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Innovation Implementation in the Public Sector: An Integration of Institutional and Collective Dynamics

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The present study integrates institutional factors and employee-based collective processes as predictors of 2 key implementation outcomes: implementation effectiveness and innovation effectiveness (Klein, Conn, & Sorra, 2001). Specifically, the authors proposed that institutional factors shape employees' collective implementation efficacy and innovation acceptance. The authors further hypothesized that these employee-based collective processes mediate the effects of institutional factors on implementation outcomes. This integrative framework was examined in the context of 47 agencies and ministries of the Korean Government that were implementing a process innovation called *E-Government.* Three-wave longitudinal data were collected from 60 external experts and 1,732 government employees. The results reveal the importance of management support for collective implementation efficacy, which affected employees' collective acceptance of the innovation. As hypothesized, these collective employee dynamics mediated the effects of institutional enablers on successful implementation as well as the amount of long-term benefit that accrued to the agencies and ministries.

Keywords: innovation implementation, innovation effectiveness, institutional context, collective implementation efficacy, public sector

Because of ever-increasing levels of competition and rapid changes in technology, innovation is regarded as a core challenge for many organizations (Greenhalgh, Robert, Bate, Macfarlane, & Kyriakidou, 2005). *Innovation* can be broadly defined as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (Rogers, 2003, p. 12). The innovation in organizations may progress through stages, such as awareness, adoption, implementation, and routinization (Rogers, 2003). Adoption refers to an organization's decision to use an innovation. Implementation, an intermediate process between adoption and routinization, refers to "the pooled or aggregate consistency and quality of targeted organizational members' use of an innovative technology or practice" (Klein et al., 2001, p. 812). Fichman and Kemerer's (1999) survival analysis showed that new information technologies remain unused for the first 5 years after adoption in more than half of adopting organizations, creating a substantial "assimilation gap," a common phenomenon in which the rate of implementation lags far behind the rate of adoption. Nevertheless, "without implementation, the most brilliant and potentially far-reaching innovation remains just that—potential" (Real & Poole, 2005, p. 63).

Existing studies of innovation implementation have focused on either employee-related processes or organizational/institutional processes. The former type of study has typically been conducted at the individual level and has examined employees' affective and behavioral responses to an innovation, such as psychological commitment to the innovation, intention to use it, and actual innovation use behavior (Choi & Price, 2005; Hartwick & Barki, 1994). In contrast, the latter group of studies have conceptualized implementation as an organization-level phenomenon that may be driven by institutional structure, resources, and practices and systems of the implementation unit (Chatterjee, Grewal, & Sambamurthy, 2002; Purvis, Sambamurthy, & Zmud, 2001). Without doubt, these two approaches are complementary. For example, institutional factors may affect the organization's implementation success by influencing its members' attitudes and behavior (Greenhalgh et al., 2005; Scott, 1995).

In the present study, by integrating these two processes, we developed a theoretical framework to explain how collective processes involving employees and institutional factors together influence various implementation outcomes. Specifically, drawing on Klein et al. (2001), our model includes two implementation outcomes for social units engaging in innovation implementation: (a) *implementation effectiveness,* or the overall level of assimilation of an innovation into the unit's work processes, and (b) *innovation effectiveness*, which refers to the extent to which the unit accrues benefits from the innovation.

We empirically validated our framework using multimethod, longitudinal data collected from 47 agencies of the Korean government. Given that most prior studies of innovation implementation have been conducted in the context of business organizations in Western countries, the present research provided a unique opportunity to investigate the phenomenon in a new and culturally

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different setting. The importance of innovation in the public sector has been recognized in both the European (new public management; NPM) and the American (reinventing government) context (Moon & deLeon, 2001). The Korean government, facing the same challenges, has initiated a government-wide innovation effort to reorganize task processes and change work practices through the use of information technology (E-Government). The target innovation of this study thus represents a *process innovation,* which refers to "deliberate and new organizational attempts to change production and service processes" (Baer & Frese, 2003, p. 45).

The empirical goal of this study, therefore, was to understand how institutional factors and employee-based collective processes predict outcomes of implementing the process innovation at the agency level.[1] We focused on this collective unit of implementation because successful implementation of a process innovation, such as E-Government, requires collective and coordinated action. This is because the extent to which an employee can use and benefit from electronic work practices and online services largely depends on the *concurrent* actions of interdependent others (Holahan, Aronson, Jurkat, & Schoorman, 2004). In this context, the *collective* processes that represent shared and aggregated patterns of beliefs and behavior of employees would appear to be the most promising area of focus (Klein & Knight, 2005). By adhering to the *agency level* throughout the model, we maintain consistency in level of conceptualization, measurement, and inferences from empirical analysis (Kozlowski & Klein, 2000).

Conceptual Framework

Figure 1 summarizes the conceptual framework of the present study. Drawing on institutional theory (Scott, 1995) and the implementation literature (Klein et al., 2001), we propose that institutional factors shape agency employees' innovation-related collective beliefs and attitudes, which, in turn, mediate the effects of the institutional factors on implementation outcomes of the agency. Below we develop hypotheses for each link depicted in Figure 1.

Context for Innovation Implementation: Institutional Enablers

Institutional theory offers a convincing explanation of the ways in which institutional structure influences members' cognition and behavior (Scott, 1995). Specifically, institutional factors shape individuals' beliefs and actions by (a) providing meaning to and understanding of the situation, (b) offering normative templates to validate a specific behavior, and (c) regulating individual actions by means of sanctions. Previous studies have identified various *institutional enablers* that promote the process of innovation implementation in organizations (e.g., Chatterjee et al., 2002; Orlikowski, Yates, Okamura, & Fujimoto, 1995). A systematic review of the implementation literature (Greenhalgh et al., 2005) isolated various institutional enablers, such as structure (e.g., complexity, decentralization), leadership, resources, supportive climate (e.g., risk taking, incentives), and knowledge utilization practices (e.g., learning, knowledge sharing). In this study, we attend to three institutional enablers associated with the agency: management support, resource availability, and support for learning. Although these three enablers are far from exhaustive, they address critical factors for effective implementation in collective entities (Clayton, 1997; Fichman & Kemerer, 1999; Klein et al., 2001).

Scholars have agreed that institutional elites, such as senior managers, are a primary source of institutional structure because they can effectively manipulate the institutional environment (Kozlowski & Hults, 1987; Purvis et al., 2001; Russel & Hoag, 2004; Scott, 1995). Chatterjee et al. (2002) identified top management championship and clear strategic investment rationale as significant institutional enablers of innovation assimilation. When management supports an innovation and provides a clear, strategic vision for it, implementation success is more likely because this institutional context communicates a clear message to employees that implementation of the innovation is important, normatively expected, and even rewarded, thus creating a strong climate for implementation (Klein et al., 2001).

In addition to management support, Klein et al. (2001) found that adequate financial resources are critical for successful implementation because implementation efforts involve substantial costs (e.g., new equipment and software, training). Although prior studies have emphasized financial resources (Kumar, Maheshwari, & Kumar, 2002), Clayton (1997) maintained that successful innovation implementation requires four types of resources: material resources (physical and financial means), personnel resources (manpower), conceptual resources (knowledge and skills), and time resources (for transition and experimentation). Drawing on Clayton, we expand the notion of resources beyond the financial domain to include personnel and social resources (e.g., providing support for innovation champions, establishing social networks for innovation use). An adequate allocation of these resources may develop a desirable institutional environment that eases the challenge of innovation use for agency employees (Greenhalgh et al., 2005; Klein & Sorra, 1996).

The last institutional enabler in our model is support for learning, which refers to the extent to which an agency encourages and provides a supportive environment for learning-related activities. Fichman and Kemerer (1999) pointed out that one primary reason for delayed assimilation of an innovation is a lack of learning that results in knowledge barriers. Clayton (1997) also identified knowledge and skills as a critical resource for successful implementation, thus endorsing the need for collective learning (Edmondson, 1999; Greenhalgh et al., 2005). Support for learning may move innovation implementation forward by making available the knowledge and skills needed for implementation and by offering a context in which "employees eagerly engage in experimentation and risk taking" (Klein & Knight, 2005, p. 245), thus indirectly providing time resources for innovation users (Clayton, 1997). Support for learning also encourages employees to redefine

[1] The current sample of government agencies (e.g., Ministry of Education, Ministry of Defense, Food and Drug Administration, National Police Agency) together comprise the larger national government system. Like agencies of the U.S. federal government, these agencies represent a variety of public organizations that have distinct goals and missions. As highly autonomous operating units, they have their own functions, distinct personnel and expertise, resources, task environments, cultures, rules of practice, and leadership that differ from each other in many ways. Studies of public administration have demonstrated that such public agencies are highly independent from one another and constitute clearly distinct collective entities (e.g., Chun & Rainey, 2005; Meier, 1980).

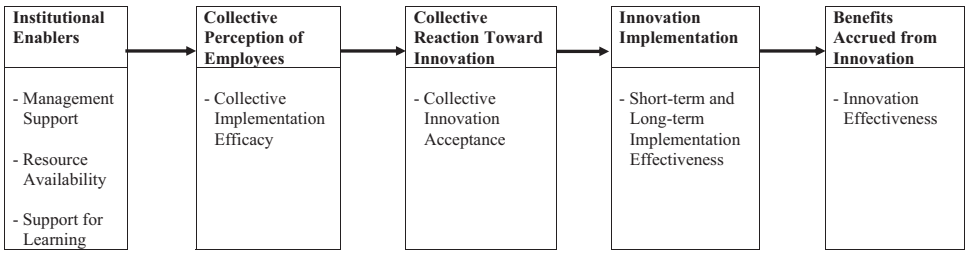

Figure 1. Theoretical framework predicting implementation outcomes.

work-related practices, resulting in the generation and sharing of new ideas and enabling the improvisation necessary for effective implementation (Orlikowski et al., 1995; Purvis et al., 2001).

Contextual Perception of Employees: Collective Implementation Efficacy

Drawing on institutional theory (Scott, 1995), we propose that institutional enablers indirectly influence implementation outcomes by shaping agency employees' beliefs and reactions with regard to the innovation. Existing studies have often presumed this mediating role of collective processes involving employees (Chatterjee et al., 2002; Purvis et al., 2001), although it has yet to be tested. With regard to contextual perceptions related to implementation, scholars have focused on implementation climate or employees' shared perceptions regarding the implementing unit's support for the innovation (Holahan et al., 2004; Klein et al., 2001). In this study, we introduce a new construct—collective implementation efficacy, which refers to agency employees' collective perception of the extent to which agency members as a group are capable of implementing the innovation (adapted from Bandura, 1997, p. 477). Existing studies on collective efficacy have largely focused on its outcomes (Chen & Bliese, 2002; Gully, Incalcaterra, Joshi, & Beaubien, 2002), particularly at the team level, such as team performance, and have thus failed to specify antecedents of collective efficacy (Tasa, Taggar, & Seijts, 2007). The current study addresses this gap and proposes that collective efficacy of a larger collective unit, such as government agencies, can be shaped by its institutional factors.

Although efficacy belief is in part dependent on actual competence, it is also a situation-specific judgment based on the resources, opportunities, and constraints present in a given setting (Choi, Price, & Vinokur, 2003; Gist & Mitchell, 1992). Klein et al. (2001) also speculated that "implementation policies and practices influence innovation use by shaping employees' skill and comfort in innovation use" (p. 822). We therefore propose that collective efficacy for implementation is shaped by institutional factors that equip agency members with the resources and opportunities needed for successful innovation use (cf. means efficacy of individual performers; Eden, 2001). First, when an agency director or minister of a department supports an innovation, agency employees are more likely to believe that they have the authority to use it, which increases their collective confidence in implementing it (Kozlowski & Hults, 1987; Walumbwa, Wang, Lawler, & Shi, 2004). Because of their salience and high visibility, senior managers' behavior related to the innovation is particularly influential in shaping members collective efficacy related to it (Chen & Bliese, 2002).

Second, we expect that agency employees' collective implementation efficacy will increase when the agency makes financial, human, and social resources available (Clayton, 1997) because abundant resources may enhance the collective confidence that implementation efforts will be successful. Just as individuals conduct a detailed assessment of the availability of specific resources and the constraints related to the performance of a novel task to form self-efficacy with regard to the task (Eden, 2001; Gist & Mitchell, 1992), agency members may consider how well they are equipped with needed resources and how many constraints they may encounter in order to form their collective efficacy belief with regard to implementing the innovation.

Finally, support for learning may provide conceptual and time resources that facilitate the development of skill and knowledge among agency employees, a condition that can boost their collective efficacy regarding innovation use (Bandura, 1997). Particularly for the implementation of process innovations such as E-Government, it is important to ensure that employees have opportunities to learn and practice new ways of operation through training, communities of practice, and a mutually supportive social learning process (Edmondson, Bohmer, & Pisano, 2001). These learning activities are positively related to collective efficacy, perhaps due to increased reflection among employees and greater understanding of the task (Edmondson, 1999). Thus, support for learning at the agency level fosters these learning behaviors among employees, which, in turn, can contribute to the development of collective efficacy.

Employee Reaction Toward Innovation: Collective Innovation Acceptance

We identify agency members' collective acceptance of an innovation as an intermediate outcome involving employees that may result in the agency's success in implementing it. Collective innovation acceptance refers to employees' shared positive views regarding the innovation and their belief that it will result in favorable outcomes for themselves and the agency (Choi & Price, 2005; Jones, Jimmieson, & Griffiths, 2005). Scholars have singled out employees' acceptance, or "buy-in," as a critical condition for successful introduction of new practices or technologies (Clayton, 1997; Leonard-Barton, 1988). For example, when employees develop negative reactions, such as resistance, the implementation process is less likely to be smooth, creating a substantial assimilation gap (Fichman & Kemerer, 1999). We expect that agency employees' collective innovation acceptance will be positively affected by their collective efficacy for implementation. Although there have been no organization-level studies, this connection between collective efficacy and members' acceptance of a collective goal was empirically demonstrated at the group level (Mulvey

& Klein, 1998). In the present context, low collective implementation efficacy that reflects limited member competence and/or situational resources within an agency creates a condition in which agency members perceive a low likelihood of success, which generates negative collective reactions toward the innovation.

Implementation Outcomes: Implementation Effectiveness and Innovation Effectiveness

When employees of an agency buy into the process innovation, its implementation efforts are more likely to be successful and fruitful (Clayton, 1997; Leonard-Barton, 1988). In this study, therefore, we hypothesized that collective innovation acceptance by agency members would predict both short-term and long-term implementation effectiveness, which, in turn, would further determine innovation effectiveness of the agency (see Figure 1).

Method

Research Setting

In 2003, The Korean government initiated a long-term, large-scale innovation campaign to change the way its employees work by utilizing the Intranet and the Internet. Specifically, this process innovation, called "E-Government," involved the introduction of extensive electronic documentation systems with Intranets and the promotion of online public service systems. In order to facilitate these process changes, the innovation also emphasized the development of knowledge management practices. As part of its effort to implement E-government, the Korean government provided intensive training programs and manuals. This process innovation has turned out to be quite successful. According to a report on the E-Government readiness of 191 nations (United Nations, 2005), the overall ranking of Korea soared from 13th in 2003 to 5th in 2005. Moreover, in a recent study of 198 nations, Korea ranked first in providing E-government services (West, 2006).

We empirically tested the present conceptual framework using data collected in 47 ministries and agencies that compose the executive branch of the Korean government (e.g., Ministry of Defense, Ministry of Foreign Affairs, National Police Agency). On average, each agency was composed of 316 employees (SD = 224.57). Although these central government agencies represent relatively independent operating units, all of them began to implement the present process innovation at the same time, following the same guidelines. Thus, the nature of the innovation and the duration of implementation were constant across the sites.

Sample and Data Collection Procedure

The data were collected at three different time points. Time 1 data were collected from two sources 12 months after the initiation of the innovation: (a) Agency employees reported their collective implementation efficacy and collective innovation acceptance and (b) external experts assessed institutional enablers and short-term implementation effectiveness. We asked the innovation manager of each agency to develop a random, stratified sample of agency employees, taking into account their hierarchical levels. Given the different sizes of the agencies, we sampled different proportions of agency employees. Specifically, we sampled 30%, 20%, and 15% from small (200 or fewer employees), medium (between 201 and 400), and large (401 or more) agencies, respectively (see Bartlett, Kotrlic, & Higgins, 2001). Overall, the initial sample included 3,964 employees, which represented 26.7% of the entire population (N = 14,862). A private survey firm administered a Web-based survey by directly contacting the sampled employees via e-mail. Over a period of 2 weeks, 1,591 employees participated (response rate = 40.1%). The average number of participants per agency was 34 (SD = 24.34). The participants were 87.8% male with an average age of 43 years (SD = 7.24) and an average tenure of 16 years (SD = 8.37).

At Time 1, a panel of 24 experts, including 12 innovation consultants and 12 professors in the disciplines of public administration, management, and psychology, was formed. This expert panel systematically evaluated each agency's implementation process using the following steps based on the integrative group process (Gustafson et al., 2003): (a) They generated 12 criteria (e.g., management support) for successful implementation; (b) for each of the 12 criteria, two experts independently reviewed and evaluated each agency's written reports (prepared following a standard guideline that requests relevant information) and together generated agreed upon ratings regarding each criterion for all 47 agencies; (c) the panel was divided into four teams of six experts, each of which conducted site visits (for an average of 12 agencies per team) involving interviews with government officials and members of the innovation management team; (d) following site visits, each team made necessary modifications in the initial ratings based on written reports; and (e) the entire panel of 24 experts collectively reviewed the site visit reports and made final adjustments in the ratings of each agency in order to enhance consistency in ratings across agencies.[2]

At Time 2 (22 months after implementation), long-term implementation effectiveness was assessed by administering a follow-up Web-based survey. For this purpose, we generated a random list of 10 employees in each agency. In addition to innovation managers, we randomly selected two employees in each agency from the list and invited them to evaluate the extent to which the process innovation was implemented in their agency. A total of 141 individuals (1 manager plus 2 employees per agency) participated in this follow-up Web-based survey.

Finally, at Time 3 (28 months after implementation), a new panel of 36 experts was formed to evaluate each agency's success in implementing the process innovation and in reaping benefits from it. The same procedure used by the expert panel at Time 1 was followed.

Measures

The present hypotheses were tested using data from four different sources collected over three time periods. Both expert ratings and employee surveys were based on 5-point scales. Employee responses were aggregated at the agency level, which was empirically supported by an interrater agreement index, $r_{wg(j)}$, intraclass

[2] Unfortunately, the procedural information that could be used to calculate interrater agreement among the external experts was not available. However, we were able to contact two experts who participated in the T1 panel and found that they had experienced a high-level of initial agreement in evaluating the agencies' implementation efforts and performance. Both of them commented that they came up with almost identical initial, independent judgments in 8 or 9 out of 10 cases in their evaluation of the agencies.

correlations, ICC(1), ICC(2), and group-level reliability (Chen, Mathieu, & Bliese, 2004).

Management support (expert, Time 1). The level of management support for the innovation was measured by the following four items ($\alpha = .90$) as evaluated by 24 external experts: (a) the director's (minister's) commitment to the innovation, (b) adequate procedures applied to develop a vision and strategy for the innovation, (c) persuasiveness of the innovation vision, and (d) feasibility of the vision for the innovation.

Resource availability (expert, Time 1). The expert panel evaluated the extent to which an agency provided resources for innovation by rating four items ($\alpha = .78$): (a) allocating sufficient budget for innovation-related projects, (b) providing additional resources for the innovation management team, (c) identifying and supporting innovation champions, and (d) promoting a collaborative social network for innovation that includes external experts.

Support for learning (expert, Time 1). The expert panel evaluated each agency's support for learning using a four-item index ($\alpha = .84$): (a) well-developed training and education systems, (b) strong communities of learning and a culture of active debate, (c) adequate information technology infrastructure for knowledge sharing, and (d) encouragement of learning activities.

Collective implementation efficacy (employee, Time 1). Drawing on existing measures (Choi, Price, & Vinokur, 2003; Klein et al., 2001), we constructed a four-item index—individual-level $\alpha = .81$, group-level $\alpha = .94$, $r_{wg(4)} = .90$, ICC(1) = .13, ICC(2) = .72, $F(46, 1501) = 3.42$, $p < .001$—to assess employees' collective implementation efficacy. Sample items include the following: "Agency members possess the skills and abilities required for implementing the innovation" and "agency members are confident that they can successfully implement the innovation."

Collective innovation acceptance (employee, Time 1). Adapting items used in prior studies (Jones et al., 2005; Venkatesh, Morris, Davis, & Davis, 2003), we developed a four-item scale—individual-level $\alpha = .78$, group-level $\alpha = .90$, $r_{wg(4)} = .87$, ICC(1) = .15, ICC(2) = .75, $F(46, 1501) = 4.01$, $p < .001$—to measure employees' acceptance of the innovation. This scale included items such as "agency members have positive attitudes toward the innovation" and "innovation activities impose unnecessary extra tasks without much improvement" (reverse coded).

Short-term implementation effectiveness (expert, Time 1). The Time 1 expert panel assessed the extent to which each agency successfully implemented each of the three aspects of the process innovation ($\alpha = .81$): (a) electronic document creation and processing, (b) online public service system, and (c) knowledge management system.

Long-term implementation effectiveness (employee, Time 2). The innovation manager and two employees of each agency reported on the agency's implementation of the process innovation using the same three items—individual-level $\alpha = .69$, group-level $\alpha = .72$, $r_{wg(3)} = .86$, ICC(1) = .59, ICC(2) = .82, $F(46, 95) = 5.27$, $p < .001$—that were used to measure short-term implementation effectiveness as rated by experts.

Innovation effectiveness (expert, Time 3). After 28 months of implementation, the second expert panel evaluated the extent to which each agency accrued benefits from the innovation in the following five aspects ($\alpha = .79$): (a) improved agency performance through the process innovation, (b) visible benefits from the innovation, (c) continuous improvement through learning, (d) routinization of the innovation among employees, and (e) the development of innovative culture.

Method Variance Reduction: Two Subgroups Within Each Agency

We adopted Ostroff, Kinicki, and Clark's (2002) recommendation for reducing potential method variance due to same-source bias. Specifically, we obtained variables from separate sources within the same unit (split-group design). In this procedure, we created two equal-sized subgroups (A and B) within each agency ($n = 17$) by randomly assigning each member into one of them. Subgroups A and B were used to obtain information on the two Time 1 employee variables (i.e., collective implementation efficacy and collective innovation acceptance).

Results

In the present research design, the Time 1 expert panel provided four study variables. To ensure their empirical distinctiveness, we conducted an exploratory factor analysis (principal components extraction with varimax rotation) of the 15 items rated by the Time 1 panel. This resulted in four factors that correspond to the hypothesized factor structure, with factor loadings ranging between .61 and .88 and all cross-loadings lower than .40, clearly providing empirical support for the proposed factor structure. Table 1 reports

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

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Agency size	316.21	224.57	—								
2. Management support	3.53	0.83	.32*	—							
3. Resource availability	3.03	0.59	.36*	.55***	—						
4. Support for learning	3.25	0.71	.26	.57***	.64***	—					
5. Collective implementation efficacy	3.37	0.27	.14	.69***	.44**	.48**	—				
6. Collective innovation acceptance	3.17	0.29	−.07	.48**	.24	.26	.60***	—			
7. Short-term implementation effectiveness	3.06	0.75	.35*	.37*	.34*	.54***	.31*	.33*	—		
8. Long-term implementation effectiveness	3.69	0.80	.34*	.30*	.45**	.52***	.41**	.20	.43**	—	
9. Innovation effectiveness	3.69	0.47	.40**	.41**	.37*	.36*	.45**	.24	.41**	.45**	—

Note. The unit of analysis was agency ($N = 47$).
* $p < .05$. ** $p < .01$. *** $p < .001$.

descriptive statistics of all study variables along with agency size, which was found to be a significant covariate of implementation outcomes (see Klein et al. 2001; Purvis et al., 2001).

Creating Hypothesized and Alternative Structural Models

To validate the present framework, we conducted structural equation modeling (SEM) that allows simultaneous tests of multiple predictive relationships (Bentler, 2006).[3] Considering that the present sample is small and the data are likely to be non-normal, we conducted all SEM analyses using the robust maximum likelihood method (Bentler, 2006) and report scaled chi-square statistics that are corrected to improve their diagnostic values of model fit (Satorra & Bentler, 1994) along with Yuan-Bentler's residual-based *F* statistics, which provides the best goodness-of-fit estimation of structural models using small samples (Bentler & Yuan, 1999).

Incorporating all hypothesized structural paths, we fitted the present framework to our data.[4] This model included four additional relationships that were not hypothesized: (a) three covariances among the three institutional enablers and (b) a path from short-term to long-term implementation effectiveness. The hypothesized model showed an acceptable fit to the data: scaled (Satorra-Bentler type) $\chi^2(13, N = 47) = 19.69$, $p = .10$; Yuan-Bentler's residual-based $F(13, 34) = 1.69$, $p = .11$; comparative fit index (CFI) = .99; root mean square error of approximation (RMSEA) = .099; root mean residual (RMR) = .036. In this model, Yuan-Bentler's *F* statistic was insignificant, indicating that the model was not significantly different from the empirical data, thus providing empirical support for the present framework.

Nevertheless, there remains a possibility that one or more alternative models provide a better explanation of the observed pattern. To avoid the risk of capitalization on sample characteristics, which can be a particularly severe threat for small-sample studies (MacCallum, Roznowski, & Necowitz, 1992), we identified three theoretically plausible models and compared them with the hypothesized model. The first alternative model tested the possibility that the three institutional enablers had significant direct effects on collective innovation acceptance (Clayton, 1997). This alternative model exhibited a model fit, scaled $\chi^2(10, N = 47) = 18.65$, $p = .04$; residual-based $F(10, 37) = 1.91$, $p = .07$; CFI = .99; RMSEA = .137; RMR = .038, that was not significantly different from the hypothesized model (scaled $\Delta\chi^2(3, N = 47) = .81$, *ns*, computed with the formula by Satorra & Bentler, 2001). Given the lack of significant improvement by the three additional paths, we opted for the hypothesized, more parsimonious model. The second alternative model was created by switching the order of the two collective constructs. In this model, institutional enablers directly predicted collective innovation acceptance, which, in turn, predicted collective efficacy (Greenhalgh et al., 2005, p. 187). The goodness of fit associated with this model, scaled $\chi^2(13, N = 47) = 30.47$, $p = .004$; residual-based $F(13, 34) = 1.63$, $p = .12$; CFI = .98; RMSEA = .171; RMR = .049, was worse than that of the hypothesized model. Finally, we tested the often assumed direct effects of the three institutional enablers on implementation effectiveness. This model was tested by adding six direct paths from institutional enablers to short-term and long-term implementation effectiveness. The model fit of this alternative model, scaled $\chi^2(7, N = 47) = 19.58$, $p = .001$; residual-based $F(10, 37) = 3.01$, $p = .01$; CFI = .98; RMSEA = .198; RMR = .040, was not significantly different from the original model, scaled $\Delta\chi^2(6, N = 47) = .09$, *ns,* which was therefore retained for its parsimonious explanation of the data.

After considering the three theoretically plausible alternative models, we determined that the current data support the hypothesized model, which is depicted in Figure 2 with standardized path coefficients. Given that our model proposes complex mediated relationships, examining only direct effects may be limiting. For this reason, we present the magnitude and significance of indirect relationships among variables in Table 2.

Hypothesis Testing

Controlling for the effects of other institutional enablers, we found that management support was the only significant predictor of collective implementation efficacy ($\beta = .68$, $p < .001$). As hypothesized, employees' collective implementation efficacy was a meaningful predictor of their innovation acceptance ($\beta = .71$, $p < .001$), which was also significantly predicted by management support ($\beta = .48$, $p < .001$; see Table 2).

Short-term implementation effectiveness was significantly associated with collective innovation acceptance ($\beta = .43$, $p < .01$).

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[3] Because of the small sample size at the agency level ($N = 47$), instead of creating a full measurement model, we used scale means to indicate latent factors. To incorporate measurement error into the model, we set the random error of each scale to its variance multiplied by one minus its reliability (variance $\times$ [1 $-$ α]; see Bollen, 1989). The use of a single indicator, although it should be avoided whenever possible, produces results that are quite comparable to those based on multiple indicators (Liang, Lawrence, Bennett, & Whitelaw, 1990). To identify any biases associated with the use of single indicators, we tested the same SEM model using 2 indicators per factor, 3 indicators per factor, and all 31 indicators of the eight factors. The pattern of structural relations among factors was identical across the four SEM models based on different numbers of indicators. Including more indicators, however, generally reduces model fit in small-sample analysis (Fan, Thompson, & Wang, 1999). Moreover, in order to maintain the acceptable ratio of subjects to estimated parameters (i.e., 2:1) that is required to obtain adequate and usable solutions (Nevitt & Hancock, 2004), it was necessary to conduct the SEM analysis using single indicators in which the ratio of subjects to estimated parameters was 2.04:1. For these reasons, we report the results based on single indicators. The only concern in adopting a single-indicator model is a relatively low power (in the present context, .25; MacCallum, Browne, & Sugawara, 1996). This concern is alleviated in our data because exactly the same structural pattern among the study variables was supported in all three multiple-indicator models described above, with power ranging between .74 and .99.

[4] In testing the current structural relationships, we estimated the SEM models with and without agency size as a control variable. The two types of models generated identical results in terms of the pattern of relationships and their significance levels. Below we present the results without controlling for agency size because the inclusion of this control variable in the tested models substantially reduced model fit. In addition, we tested each SEM model twice, by switching the source of the two Time 1 employee variables (thereby obtaining collective implementation efficacy and innovation acceptance from Subgroups B and A, respectively). Again, the results, in terms of the magnitude and significance of each path, were almost identical to the original results (before the data source switch), indicating that the present findings are fairly robust.

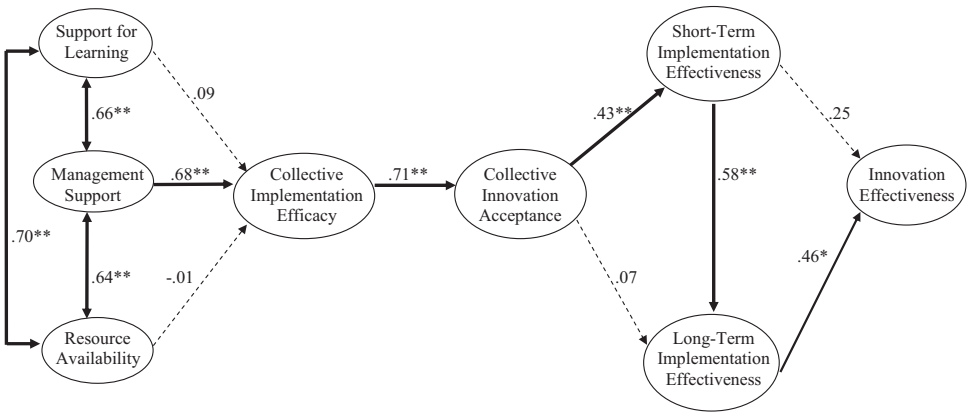

Figure 2. Agency-level structural model. Thicker lines represent statistically more significant results. Dotted lines represent statistically insignificant results. $^{*}p < .05$. $^{**}p < .01$.

As shown in Table 2, it was also indirectly predicted by both management support and collective implementation efficacy ($\beta = .21$, $p < .05$, and $\beta = .31$, $p < .01$, respectively). The results demonstrate a significant temporal stability of implementation effectiveness over the period of 10 months as shown in the strong association between short-term and long-term measures ($\beta = .58$, $p < .01$), which was particularly meaningful because they were based on different sources (experts versus employees). Finally, innovation effectiveness was directly predicted by long-term implementation effectiveness ($\beta = .46$, $p < .05$) and indirectly predicted by collective implementation efficacy and innovation acceptance ($\beta = .18$, $p < .05$, and $\beta = .25$, $p < .05$, respectively).

Table 2
Indirect Effects of Independent Variables

Dependent variable/ independent variable	Indirect effect	*p*
Collective innovation acceptance		
Management support	.48***	.01
Resource availability	−.01	.94
Support for learning	.06	.92
Short-term implementation effectiveness		
Management support	.21*	.04
Resource availability	.00	.94
Support for learning	.03	.93
Collective implementation efficacy	.31**	.01
Long-term implementation effectiveness		
Management support	.15	.16
Resource availability	.00	.94
Support for learning	.02	.66
Collective implementation efficacy	.23†	.09
Collective innovation acceptance	.25*	.04
Innovation effectiveness		
Management support	.12†	.07
Resource availability	.00	.94
Support for learning	.02	.65
Collective implementation efficacy	.18*	.05
Collective innovation acceptance	.25*	.03
Short-term implementation effectiveness	.27†	.09

$^{\dagger}p < .10$ $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Discussion

Scholars have lamented the lack of attention to implementation, as compared with adoption, of innovation and have further pointed out the dominance of qualitative studies based on a single or small number of organizations (Greenhalgh et al., 2005). Klein and Sorra (1996) suggested that studies of implementation should integrate a research design based on longitudinal data collected from multiple organizations. The present study, along with Klein et al. (2001) is one of the first such empirical studies. While replicating some of the initial findings of Klein et al., this study expands the implementation literature in several meaningful ways. First, the current conceptual framework and empirical findings highlight the importance of simultaneously considering both institutional factors and collective processes involving employees in an attempt to understand innovation implementation. Specifically, this study revealed the significance of employees' collective efficacy and innovation acceptance as mediators between institutional factors and implementation outcomes (see Table 2). Second, the unique characteristics of this study, such as the use of multiple panels of experts and multiwave data collected from a large number of internal respondents, provide a significant empirical contribution. Third, unlike prior studies, which have been based primarily on Western, private firms, we examined innovation implementation in the context of the public sector using a non-Western sample. The current study offers valuable insights into the ways in which public agencies deal with increasing external demands through continuous innovation in their operating routines and practices (Kumar et al., 2002). Below we highlight critical findings and discuss their theoretical and practical implications along with the limitations of this study.

Although all three institutional enablers had significant correlations with collective implementation efficacy, management support was the only significant predictor in the structural model. As argued in prior studies (Klein et al., 2001; Purvis et al., 2001; Russel & Hoag, 2004), employees appeared to develop positive beliefs regarding implementation when institutional elites encouraged the innovation and provided a convincing vision for its implementation (Scott, 1995). This dominant role played by institutional elites

in shaping employees' collective belief may be partly due to the often bureaucratic nature of government agencies (Moon & de-Leon, 2001). In the present data, however, considering the sizable correlations among the three enablers (thus, multicollinearity among them), it is premature to conclude that management support is the only variable that is meaningful in shaping collective employee processes. Future studies should continue to consider other organizational context variables, such as the provision of various types of resources (Clayton, 1997; Klein et al., 2001) and collective learning environment (Klein & Knight, 2005), that may affect collective processes involving employees. In addition, it would be useful to conceptualize distinct employee-based processes that could mediate the effects of different types of institutional enablers on implementation outcomes.

Our analysis revealed that collective implementation efficacy is a meaningful mediator of the effect of institutional environment on implementation outcomes (see Table 2 for significant indirect effects). In a school-level study, McCormick, Steckler, and McLeroy (1995) found that increased capacity for implementation through initial training did not increase the level of initial implementation of a health-promotion program, but it doubled the probability that the program would be sustained as a routine practice 4 years after initiation (62% versus 30%). The present data showed that agency employees' collective confidence in implementing the innovation indirectly predicted both implementation and innovation effectiveness by increasing employees' innovation acceptance (see Table 2). This pattern is consistent with a group-level finding that a group's collective efficacy promotes members' commitment to its goal (Mulvey & Klein, 1998). The finding calls for increased attention to the capacity for implementation, particularly as collectively perceived by employees, in addition to the often studied socionormative context for implementation, which involves factors such as implementation climate, innovative climate, and openness to change (Holahan et al., 2004). In this regard, a key task for researchers is to differentiate and identify the relationships among these collective constructs. However, a clear distinction among them could be challenging because these collective perceptions may share a common overall perception of supportive implementation context.

This study has several limitations. First, the present analysis was based on 47 government agencies, which provided a sample barely large enough to conduct an omnibus test of the present model. Second, the three institutional enablers, employee-related mediating variables, and short-term implementation effectiveness were reported by the first panel of experts and employees at Time 1. Given the cross-sectional nature of these measures, the causal directions among them cannot be determined. Third, we assessed implementation and innovation effectiveness approximately 2.5 years after the implementation effort had begun. It would be desirable to examine the impact of innovation on other outcomes, such as service quality improvement or customer satisfaction, over a longer time frame at multiple points. Finally, a portion of the present data came from two separate panels of external experts. Although this approach may have resulted in somewhat more objective and consistent ratings across the 47 agencies than an approach using a single inside informant (e.g., an innovation manager), it is still necessary to establish the reliability and validity of external versus internal perspectives in the assessment of various organizational phenomena (Bagozzi et al., 1991).

All in all, this study meaningfully expands the implementation literature with its rigorous research design and international data from the public sector and also offers valuable guidelines for successful innovation implementation. The present framework encompassing both institutional and employee-related processes may be more ecologically valid and provide a more complete view of the innovation phenomenon than models focused solely on just one of the two processes. Considering the fact that innovation implementation is a "human" process (Russel & Hoag, 2004) and that public sector organizations are characterized by high political complexity (Kumar et al., 2002), the findings suggest that efforts to innovate in the public sector will be more effective if managers take into account both processes. Further conceptual and empirical developments with regard to the ways in which institutional and collective dynamics interact to shape implementation outcomes in various organizations as they introduce different types of innovations would be fruitful.

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