or external factors around individual can be motivational or increasing the efficacy of work performance [33].

The theory of the intrinsic motivation is induced by inherent compensation, which comes from psychological achievement or challenging attitude, and confidence that are intangible aspects from the relationship with organization members. Therefore, it manifests while the members carry out the tasks [26] [36]. Malone and Lepper (1987) classified intrinsic motivation as a challenge, a curiosity, control, and fantasy. Gill (1996) considered a sense of control as a motivation factor and classified into autonomy, choice, self-determination and discretion. The intrinsic motivation is a personal motive and it can be seen as perceived enjoyment, self-efficacy, and goal orientation.

Yi and Hwang (2003) set self-efficacy, enjoyment, and Learning Goal Orientation as variables of the intrinsic motivation. They deemed that the enjoyment, Learning Goal Orientation, and the self-efficacy play an important role in deciding human behavior; and therefore studied the pertaining variables. Individuals with characteristics of Learning Goal Orientation improve the competence level to understand the work implementation. Their skills, namely abilities can continue to improve through acquiring knowledge and strengthening their capabilities [38]. Persons with higher Learning Goal Orientation can accept a new

environment or challenge so positively that they perceives this as an opportunity to accumulate their competence.

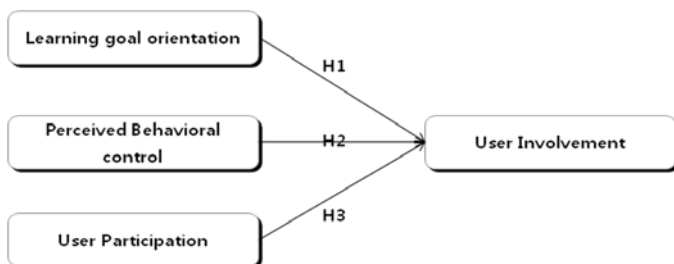
Gill (1996) illustrated a control as an intrinsic motivation. User Perception on a control is known in general as the motivation. Byrd (1993) and Hebert and Bradley (1993) also defined this control as the motivation toward the system use. Perceived Behavioral Control is accounted for as Control Beliefs and Perceived Facilitation [28]. Ajzen and Madden (1986) also defined Perceived Behavioral Control as each individual's perception about opportunity or resources for the necessary action, the control belief as skill, resource and perception about knowledge availability, and perceived facilitation as a personal evaluation on the required resource to achieve a desired goal. Baronas and Louis (1988) also said that Perceived Behavioral Control has influence on user to accept the system during implementation stage.

### III. Research Model and Hypotheses Development

This study is to investigate impact of personal characteristics on User Involvement and the practical use of EA. Antecedent factors of User Involvement are set as main variable, and the relationships between these antecedent factors, User Involvement, and the practical use of EA are lighted on. Also there are organizational and individual variables in this paper.

#### Proposed Research Model

User's characteristics that can influence on User Involvement about the practical use of EA are set as variables. With the relation among them, a research model is designed. [Figure 1] shows the development process.



[Figure 1] Proposed Research Model

#### Research Variables and Measurement Items

##### Learning Goal Orientation

In intrinsic motivators, Learning Goal Orientation that determines the adaptive behavior to new environment is set as a variable having influence on User Involvement. Learning goal orientation shows the degree of improving competence, understanding given task for individual EA use. This study used both measurement items about Learning Goal Orientation developed by Brett and VandeWalle (1999), and Learning Goal Orientation items partly used as

situational motivator by Santosa et al. (2005). As a result, measurement items are (1) Learning new knowledge (Learn1), (2) Learning new skill (Learn2), (3) Opportunities to develop (Learn3).

##### Perceived Behavioral Control

Perceived Behavioral Control is one of intrinsic motivation, and is related to the behavioral motivation that follows the degree of user's perception of the behavioral control. In other words, it is the perception degree, capable of fulfilling the EA implementation. Referring from Mathieson (1991) and Taylor and Todd (1995), measurement items are as follows: (1) would be able to use the EA (Con1), (2) entirely within my control (Con2), (3) have resource, knowledge and ability (Con3).

##### User Participation

As the theoretical background of this study, previous studies showed that User Participation is a major factor to a successful system [13] [16] [17] [22] [29]. User Participation was a critical factor of system success and a variable in many cases chosen as shown in previous IS researches. This article also considered User Participation as participation in the information development stage.

The previous studies focused on details of development stage and measured the degree of participation. On the contrary, this study focuses on measuring the degree of actual participation in EA development stage, making use of the EA characteristics as an enterprise tool. For this purpose, the measurement items of User Participation developed by Barki and Hartwick (1994) was applied to set the following items: (1) User-IS relationship (Part1), (2) Hands-on activity (Part2), (3) Help define EA (Part3).

##### User Involvement

User Involvement is a psychological state about how important and relevant users feel toward EA. Developing measurement items for this definition was referred to the work of Barki and Hartwick (1994) who separated the concepts between User Participation and involvement, and the work of Santosa, Wei and Chan (2005). The controlled definition of User Involvement variable is importance of the personal relevance of user about the practical use of EA. Measurement items are (1) Importance (Inv1), (2) Need (Inv2), (3) Essential (Inv3), (4) Relevant to me (Inv4), (5) Means a lot to me (Inv5), and (6) Of concern to me (Inv6).

##### Research Hypothesis Development

To achieve this research goal, hypothesis to be practically verified is deducted by considering User Involvement from reference study and its influential factors as the following.

Hypothesis 1: The higher extent of Learning Goal Orientation about the practical use of EA, then User Involvement in the practical use of EA will be higher.

Hypothesis 2: The higher extent of behavioral control of

user’s perception about the practical use of EA, then User Involvement in the practical use of EA will be higher.

Hypothesis 3: The more users participate in EA development stage, and then User Involvement in the practical use of EA will be higher.

**IV. Research Methodologies**

**Composition of Questionnaire**

To validate the hypothesis, questionnaire is composed of three parts. Part 1 had 16 questions with 7 points in Likert scale in order to validate the research hypothesis. Part 2 had questions regarding users’ information in the practical use of EA. Part 3 had demographic questions. To get accurate answers from EA users, questionnaire included the definition of terms, tasks and the practical use of EA. For identifying the practical use of EA in the work area, the respondent was asked to put their work scope using the practical use of EA.

**Data Collection**

Samples were collected from individuals in public institutions using EA for their works. For this survey, 132 public institutions of the study subject of annual EA maturation by NIA were selected. Surveyed institutions are either having yearly budget for the previous 3 years to be 2 billion KRW in average or having total size of investment in a new information project over 10 billion KRW [31].

This is the study on individuals’ characteristics, such that unit of analysis was an individual level and questionnaire was sent out to respondents by E-mail. E-mail and phone message was delivered for encouraging respondents, which led 76 respondents to fill out the questionnaire. Numbers of respondents’ institutions belong to is 45. Among collected questionnaires, 8 samples with EA maturation at ‘1-level’ are exempted from further analysis because ‘1-level’ of general capabilities was not enough to verify the hypothesis.

**Characteristics of Sample Group**

Because the survey was conducted with EA users in public institution in South Korea, types of public institutions are classified into Central Administration, Metropolitan Council, and others. Respondents are 50% from Central Administration, 24% from Metropolitan Council and 26% from others. Annual IT budget for institution respondents works for is shown in [Table 1].

[Table 1] Annual IT Budget of Respondents

Classification (KRW)	Ratio (%)
Over 10 billion	58
5 billion~10 billion	10
2 billion~5 billion	16
1 billion~2 billion	7
500 million~1 billion	3
Less than 500 million	6

Scope of respondents’ practical use of EA was surveyed to

allow multiple responses. Out of 76 respondents, 72% implemented EA in information planning field, 46% in development and operation of information project, 39% in drawing up a budget for information projects, 33% in reviewing information projects, 30% in maintenance or repair, and 8% in information supervision.

The period of the practical use of EA are shown in [Table 2]. 53% of all respondents said that the duration of using EA at work is less than 1 year. Given the short implementation period after EA introduction and system construction, samples are an appropriate object of research model.

[Table 2] EA implementation period of Respondents

Classification	Ratio (%)
Less than 6 months	22
6 months~1 year	25
1 year~1 year and 6 months	16
1 year and 6 months~2 years	13
2 years~3 years	9
Over 3 years	15

**Reliability and Validity Tests**

For conducting factor analysis, we confirm the construct validity of measurement tool. Cronbach’s Alpha Coefficient ensures internal consistency among relevant measure indexes. Since Cronbach’s Alpha Coefficient is greater than 0.6, it is generally acceptable reliability of Exploratory Study. However, using the measure items of previous researches without any kinds of modification for the reliability needs the value, greater than 0.7 [32]. According the value of factor loads is greater than 0.55 and less than 0.62 means “Good”, greater than 0.63 and less than 0.70 means “Very Good”, and greater than 0.71 means “Excellent” [3].

[Table 3] Factor Analysis and Reliability Test Result

	User Involvement	Learning & Control	User Participation	Cronbach’s alpha
	1	2	3	
Inv4	<b>0.866</b>			<b>0.919</b>
Inv6	<b>0.836</b>			
Inv5	<b>0.833</b>			
Inv3	<b>0.743</b>			
Inv2	<b>0.663</b>			
Con2		<b>0.803</b>		<b>0.865</b>
Con1		<b>0.724</b>		
Learn2		<b>0.645</b>		
Learn1		<b>0.631</b>		
Con3		<b>0.600</b>		
Part2			<b>0.917</b>	<b>0.937</b>
Part3			<b>0.907</b>	
Part1			<b>0.844</b>	

[Table 3] shows the analysis result of the reliability of measurement tool. Especially, this result indicates that

variables of Learning Goal Orientation (Learn1~Learn3) and variables of Perceived Behavioral Control (Con1~Con3) are combined as one factor. This can be explained that those two factors are common concept as characteristics representation of intrinsic motivators which are viewed as one of preceding factors having influence on User Involvement. In summary, both improving individual's capacity through the practical use of EA and perceiving the ability to carry out the practical use of EA turned out to be an identical concept. Hence, this study redefined the concept as user's Perceived Competence regarding the practical use of EA.

### Hypotheses Tests

Based on the collected data, User Perception and User Participation which are redefined above, have a significant influence on User Involvement in the practical use of EA, multiple regression analysis was conducted.

The modified value of  $R^2$  on the regression analysis of effect of two variables; User Perception and User Participation on User Involvement was 0.495, which shows the overall relevance toward the research model is 49.5%. And the value of F deviation compared to  $R^2$  deviation is 33.808, with significance probability 0.000. This level is smaller than the significant level of 0.01, so that implementation of the model in 99% of reliability level turned out to be appropriate.

The regression analysis in 99% reliability showed the following two. First, User Participation did not have any statistically significant influence on User Involvement ( $\beta = 0.089, p > 0.01$ ). Secondly, Perceived Competence showed statistically significant influence on User Involvement ( $\beta = 0.661, p < 0.01$ ). Besides, it also showed that there is not any Multicollinearity problems (VIF=1.452). [Table 4] is the summary of result based on research model about validating hypothesis.

[Table 4] Summarized Research Result

Hypothesis	Acceptance/ Rejection
User Participation → User Involvement	Rejected
Perceived Competence → User Involvement	Accepted

## V. Research Result

### Conclusion and Implications

This study is for finding the influencing factors (independent variable) that increase User Involvement level (dependent variable) in the practical use of EA. As this research result, Perceived Competence in terms of user's inherent motivation point shows highly significant influence on User Involvement. The degree of User Perception in competence for the practical use of EA and improvement in work performing capability through the practical use of EA also turns out to have significant influence on User Involvement. Previous studies stated that Intrinsic Motivator has more significant influence on User Involvement, than situational

motivators [33]. Likewise, this study shows that there is strong causal relationship between intrinsic motivators and User Involvement. Eventually, it is required to establish an environment and education for individuals with the practical use of EA.

If the result of this research is reflected on public institutions, EA can be firmly established as a management activity tool by (1) examining the individual strength of users who use the EA principles, architecture/reference model on their tasks, and (2) raising the participation level on the practical use of EA.

However, most of previous researches of user perspective on IS use were about organizational characteristics or standard framework, rather than individual's competence. In contrast, this study is the research on manifesting the substantial strength of users about the practical use of EA. In addition, this study identifies the importance of user's participation in the practical use of EA and also encourages the interest in psychological state that has an impact on users' behavior. In particular, it provides grounds for determining the importance of user's strength perception and intrinsic motivators, which are proved to be influencing on User Involvement.

### Research Limitation

The targets of this study are public institutions in South Korea. Therefore, the research scope is limited. At the beginning of this study, the level of the practical use of EA was not high and users are confined to the personnel in IT departments so that it was difficult to collect samples and to compose standard group. Thus, it was not enough to control the level of EA introduction, the use period after EA introduction, and so forth. To prevent from these, questionnaire specifically asked the respondents to answer about the level of EA introduction and the use period, but their answers are likely to be based on conjectures or subjective memory. Even with these limitations, this research is the first substantial study on the practical use of EA and user's strength that lays the grounds for any further the practical use of EA and relevant research in future.

### Future Directions

Based on this study, it is necessary if User Involvement can actually turn out to be the result of the practical use of EA. Previous researches show that User Involvement is an influencing factor in the behavioral pattern of users. However, EA is an enterprise system so that researches on User Involvement cannot evaluate the product of the practical use of EA.

Hence, if researches on both establishing variable from the result of using EA and validating the relationship between User Involvement and the result of using EA are performed, it would be possible firmly to set up research framework. In addition, it is need to research on users of EA in two fields, Business and IT, for getting meaningful insights on EA.

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## Background of Authors

**So-Yun Cho** is working for SK C&C, S.Korea. She received M.S in Information System from Yonsei University, Seoul, S.Korea.

**Jung-Hoon Lee** is an associate professor at the Graduate School of Information, Yonsei University, Seoul, S.Korea. He received B.Eng/MSc in Electronic Engineering/Information Systems Engineering, MSc Information Systems from University of Manchester and London School of Economics, and Ph.D. from Manufacturing Engineering and Management from Institute for Manufacturing, University of Cambridge, U.K.

**Jung-Hyun Kim** is the Ph.D. Candidate at the Graduate School of Information, Yonsei University, Seoul, S.Korea. She received B.Eng in Information and Computer Engineering and M.Eng in Business Information Engineering from Ajou University, Suwon, S.Korea.