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A Mediating Effect of Internalization on Technology Adoption

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Abstract

Many technology innovations fail. Only a few of them are successfully implemented. Most of the remaining are discontinued before long or fail to be routinized. Although employees attempted to adopt the innovation for some legitimacy reasons, they have not reached the stage of internalization in which they believe in the real value of the innovation and become committed to the innovation. The deficiency of internalization was utilized in many studies as an important factor for explaining the failed innovation cases. However, few empirical studies examine the role of internalization in technology adoption. This study aims to investigate a mediating effect of internalization on technology adoption.

Keywords : Internalization, Technology Adoption, Secure Software Development Methodology

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1. Introduction

Technology acceptance model (TAM) is a highly renowned model for technology adoption [Davis, 1989]. Just with two belief constructs of perceived usefulness and perceived ease of use, the TAM attempts to explain user's intention to adopt the technology or innovation. Due to its simplicity and strong theoretical foundation, it has been applied in many technology situations [Kim and Kim, 2016].

One major assumption of the TAM is that user's intention to adopt technology will smoothly lead to his or her actual use. The intention-to-actual use linkage has rested on Fishbein and Ajzen [1975]'s logic that intention is the immediate determinant of behavior. This logic was called into question by Venkatesh et al. [2003] and Bagozzi [2007]. Bagozzi claimed that behavior is not a terminal goal and many actions can be taken at least as a means to more fundamental ends or goals. In particular, a variety of group or social behavior or actions can occur between intention and decision making of usage.

One such action is internalization which is defined as acting out of congruence between one's own and a group's shared values or goals [Bagozzi, 2007; Kelman, 1974]. This internalization occurs through a number of processes such as socialization, psychological development, education or training, and indoctrination [Bagozzi, 2007].

It is Kostova and Roth [2002] who first used this internalization in regard to adoption of management practice. They conceptualized practice adoption with two stages. The first is actual implementation of practice, the second is an attitudinal change through the internalization of practice [Kostova and Roth, 2002]. Some organizations formally adopted it but never reached the second stage. Such a situation is called as a symbolic or ceremonial adoption [Kostova and Roth, 2002; Chen and Wang, 2006].

A methodology is the principles, methods, and rules to be applied for solving a complex problem. System development methodology is a good example of the methodology. An adoption of new methodology often requires changing not only current processes but also core capabilities to solve problems [Pfleeger, 1999]. Riemenschneider et al. [2002] emphasized that "organizations attempting to deploy a methodology tend to face much resistance from individual developers." In this sense, an adoption of new software development methodology in IT organizations must be a crucial management practice.

We presume that such a resistance or a ceremonial adoption is mainly associated with a deficiency of internalization. Though the concept of internalization was used effectively for explaining technology adoption, there has been a paucity of empirical technology adoption research using the internalization as an important determinant. It is our view that not only the implementation but also the internalization will affect the technology adoption [Kostova, 1999]. In this study, we aim to investigate a mediating effect of internalization on technology adoption. To this end, we surveyed software developers employed in Korea software development firms that recently have adopted a secure coding methodology.

2. Literature Review

2.1 Internalization

A successful practice adoption is realized through two different processes : implementation and internalization [Kostova, 1999]. Implementation is defined as the level of complying formal rules of practice by adopters and internalization as the degree to which adopters attach a symbolic meaning to the practice [Kostova, 1999]. Internalization is the process of incorporating organizational values or goals related to the practice [Mael and Ashforth, 1992; Pierce et al., 2001]. But, implementation does not automatically lead to internalization. There actually exists many unsuccessful practice adoption cases that passed the first stage but failed to reach the second stage [Chen and Wang, 2006; Kostova and Roth, 2002; Collings and Dick, 2011]. We call it as ceremonial or symbolic adoption [Kostova and Roth, 2002; Chen and Wang, 2006].

This ceremonial adoption of practice was first identified by Meyer and Rowan [1977]. They ascribed the ceremonial adoption to a shortage of organizational belief in its real value. It frequently occurs when a subsidiary formally implements the innovation with the request of the parent company under multinational corporation context [Kostova and Roth, 2002] or when an employee formally complies with her supervisors or top executives' pressure, without her belief in the value of practice [Chen and Wang, 2006].

Pierce et al. [2001] conceptualized the internalization as a kind of psychological ownership that is defined as the state in which individuals feel as though the target of ownership is "theirs" [Pierce et al., 2003]. They investigated how organizational members come to feel this ownership. Three routes to psychological ownership were identified : controlling the target, coming to intimately know the target, and investing the self into the target [Pierce et al., 2001]. That is, the more amount of control an organizational member has over the target, the greater extent he/she intimately knows the target, and the greater extent he/she invests himself/herself into the potential target, the higher degree of ownership he/she feels toward the target. Similarly, Kostova [1999] emphasized the possibility that an organization can increase the level of internalization through organizational commitment to the practice, satisfaction with the practice, and psychological ownership of the practice.

The concept of internalization has begun to be used in practice adoption research. There are a few empirical studies on the effect of internalization. In their case study, Chen and Wang [2006] ascribed a less rapid diffusion of customer relationship management (CRM) to the incompatibility of its underlying value with the company's existing values or philosophy. A few more empirical studies were executed in quality management area [Nair and Prajogo, 2009; Tari, et al., 2012]. For instance, Nair and Prajogo [2009] showed that the high level of internalization in ISO standard effort is positively associated with the high level of operational performance. However, a mediating effect of internalization on technology adoption has not yet been empirically tested.

2.2 Technology Adoption

The most renowned technology adoption model is the TAM [Davis, 1989] by which adoption intention can be explained by two specific belief constructs : perceived usefulness (PU) and perceived ease of use (PEOU). Due to its parsimonious approach and strong theoretical foundation like the theory of reasoned action (TRA) [Fishbein and Ajzen, 1975], it has drawn lots of attention from IS researchers.

Actually, it must be the most widely applied theoretical model in the IS field [Lee et al., 2003]. Besides a great quantity of studies applying or validating the model in many different technology situations, there have occurred a number of studies directed to the model itself.

Lee et al. [2003] divided all the TAM-related studies into four periods : model introduction, model validation, model extension, and model elaboration. Studies in the model introduction period mainly replicated the TAM with other technologies and those in the model validation period tackled the power, consistency, reliability, and validity of the model. After the finding of a sufficient-enough theoretical robustness and an existence of theoretically incongruent empirical results during the above two periods, IS researchers have attempted to introduce new variables in relationships between constructs or search for antecedents (or external) variables of the major TAM constructs and ultimately to develop the next generation TAM models [Lee et al., 2003]. TAM2 [Venkatesh and Davis, 2000] and the unified theory of acceptance and use of technology (UTAUT) [Venkatesh et al., 2003] are good examples of model elaboration.

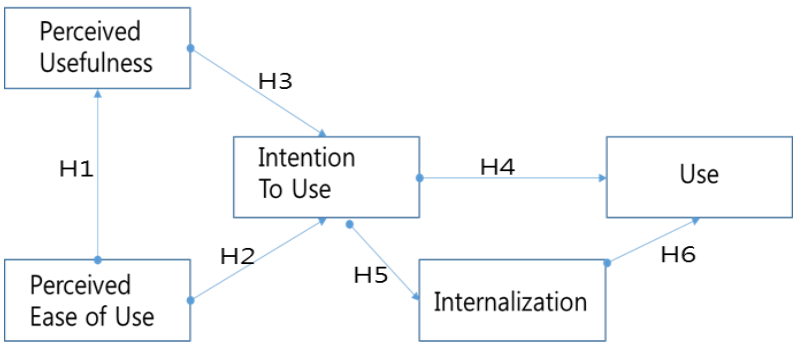
In addition, most of other systematic literature review or meta-analysis on TAM-related empirical research [Turner et al., 2009; Legris et al., 2003] are jumping to a conclusion that TAM is a useful model but needs its modification in which more human and social change constructs are integrated into the original model [Legris et al., 2003].

However, one of major criticism about technology adoption models is that the intention to adopt does not automatically result in actual adoption [Bagozzi, 2007; Recker, 2010]. Recker [2010] indicated that the attitude individuals would get after their adoption is more important than the initial intention. In his appraisal of TAM, Bagozi [2007] also claimed that the critical gap lies with the TAM-proposed linkage of intentions to use IT and actual use and that a variety of group or social behavior or actions including internalization may happen midway between intention and actual use. However, his model was not empirically tested yet.

3. Research Model and Hypotheses

The main objective of this study is to investigate the mediating effect of internalization on technology adoption. The best known model of technology adoption is Davis' TAM. Our research model was constructed on the TAM and extended to include not only actual use following the intention to use but also internalization between the two.

Our research model is shown in <Figure 1>. Perceived ease of use, perceived usefulness, and intention to use are from TAM and the other two are added for this research.



〈Figure 1〉 Research Model

The first three hypotheses are from the original TAM, so there is no need of further explanation about them.

Hypotheses 1 : Perceived ease of use is positively associated with perceived usefulness.

Hypothesis 2 : Perceived ease of use is positively associated with the intention to use.

Hypothesis 3 : Perceived usefulness is positively associated with the intention to use.

The positive relationship between the intention to use and use is kind of a basic premise behind the TAM. It is reasonable to posit the relationship since adopters with higher intention to use would be more likely to actually use it.

Hypothesis 4 : The intention to use is positively associated with actual use.

The intention to adopt practice is formed when adopters are aware of objectives and principles of the practice and requirements in adopting the practice. Adopters who are motivated to adopt the practice would more likely attach a symbolic meaning or value to the practice. By intimately knowing the practice and putting more of the self into the practice, individual users are more likely to reach a higher level of internalization [Pierce et al., 2001; Kostova, 1999]. Tari et al. [2013] also indicated that more motives, internal or external, will lead to a higher degree of internalization. By the same token, we posit that the intention to use positively is associated with internalization.

Hypothesis 5 : The intention to use is positively associated with internalization.

Institutional theory is to identify *what* elements will influence an establishment of organizational structures, rule, and norm and *how* these elements are diffused and adapted over space and time. Within the framework, Kostova and Roth [2002] highlighted the internalization as well as actual implementation. Depending upon a combination of these two, there exist four different adoption patters: minimal, assent, cere-

monial, and active. Organizations with higher level of internalization could easily move on to "active" adoption, instead of remaining on 'ceremonial adoption' stage. In this respect, we posit that internalization is positively associated with actual use.

Hypothesis 6 : Internalization is positively associated with use.

4. Research Design

4.1 Instrumentation

Our instrument was constructed by analyzing and adapting scales from previous studies and constructing new scales when necessary. Perceived ease of use and perceived usefulness were from Riemenschneider et al. [2002] and adapted for secure development methodology. Intention to use was also from Riemenschneider et al. [2002] and adapted for secure development methodology. For internalization, we defined as three components : organization's emphasis, organization's training, and social norm. Organization's emphasis on secure development is from Chan et al. [2005] and with one item being eliminated because of duplication problem. Organization's training is from Roberts et al. [1998]. Social norm is from Riemenschneider et al. [2002]. Use was measured in 3 items, just like DeLone and McLean [2004]. <Appendix Table 1> shows these measurement items.

4.2 Data Collection

In order to test the above hypotheses, a field survey of software developers working in IT firms was conducted. The questionnaire was sent by email to a manager-level personnel in each company, with a suggestion that the questionnaire be delivered to software developers who are assigned to projects requiring the application of secure software development.

Please be noted that the government of Korea lately has required each government agency to use a secure coding development methodology for enhanced security of systems when developing a new system. Because the strict application of secure coding methodology may lower software development productivity and delay development period [Whittaker, 2003; Taylor and Kaza, 2011], many software developers might avoid using it or adopt it only *ceremonially*.

Out of 210 forms handed out, 181 responses were collected yielding a response rate of 86%. With five incompletely answered questionnaires excluded, this study used 176 samples for the analysis.

As shown in <Table 1>, most of survey respondents (90%) had a job directly related to system development. 87% of survey respondents had software development experience of more than 1 year. Through the demographic analysis, we identified that survey respondents were diversely distributed.

〈Table 1〉 Summary of Demographic Information of Respondents

Job title	Person(%)	Experience	Person(%)
Programmers	90(51%)	Less than 1 Yr	22(13%)
SA & SD	28(16%)	Yr. 1~4 Yrs.	31(18%)
Tester/QA	9(5%)	4~7 Yrs.	36(20%)
PM	30(17%)	7~10 Yrs.	29(16%)
Misc	18(10%)	> = 10 Yrs.	58(33%)

5. Data Analysis and Results

5.1 Reliability and validity

For validity analysis, a confirmatory factor analysis was used. We used AMOS 18.0 to analyze the validity.

As shown in <Table 2>, though a few indices such as X^2 and RMR did not meet the criteria, CMIN/DF was very close to the criteria and the rest of them met the criteria. We argued that the survey data was considered as reliable and valid.

For reliability analysis, we estimated Cronbach's alpha. All of them were above 0.779, given that the criteria is above 0.6.

〈Table 2〉 Reported Values of Model Fit

Model Fit Index	Recommended Value	Reported Value	Proper
X^2	P ≥ 0.05	0.000	No
CMIN/DF	≤ 2.00	2.262	No
RMR	≤ 0.05	0.102	No
GFI	≥ 0.80	0.873	Yes
AGFI	≥ 0.80	0.816	Yes
CFI	≥ 0.90	0.926	Yes
NFI	≥ 0.90	0.977	Yes
IFI	≥ 0.90	0.927	Yes

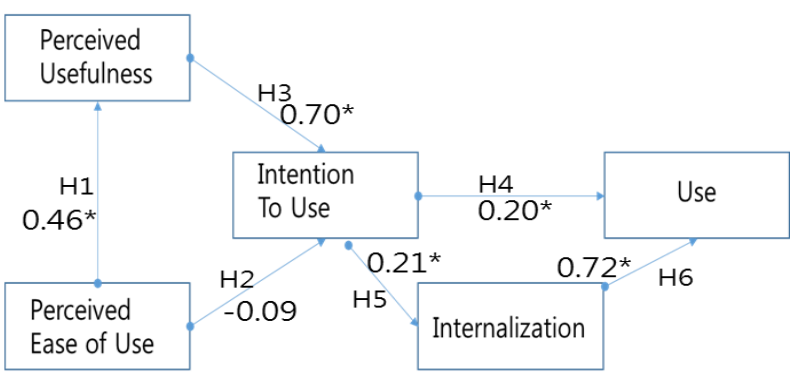
5.2 Analysis Results

We used path analysis to test the hypotheses. The result is shown in <Figure 2>.

Though perceived usefulness shows to be significantly associated with the intention to use, perceived ease of use is insignificantly associated with the intention to use. We can interpret this result in regard to the voluntariness of the practice. In this research setting, secure software development methodologies were compulsorily introduced due to a government-directed mandate. So this result appeared quite natural. And, the analysis result shows that the intention to use is positively associated with use, as expected.

We used Sobel test to test the mediating effect of internalization on use. The Sobel test is for evaluating the mediating effect between two variables and gives Z score as an estimate.

Generally speaking, when Z score in Sobel test is greater than 1.96 or less than -1.96, the mediating effect is determined as statistically significant. From the <Table 3>, this study indicates that the internalization has a positive mediating effect on the relationship between in-



〈Figure 2〉 Results of Hypotheses Testing

〈Table 3〉 Results of Mediating Effect Testing

path	Unst. Coef.	S.E.	Sobel Z Score	result
Intention → internalization	0.21	0.068	2.8101(***)	Accept
Internalization → Use	0.725	0.107		

tention to use and actual use. Please note that the effect of internalization on use is much stronger than the effect of the intention to use on actual use. However, as there is also a positive association between the intention to use and use, the mediating effect of internalization is only partial.

6. Implications of Results

Results of this study show the adequacy of TAM. Perceived ease of use and perceived usefulness can be used as key determinants for methodology adoption. However, when the innovation is driven by organization, not by individual's free will, perceived ease of use may not be an important determinant for the intention to adopt innovation. This finding confirms the results of some previous studies that determined that ease of use had no direct effect on the intention to adopt technology [Igbaria and Iivari, 1995; Igbaria et al., 1995].

Internalization was found to be an important mediating effect. Since the effect of internalization appears much higher than the intention to use, we can assert that organizations would better highlight the internalization in innovation effort. Continuous awareness-raising and training by organization should be taken in order to increase the level of internalization. Social norm is also found to be a significant factor for internalization. This result supports Bagozzi [2007]'s claim that the causal relationship between individual's attitude and behavior which is presumed in TAM is not simple. Individuals may interpret social or organizational pressures on their own and then arrive at their behavior or action.

Theoretically speaking, this study seems to have presented a new avenue to elaboration of TAM by including *internalization* as a *mediating* construct and *actual use* as an *outcome* construct [Lee et al., 2003]. Through these modifications, the TAM may somewhat get free from a lot of criticism about the direct linkage of intention to actual use.

7. Summary and Future Directions

This study has investigated the mediating effect of internalization on innovation adoption. The empirical analysis was made on software developers who came to use secure software development methodology. The results of analysis showed a partial but strong mediating effect of internalization on actual use.

However, our study has a major limitation in our research design. We attempted to measure the intention to use and internalization at the same moment. Strictly speaking, subjects were asked to recollect the past state at the moment of measuring the intention to use. For this study objective, a longitudinal study should have been taken. However, as the moment the compulsory use of secure software development methodology was mandated by the government was not long ago, software developers have received related seminar or training programs until a recent

date. So we thought it would not be a big problem with that research design.

For further studies, one may evaluate the hypothesized model using a longitudinal approach. Also, the inclusion of more social or human change factors [Bagozzi, 2007], rather than internalization only, in research model would be made. Future studies reflecting these remedies will allow us to understand more thoroughly about innovation adoption.

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〈Appendix Table 1〉 Constructs and Measurement Items

Constructs	Measurement
Perceived Usefulness	1. Using secure development methodology (SDM) makes it easier to do my job. 2. Using SDM enhances the quality of my work. 3. The advantages of using SDM outweigh the disadvantages 4. SDM is useful in my job.
Perceived Ease of Use	1. Learning SDM was easy for me. 2. Using ADM does not require a lot of mental effort. 3. Using SDM does not take too much time from my normal duties. 4. SDM is not cumbersome to use.
Intention to Use	1. Given the opportunity, I would use SDM. 2. I intend to use SDM in the future for my work.
Internalization	• Organization's continuous emphasis 1. My organization discusses secure software development with me and my coworkers. 2. My organization praises me when I adopt secure development methodology. 3. My organization considers the use of secure development methodology as a key factor in assessing my overall performance. • Organization's continuous training 4. Training on SDM is provided. 5. Training on the use of tools supporting SDM is provided. 6. Training on the application of SDM in my work is provided. • Social norm 7. People who influence my behavior think I should use SDM. 8. People who are important to me think I should use SDM. 9. Coworkers think I should use SDM.
Use	1. I frequently apply SDM in my work. 2. I put a considerable amount of my time in applying SDM for my work. 3. It is quite natural for use

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