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THE ROLES OF INDIVIDUAL DIFFERENCES AND INNOVATION PROPERTIES IN MULTIPLE FORMS OF INNOVATION IMPLEMENTATION

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We departed from research strategies suggested in prior studies in which binary outcomes of implementation, such as use or acceptance and nonuse or resistance, have been used, and we proposed the examination of diverse patterns of implementation behavior, including mechanical implementation, learning, reinvention, and mutual adaptation. These implementation patterns can be explained by innovation-related individual differences, innovation properties, and their interactions. We collected longitudinal data from 141 employees of a large steel company in Korea. Results showed that when employees participated in innovation-related training and when the innovation was compatible with the company's existing values and practices, the employees implemented the innovation as designed. In contrast, when employees had sufficient experience with the innovation and perceived it as flexible and adaptable to the local needs, they reinvented the innovation by customizing it to the local context. Employees' innovation competence was positively related to high-fidelity implementation only when compatibility of the innovation was high and flexibility of the innovation was low.

Keywords: innovation, individual differences, compatibility, flexibility, innovation implementation, mechanical innovation implementation.

Innovation in business is imperative in a rapidly changing environment and amid fierce market competition; hence, the effective adoption and diffusion

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of innovation has become a critical concern among managers of firms and researchers (Choi & Chang, 2009; Klein & Knight, 2005). Despite potential benefits expected from innovations, over 50% of attempts to implement innovations have been estimated to end in failure (Baer & Frese, 2003). Scholars have explained this phenomenon not as innovation failure, but as *implementation failure*, or "the failure to gain targeted individual employees' skilled, consistent, and committed use of the innovation" (Klein & Knight, 2005, p. 243). Thus, an understanding of how innovations are actually implemented after they are adopted is deemed necessary. In the present study we identified various forms of innovation implementation and their predictors.

In adaptive structuration theory it is pointed out that the original design of the adopted innovation is often modified, both intentionally and unintentionally (Fedorowicz & Gogan, 2010; Jones & Karsten, 2008). In addition, the implementation process involves inevitable interaction between an innovation and its users (Choi, 2006; Yi, Fiedler, & Park, 2006). Unfortunately, in existing studies researchers have mostly focused on a narrow set of binary outcomes: use or nonuse, and endorsement or avoidance (Klein, Conn, & Sorra, 2001). In this respect, previous researchers have overlooked the possibility of various forms of behavioral patterns that may emerge during the implementation process carried out by heterogeneous individual users. Drawing on Nicholson's (1984) model of role adaptation, we identified four types of implementation behavior that may emerge to reflect distinct ways through which each individual user interacts with the innovation. These four behaviors are mechanical implementation, learning, reinvention, and mutual adaptation, and we reasoned that examining the formative processes of these distinct implementation patterns should enrich understanding of innovation processes driven by individual attitudinal and behavioral reactions.

Expanding on findings in previous studies of innovation in which researchers have attended to various individual factors, such as demographic variables (Kamhawi, 2008), personality-related variables (Oreg, 2003), and emotional variables (Beaudry & Pinsonneault, 2010), we focused on innovation-related individual differences such as innovation training participation, prior experience, and innovation competence of individuals to explain their implementation behavior. With respect to innovation properties, we proposed that the compatibility of the innovation to the current implementation setting and its flexibility to the local context would drive distinct implementation behaviors (Fedorowicz & Gogan, 2010; Venkatesh, Morris, Davis, & Davis, 2003). Considering the inevitable interaction between an innovation and its users (Choi, 2006), we also investigated the interactive effects between individual differences and innovation properties that account for the emergence of different implementation patterns.

Literature Review

Multiple Forms of Innovation Implementation Behavior

Innovation refers to an idea, practice, or object that is perceived as new by an individual or other units of adoption (Rogers, 2003, p. 12). Focusing on the critical role of implementation as a bridge between adoption and routinization of an innovation, scholars have mostly investigated implementation outcomes on a single continuum between resistance and acceptance (Damanpour & Schneider, 2006; Klein et al., 2001). However, researchers using this approach have overlooked the rich possibilities of implementation based on the interaction between an innovation and its users, during which the innovation and the users mutually influence and transform each other. Attending to these dynamic exchanges, in this study we suggested multiple forms of implementation behavior that may emerge during the encounter between the person and the innovation. Theoretically, we drew on Nicholson's (1984) model of work transitions, proposing four modes of role adaptation (replication, determination, absorption, and exploration) and took into account both role change and person change. Similarly, we proposed four dimensions of implementation behavior: (a) mechanical implementation, (b) learning, (c) reinvention, and (d) mutual adaptation.

Mechanical implementation refers to a precise and reliable replication of the original design of the innovation according to the manual, without changes in either the innovation or the user. This pattern is compatible with the traditional image of implementation as an exact copy or imitation of previous users of a well-designed innovation (Dusenbury, Brannigan, Falco, & Hansen, 2003). *Learning* involves users' adaptation to the innovation by changing their beliefs, attitudes, and task behavior in accordance with the demands of the innovation (Beaudry & Pinsonneault, 2005, 2010). These changes in employee psychology and actions are the typical outcomes intended by the organization introducing the innovations. *Reinvention* refers to changes or modifications of features or components of the innovation by users in the implementation process (Castro, Barrera, & Martinez, 2004; Nevo & Nevo, 2012). Although reinvention has long been rejected as distortion or noise, it occurs naturally during implementation through local adjustments and users' motivated engagement with innovation (O'Mahoney, 2007). *Mutual adaptation* involves changes in both innovation and individual users in the course of implementation (Castro et al., 2004; Choi, 2006). Given that the idea of innovation being entirely reinvented and losing its original identity is not realistic, nor is the idea of individual users completely transforming themselves through learning, a more realistic implementation behavior may be a compromise between the innovation and users.

Based on the distinction of the four potential types of innovation implementation, in this study we have further explored antecedents of those distinct implementation patterns. To this end, we have attended to the characteristics of the two interacting entities: that is, innovation and users. We isolated innovation-relevant individual differences that affect implementation by shaping users' beliefs about values and usefulness of the target innovation. Specifically, we proposed that the amount of training, competence levels, and experience of using the innovation constitute innovation-relevant individual differences, because these differences should determine the extent to which the user needs to engage in learning and the extent to which the user is willing to and/or able to reinvent the innovation. We also attended to the properties of innovation that may channel implementation to a particular direction. Drawing on Rogers' (2003) typology of innovation properties, we identified compatibility and flexibility as two primary innovation properties that explain the emergence of the four forms of implementation behavior.

Individual Differences Predicting Implementation Patterns

Participation in training. Training for innovation has been emphasized as a primary tool for successful implementation (Dusenbury et al., 2003; Klein & Knight, 2005; Sung & Choi, 2014). Agarwal and Prasad (1999) stated that participation in training has significant effects on users' beliefs about usefulness, and, thus, their positive attitude toward an innovation. Training conveys a clear message that the innovation is an important and legitimate agenda within the organization (Choi, Sung, Lee, & Cho, 2011; Clayton, 1997); hence, users are likely to be motivated to adopt the course of action prescribed by the innovation as they are, thus adhering to the original form of the innovation (i.e., mechanical implementation). In addition, training clarifies the behavioral demand and reduces uncertainty related to implementation by: (a) providing specific information, knowledge, and skills required for innovation, (b) directly demonstrating or modeling the behavior needed to implement the target innovation, and (c) offering a supportive emotional atmosphere for implementation (Dufrene, Noell, Gilbertson, & Duhon, 2005; Klein et al., 2001). For this reason, participation in training enables users to realign their attitudes and competencies in accordance with the innovation. This process facilitates learning by assimilating new innovation-related values and task behaviors into their existing repertoire of values and behaviors.

Hypothesis 1: Participation in training for an innovation will be positively related to mechanical implementation and learning.

Innovation competence. Implementation of an innovation requires an adequate level of cognitive resources such as innovation-relevant knowledge, skills, and abilities of users (Clayton, 1997). Choi and Price (2005) found that a user's innovation skills and knowledge significantly increase both the frequency and effectiveness of how an innovation is used. When users are already equipped with adequate levels of the competences needed for implementation, they may engage in either mechanical implementation or reinvention. With sufficient competence, individuals can incorporate the innovation into their job easily and achieve a faithful replication of the original design as mandated by the innovation (Jones & Karsten, 2008). In addition, as adaptive structuration theorists have suggested, users with innovation-relevant expertise are skilled at generating alternative ways to use the innovation and, consequently, modifying the innovation to better fulfill their task-specific needs, thus customizing it for the local context.

Hypothesis 2: Innovation competence will be positively related to mechanical implementation and reinvention.

Prior experience. Researchers have asserted that understanding users' implementation behavior involves taking into consideration their past history with the innovation, because prior experience reflects the extent to which users have worked with the target innovation in their task settings (Dusenbury et al., 2003; Kim, 2012). Such experience enables users to assess the merits and drawbacks of the target innovation as it relates to their own work, and provides opportunities to develop the know-how necessary for utilizing it in their task settings. Prior experience also allows for the development of efficacy expectations regarding the innovation, which over time can be violated with increasing exposure to the innovation, thus leading to misfit or an imperfect fit between the user and the innovation (Castro et al., 2004). Under such circumstances, users become motivated to remedy the unsatisfactory situation by using the innovation in different ways (Nevo & Nevo, 2012). In addition, users can selectively employ various features of the innovation and develop their own idiosyncratic ways of implementation to customize it to their task-specific needs (Agarwal & Prasad, 1999). For this reason, users who have had prior experience with the innovation are less likely to simply accept and follow the prescribed innovation procedures. Instead of mechanically implementing a given innovation, users with prior experience may explore new ways of implementing the innovation, by modifying its features and components to fill the gap between their changing expectations and the given form of the innovation.

Hypothesis 3a: Prior experience will be negatively related to mechanical innovation implementation.

Hypothesis 3b: Prior experience will be positively related to reinvention of an innovation.

Innovation Properties Predicting Implementation Patterns

Compatibility. *Compatibility* refers to "the degree to which an innovation is perceived as being consistent with the existing values, past experience, and needs of the potential adopter" (Rogers, 2003, p. 240). Compatibility with existing values and practices promotes user acceptance and use of the innovation (Lee & Kim, 2007). When a given innovation is compatible with existing norms, skill sets, and organizational practices, employees may not feel the need for any changes in the innovation itself or themselves (Sung, Choi, & Cho, 2011). In such situations, users are apt to conform to the course of action prescribed by the innovation and maintain strict adherence and fidelity to the original design (Dusenbury et al., 2003). For this reason, a highly compatible innovation may promote mechanical implementation, although the fact of its high compatibility may decrease the likelihood of reinvention, learning, and mutual adaptation occurring – the other three forms of implementation that invite changes in either the innovation, the users, or both.

Hypothesis 4a: Compatibility will be positively related to mechanical innovation implementation.

Hypothesis 4b: Compatibility will be negatively related to learning, reinvention, and mutual adaptation of an innovation.

Flexibility. *Flexibility* refers to the extent to which an innovation can be modified from its original design and, thus, used in a different manner (Fedorowicz & Gogan, 2010). Flexibility enables users to partially adopt and use some components of an innovation without using the full original design, and to modify the innovation to fit it to their specific task context (Rogers, 2003). When a given innovation provides users with the option to employ specific elements selectively, and to customize the way the innovation is applied in their work, users are likely to be motivated to try different combinations and alternative means of effectively utilizing it according to their own task needs (Nevo & Nevo, 2012). Consequently, when working with a high level of flexibility to implement an innovation, individuals are likely to reinvent the innovation by modifying or customizing it to better achieve their task goals and to fit the innovation to the local implementation context (Choi, 2006).

Hypothesis 5a: Flexibility will be negatively related to mechanical innovation implementation.

Hypothesis 5b: Flexibility will be positively related to reinvention of an innovation.

Interaction Between Individual Differences and Innovation Properties

Thus far, we have advanced theoretical propositions that link innovation-related individual differences and innovation properties to various forms of implementation behavior. For example, in Hypothesis 2, we have proposed that innovation competence will be positively related to both mechanical implementation and reinvention, because users with sufficient competence are capable of implementing the innovation as required but, at the same time, they are capable of customizing it to their needs at will based on their thorough understanding of the innovation. This somewhat contradictory prediction calls for the contingency or boundary condition that channels the effect of innovation competence to a particular direction. Properties of the innovation can play such a role and moderate the relationship between innovation-related individual differences and implementation patterns. Thus, we further proposed that individual users and the target innovation would inevitably interact to result in distinct implementation patterns (Choi, 2006; Yi et al., 2006).

When the target innovation is highly compatible with users' existing needs, practices, and skill sets, users are urged to faithfully replicate the original design of the innovation because the innovation is already designed to offer sufficient benefits without clashing with existing practices (Dusenbury et al., 2003; Lee & Kim, 2007). Thus, compatibility unleashes the potential of innovation-related individual differences (i.e., participation in training and innovation competence) that drive mechanical implementation by increasing user motivation to follow the mandates of the innovation. In addition, where there is high compatibility of an innovation, users are willing to change their attitudes or behavior in line with the innovation if necessary, thus promoting the implementation of the innovation as it is designed (Beaudry & Pinsonneault, 2005; Castro et al., 2004). Therefore, we expected that compatibility would moderate the relationship between innovation-relevant individual differences and mechanical implementation and learning, such that the relationships would become stronger when compatibility was high compared to when it was low.

Hypothesis 6: Compatibility will strengthen the positive relationships between (a) participation in training and mechanical implementation, (b) participation in training and learning, and (c) innovation competence and mechanical innovation implementation.

On the other hand, when the target innovation is flexible, with features such as modularization, adaptability, and reconfigurability (Choi, 2006; Fedorowicz & Gogan, 2010; Rogers, 2003), the innovation offers opportunities for customization and experimentation with diverse possibilities by enabling users to adopt, reject, or modify various components of the innovation for different purposes and in diverse contexts. When this occurs it is likely to unleash the potential of individual differences directed toward reinvention. Thus, we expected that flexibility would moderate the relationship between innovation-related individual differences and reinvention, such that the relationship would become more pronounced when flexibility was high in comparison to when it was low.

Hypothesis 7: Flexibility will strengthen the positive relationships between (a) innovation competence and reinvention and (b) prior experience and reinvention in the process of adopting an innovation.

Method

Research Setting and Target Innovation

To test the current hypotheses empirically, we conducted a field study in a large Korean steel company. Over the course of several meetings with 34 organizational staff members, comprising senior managers and employees, we identified a target innovation for this study, which was a key management agenda within the company at the time of data collection. To promote continuous improvement activities, the company initiated an innovation called "Quick Six Sigma (QSS)," a revised version of Six Sigma based on the Toyota Productivity System. The company subsequently expanded this practice to every department of the company and implemented QSS across all functions and work sites.

Participants

The target sample consisted of 220 employees who participated in QSS-focused operations and held responsibilities in implementing the innovation in their work units at the time of data collection. A manager in the human resource department of this company mailed the survey instrument to these 220 employees through the company mailing system. The data were collected at two different time points. At Time 1, over a period of two weeks, 181 employees participated in the survey (response rate = 82.27%) by responding to scales related to individual differences and innovation properties. At Time 2 (two months after the Time 1 survey), innovation implementation behavior was assessed by a follow-up survey. Of the 153 participants who participated in this follow-up survey (response rate = 69.55%), 141 participants provided usable data. All the participants were men. This is, perhaps, because the data were collected from the production-line employees of a steel company. Their mean age was 45 years (*SD* = 5.02), and their mean organizational tenure was 21 years (*SD* = 4.27).

Measures

We tested the current hypotheses empirically using time-lagged data, in which the predictors were assessed at Time 1 and the implementation outcomes were measured at Time 2. All constructs were assessed by multiitem measures using a 6-point Likert-type rating scale (1 = *strongly disagree*, 6 = *strongly agree*).

Innovation-relevant individual differences. We examined the effects of the following three innovation-relevant individual differences: (a) participation in training, (b) innovation competence, and (c) prior experience with the innovation (Agarwal & Prasad, 1999; Dufrene et al., 2005; Patterson et al., 2005). To assess participation in training, we created a dummy variable to indicate whether or not the person had participated in intensive QSS workshops (0 = *no*, 1 = *yes*). Innovation competence was assessed using a scale with four categories to indicate the level of certification regarding overall competence in QSS (1 = *none*; 2 = *green belt*; 3 = *black belt*; 4 = *master black belt*). Prior experience was measured by the number of times the person had participated in problem-solving projects using QSS.

Compatibility. Drawing on prior conceptualizations of compatibility (Rogers, 2003; Venkatesh et al., 2003), we constructed a scale to assess compatibility, which consisted of the following four items (α = .92): (a) "QSS is compatible with all aspects of my work;" (b) "QSS activities are well integrated with my daily operation;" (c) "QSS fits well with what I want to achieve in my work;" and (d) "QSS fits into my work style."

Flexibility. Based on items in previous studies (Clayton, 1997; Fedorowicz & Gogan, 2010), we composed the following four items (α = .83) to assess flexibility: (a) "I can flexibly apply QSS according to the task at hand;" (b) "I don't have to use the entire process of QSS;" (c) "I can modify QSS according to my task characteristics;" and (d) "QSS can be used differently according to task requirements and circumstances."

Mechanical implementation. Four items were developed to assess mechanical implementation. The scale contained the following items (α = .75): (a) "I straightforwardly follow the guidance of our company in using QSS;" (b) "I have never tried to change the way in which QSS is used;" (c) "I use QSS as I learned in the QSS training programs our company provided;" and (d) "I try to adhere to the original instruction of QSS."

Learning. A three-item scale was constructed to measure the extent of learning. The scale contained the following items (α = .83): (a) "Through QSS, I have developed a new way of thinking related to my work;" (b) "I have changed the content of my work according to QSS;" and (c) "I have changed my work procedures according to QSS."

Reinvention. To assess the level of reinvention, we constructed a three-item scale (α = .87): (a) "I put effort into changing and applying the QSS tools according to my task characteristics;" (b) "I always search for new ways to improve QSS in my work;" and (c) "According to differing circumstances, I flexibly apply QSS in conducting my tasks."

Mutual adaptation. To assess the level of mutual adaptation, the following three items α = .90) were used: (a) "Through using QSS, I not only experienced many changes in my way of working but also put much effort into creatively using QSS;" (b) "QSS activities led to positive changes in my job, but I also made my own QSS tools;" and (c) "Because of QSS, I experienced many changes in myself, but I also changed QSS while I used it."

Control variable. Considering the implications of demographic variables for user behavior regarding innovation implementation, in our analysis we controlled for the effect of years of organizational tenure (Agarwal & Prasad, 1999; Damanpour & Schneider, 2006).

Data Analysis

In this study, we conducted confirmatory factor analysis (CFA) to establish the discriminant validity of the measures. We then performed hierarchical regression analysis to test the theoretical propositions in our research framework empirically.

Results

Although innovation properties (compatibility and flexibility) and implementation behavior (mechanical implementation, learning, reinvention, and mutual adaptation) were measured at different time points, the data were drawn from the same source. To validate the empirical distinctiveness of the six scales, a CFA of the 21 items constituting the measures was conducted. The six-factor model exhibited a very good fit according to comparative fit index (CFI) and root mean square error of approximation (RMSEA) with the observed data (c^2 (df = 156) = 207.36, p = .004; CFI = .98; RMSEA= .048) and performed better than any alternative five-factor model (all $p < .001$ based on c^2 difference tests). The CFA results supported the empirical distinctiveness of the six latent factors. The descriptive statistics and correlations among all study variables are reported in Table 1.

Main Effects of Innovation-Related Individual Differences

As shown in Model 1-1 and Model 2-1 of Table 2, participation in training exerted positive effects on mechanical implementation and learning (β = .17, $p < .05$ and β = .24, $p < .01$, respectively), supporting Hypothesis 1. Participation in training was also significantly related to mutual adaptation (β = .23, $p < .05$) (see Model 4-1, Table 2). Innovation competence did not have a significant effect on either mechanical implementation or reinvention, so Hypothesis 2 was not supported. Our analysis demonstrated that prior experience was not a meaningful predictor of mechanical implementation; thus, Hypothesis 3a was not supported. However, prior experience exerted a positive effect on reinvention (β = .18, $p < .05$) supporting Hypothesis 3b (see Model 3-1, Table 2).

Main Effects of Innovation Properties

As reported in Model 1-2 (Table 2), compatibility was positively related to mechanical implementation (β = .29, $p < .01$), confirming Hypothesis 4a. However, compatibility was not significantly associated with any of the other dimensions of implementation behavior, so Hypothesis 4b was not supported. Results showed that flexibility was not significantly associated with mechanical

Table 1. *Means, Standard Deviations, and Correlations Among Study Variables*

Variables	*M*	*SD*	1	2	3	4	5	6	7	8	9	10
1. Organizational tenure	20.88	4.27	–									
2. Participation in training	0.92	0.27	-.21*	–								
3. Innovation competence	1.42	0.49	-.10	.24**	–							
4. Prior experience	1.23	1.10	-.09	.06	-.05	–						
5. Compatibility	4.67	0.75	.14	.04	-.04	.12	–					
6. Flexibility	4.91	0.67	.03	-.01	-.06	.04	.62**	–				
7. Mechanical implementation	4.29	0.78	.18*	.13	-.04	-.04	.29**	.16	—			
8. Learning	4.86	0.83	.20*	.19*	.01	.05	.24**	.24**	.46**	–		
9. Reinvention	4.59	0.80	.04	.07	.03	.17*	.15	.27**	.39**	.64**	–	
10. Mutual adaptation	4.79	0.84	.07	.23**	-.02	.10	.27**	.32**	.55**	.69**	.73**	–

Note. Unit of analysis is individual. $N = 141$. * $p < .05$, ** $p < .01$.

Table 2. *Results of Hierarchical Regression Analyses Predicting Implementation Behavior*

	Mechanical implementation			Learning			Reinvention			Mutual adaptation		
Model:	1-1	1-2	1-3	2-1	2-2	2-3	3-1	3-2	3-3	4-1	4-2	4-3
Organizational tenure (OrgTenu)	.25**	.20*	.16	.26**	.24**	.23*	.09	.08	.09	.15	.12	.12
Participation in training (ParTrain)	.17*	.14	.17	.24**	.22**	.28**	.06	.05	.10	.23*	.21*	.25**
Innovation competence (InnComp)	-.09	-.08	-.06	-.03	-.01	-.01	.02	.04	.04	-.03	-.01	-.01
Prior experience (PriorExp)	-.04	-.07	-.05	.04	.04	.06	.18*	.19*	.21*	.10	.10	.11
Compatibility (Compa)		.29**	.19		.08	.01		-.06	-.11		.09	.06
Flexibility (Flexi)		-.04	.04		.18	.23*		.30**	.35**		.25*	.27**
ParTrain × Compa		.15			.24*				.19			.14
InnComp × Compa		.20*			.07				.10			.01
PriorExp × Compa		-.01			-.04				-.12			-.01
ParTrain × Flexi		-.21			-.22*				-.12			-.11
InnComp × Flexi		-.22*			-.09				.01			.01
PriorExp × Flexi		.05			-.06				.01			-.02
F	2.76*	3.68**	2.49**	3.85**	4.09**	2.64**	1.50	2.82*	1.82*	2.82*	4.7***	2.39**
R^2	.08	.14	.19	.10	.16	.20	.04	.11	.15	.08	.18	.19
ΔR^2		.06**	.05		.06*	.04		.07**	.04		.10**	.01

Note. $N = 141$. * $p < .05$, ** $p < .01$, *** $p < .001$.

implementation, so Hypothesis 4a was not supported. However, flexibility was significantly associated with reinvention ($\beta = .30$, $p < .01$) supporting Hypothesis 4b (see Model 3-2, Table 2). The results also demonstrated (see Model 4-2, Table 2) that flexibility was a meaningful predictor of mutual adaptation ($\beta = .25$, $p < .05$).

Moderating Effects of Innovation Properties

To reduce the multicollinearity among main effect variables and their interaction terms, the scores of innovation-related individual differences and innovation properties were mean centered (Aiken & West, 1991). To test the hypothesized effects, we entered the interaction terms after controlling for the main effects.

As reported in Model 1-3 (Table 2), the interaction between innovation competence and compatibility was significant for mechanical implementation ($\beta = .20$, $p < .05$), supporting Hypothesis 6c. To further probe this significant interaction, we conducted a simple slope analysis (Aiken & West, 1991). The two regression lines shown in Plot A of Figure 2 demonstrate that the level of innovation competence increased mechanical implementation when there was a high level of compatibility ($\beta = .45$, $p < .10$), whereas it significantly decreased mechanical implementation when compatibility was low ($\beta = -.72$, $p < .01$). Results also showed (see Model 2-3, Table 2) that the interaction between participation in training and compatibility was significant for learning ($\beta = .24$, $p < .05$). As shown in Plot B of Figure 2, participation in training significantly improved learning when compatibility was high ($p = .73$, $p < .01$), but not when it was low ($p = .01$, *ns*). This pattern confirms Hypothesis 6b. Overall, the results support Hypothesis 6 in that compatibility intensified the effects of innovation-related individual differences, and mechanical implementation or learning.

According to our data (see Model 1-3, Table 2) there were also significant interactions between innovation competence and flexibility for mechanical implementation ($p = -.22$, $p < .05$). Plot A of Figure 3 reveals that innovation competence significantly decreased mechanical implementation when there was a high level of flexibility ($p = -.51$, $p < .05$), but not when there was little flexibility ($\beta = .34$, *ns*). Moreover, (see Model 2-3, Table 2) the analysis revealed a significant interaction between participation in training and flexibility in predicting learning ($\beta = -.22$, $p < .05$). Plot B of Figure 3 demonstrates that participation in training significantly increased learning when flexibility was low ($\beta = 1.46$, $p < .001$), but not when it was high ($\beta = -.12$, *ns*). According to our results, interactions between innovation-related individual differences and flexibility for reinvention were not significant, so Hypothesis 7 was not supported.

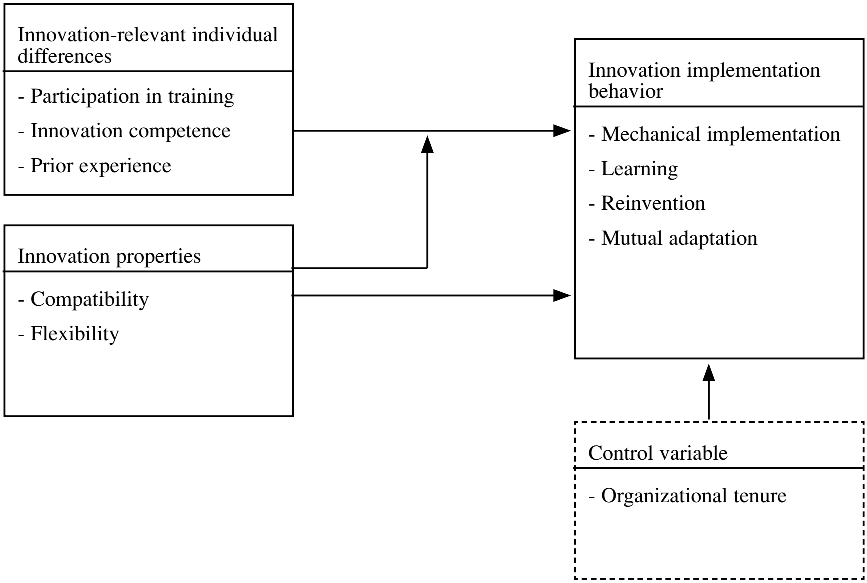

Figure 1. *Theoretical framework of multiple forms of innovation implementation behavior.*

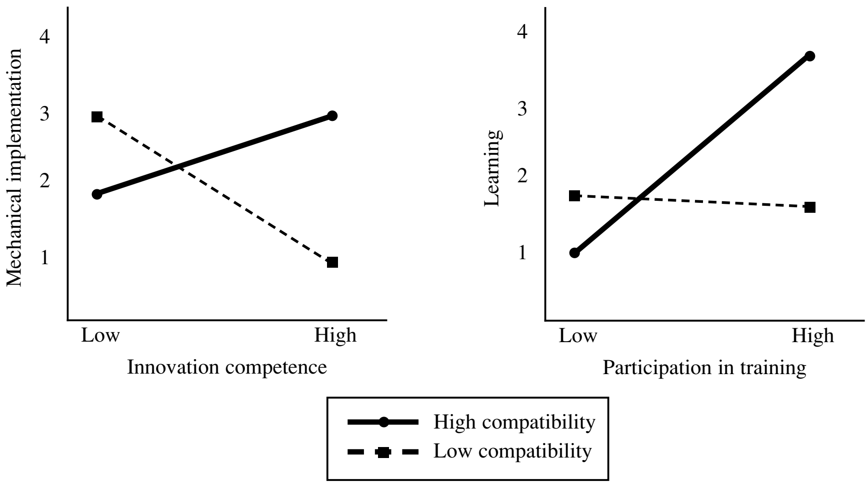

Figure 2. *Interaction between innovation-relevant individual differences and compatibility in predicting innovation implementation behavior.*

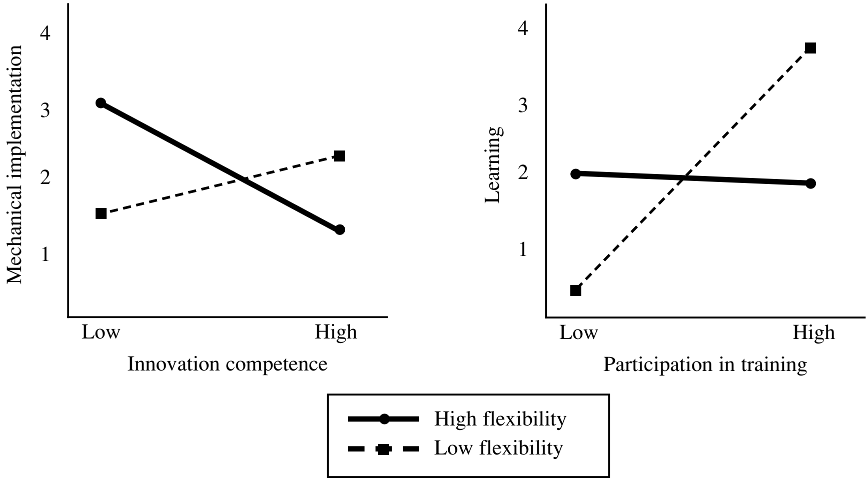

Figure 3. *Interaction between innovation-relevant individual differences and flexibility in predicting innovation implementation behavior.*

Discussion

The main premise in the present study was that individual users would show various behavioral reactions toward a given innovation that could not be captured by the binary outcomes of use and nonuse or acceptance of and resistance to the innovation. Attending to the extent of changes in the innovation and the individual, we identified four potential patterns of implementation along with their predictors and moderating contingencies.

Theoretical Implications

Our analysis indicates that employees' participation in innovation-related training was positively related to mechanical implementation. By providing specific directions related to the innovation, training may enable users to follow the original forms of the innovation easily (Choi et al., 2011). According to our data compatibility was also a significant predictor of mechanical implementation. When the innovation endorses a set of values and practices that are similar to those already held by users, they tend to be more committed to, and willingly use, the innovation without much resistance (Lee & Kim, 2007). These patterns suggest that personal resources supplied to individuals through training and compatibility of the innovation enhance employee conformity to the original design of the innovation.

Similarly, learning was also predicted by participation in training. Training provides meaning to, and understanding of, the innovation, which promotes users' innovation-related knowledge and generates psychological comfort and buy-in of the innovation among employees (Klein et al., 2001). By showing the organization's commitment to the innovation, and specifying the goal and the desired courses of action, provision of training may boost the legitimacy of the innovation and encourage employee assimilation of it (Gómez et al., 2004).

On the other hand, reinvention was significantly related to prior experience with the innovation. Based on innovation-specific know-how and skills that have been accumulated through practice, users with prior experience are likely to modify and customize the innovation to make it a better fit for their specific task. In addition, reinvention was positively related to the level of flexibility of the innovation, because flexibility enables individual users to utilize subcomponents of the innovation selectively, and to adjust it to suit their own needs (Fedorowicz & Gogan, 2010; Rogers, 2003). Flexibility also predicted mutual adaptation between the person and the innovation. During the course of reinvention that promotes user ownership and commitment to the innovation through the individual's personal and empowered involvement in the implementation process (Nord & Tucker, 1987; Wrzesniewski & Dutton, 2001), each individual user may feel responsibility for successful implementation. In this case, users may change their own values and work behaviors in accordance with the demands of a given innovation. These factors taken together mean that flexibility may reinforce not only changes in the innovation itself, but also changes in the way of thinking of the individual user and also the way that user performs the task or tasks related to the innovation.

In exploring further the interactive dynamics involving person and innovation during implementation, we theorized and, through our empirical research, identified interaction patterns that we found intriguing. Individuals' innovation competence was positively related to mechanical implementation when compatibility was high and flexibility was low. In contrast, the same competence was negatively related to mechanical implementation when compatibility was low and flexibility was high. As Rogers (2003) argued, when the innovation is compatible, this is apt to reduce the need for any adaptation of the innovation, a situation that channels the potential for innovation competence toward the replication of the original design of the innovation. Likewise, flexibility in an innovation seems to direct competent individuals to shun mechanical implementation, because innovations that are flexible possess inherent adaptability and reconfigurability that allow highly competent users to experiment with different possibilities (Nevo & Nevo, 2012).

We observed similar moderating roles of innovation properties in the relationship between participation in training and learning. The positive effect of training participation on learning occurred under the conditions of high compatibility and low flexibility of the innovation. Thus, unless employees perceive that an innovation is compatible with existing values and practices, they do not assimilate the innovation. In addition, participation in training was not effective in generating learning when the innovation was perceived as nonfixed, and, thus, capable of being adaptably applied to work in many different forms. Perhaps, when an innovation is highly flexible, users might believe that training offers only one of many possible ways to put that innovation into practice, which would diminish the informational value and behavioral guidance offered by a training session.

Study Limitations and Directions for Future Research

The present findings should be interpreted with caution owing to several limitations. First, the four types of implementation behavior were assessed by participants' self-reports. Although self-reported measures of innovation usage have previously been found to be highly correlated with actual usage (Taylor & Todd, 1995), this type of measure could still invite potential bias due to common method variance. Second, the context of our research, involving Korean employees, may have influenced the observed patterns because the patterns and processes of innovation implementation are contingent upon cultural contexts (Williams & McGuire, 2005). Finally, we conducted our study in an organization with a single target innovation, which could limit the range of variation in individual characteristics and innovation properties. Empirical validation using a large number of heterogeneous innovations implemented in various organizational settings may reveal further implementation dynamics that were not detected in the current study.

Despite these limitations, in the present study we have made meaningful contributions to the literature on innovation by highlighting the significance of individual attitudes about, and behaviors toward, innovation that lead to different patterns of implementation. By expanding the current conceptual framework and empirical findings, several directions can be taken in future research. First, for a comprehensive understanding of the emergence of various implementation patterns, future researchers need to consider the role of organizational contextual factors, such as managerial interventions and implementation climate, that have significant implications for implementation patterns (Klein et al., 2001). Second, employees' psychological reactions, such as motivation, attitudes, and affect related to innovation, could provide plausible mechanisms that account for the effects of user characteristics and innovation properties on implementation (Agarwal & Prasad, 1999; Kamhawi, 2008). Finally, general individual characteristics such as proactivity, learning-goal orientation, and locus of control can be meaningful predictors of diverse forms of implementation behavior. Future researchers could investigate the possibility that these personality-related traits may strengthen or weaken the effects of innovation-related user characteristics and innovation properties on various implementation behaviors.

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