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Testing Klein and Sorra's innovation implementation model: An empirical examination☆

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ABSTRACT

Despite a substantial volume of research activities on innovation implementation [Holahan, P.J., Aronson, Z.H., Jurkat, M.P., Schoorman, F.D., 2004. Implementing computer technology: a multi-organizational test of Klein and Sorra's model. Journal of Engineering and Technology Management 21 (1), 31–50; Klein, K.J., Sorra, J.S., 1996. The challenge of innovation implementation. Academy of Management Review 21 (4), 1055–1080; Kwon, T.H., Zmud, R.W., 1987. Unifying the fragmented models of information systems implementation. In: Hirschheim, B.R. (Ed.), Critical Issues in Information Systems Research. John Wiley and Sons Ltd., New York, pp. 227–252], implementation outcomes continue to disappoint—particularly those related to large-scale information systems (ISs) implementation projects [Aiman-Smith, L., Green, S.G., 2002. Implementing new manufacturing technology: the related effects of technology characteristics and user learning activities. Academy of Management Journal 45 (2), 421–430; The Standish Group International Inc., 1995. Chaos (Application Project Failure and Success). Access http://www.standishgroup.com/chaos.html; Whittaker, B., 1999. What went wrong? Unsuccessful information technology projects. Information Management & Computer Security 7 (1), 23–29]. In 1996, Klein and Sorra introduced a promising model that posited key determinants of implementation effectiveness. In this paper we present new validated construct measures, and then test the Klein and Sorra model using a survey of 209 employees in seven organizations. Our results demonstrate that IS implementation effectiveness is

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influenced directly and indirectly by innovation-values fit, and indirectly by implementation climate.

1. Introduction

Implementation is "the process of gaining targeted organizational members' appropriate and committed use of an innovation" (Klein and Sorra, 1996, p. 1055). Decrying the fragmented nature of existing research, Klein and Sorra proposed an integrative innovation implementation model, based on social influence theory, which conceptualized antecedents and outcomes of implementation effectiveness (defined as "the quality and consistency of targeted organizational members' use of an adopted innovation" (Klein and Sorra, 1996, p. 1056)).

The model appeals to both academics and professional managers who struggle to reap the benefits from their adopted innovations. For academic researchers, the parsimonious model incorporates various key factors for an innovation implementation and offers a strong theory for innovation implementation success. It offers an alternative perspective that can deepen our understanding of innovation adoption and implementation—a domain that to date has been dominated by a small number of well-worn and conceptually interrelated theories such as the theory of reasoned action (e.g., Davis, 1989; Mathieson, 1991; Mathieson et al., 2001), the theory of planned behavior (e.g., Mathieson, 1991; Taylor and Todd, 1995), the technology acceptance model (Davis, 1989; Mathieson et al., 2001), and the unified theory of acceptance and use of technology (Venkatesh et al., 2003).

While this body of work has been stimulating and revealing, our understanding of IS adoption and implementation success remains limited (Chin and Marcolin, 2001), and factors contributing to enthusiastic and committed system usage remain unexplored (DeLone and McLean, 2003). From the perspective of social influence theory, Klein and Sorra's model has the potential to offer new insights particularly into large-scale packaged software adoption, one type of administrative innovation that has become a widespread phenomenon across organizations (Markus and Tanis, 2000).

2. Relevant literature

Studies on information system (IS) implementations generally conceptualize the introduction of an innovation as a mutually adaptive organizational change process (e.g., Davenport, 1998; Kwon and Zmud, 1987; Leonard-Barton, 1988; Lucas et al., 1990). For example, adaptive structuration theory proposes a framework delineating how technology structures can trigger organizational change and vice versa (DeSanctis and Poole, 1994; Giddens, 1984). A plethora of empirical studies have recorded disastrous changes brought about by new information systems, and enterprise systems in particular (e.g., Davenport, 1998, 2000; Markus, 1983; Markus et al., 2000), in which the root cause of failure is often attributed to user resistance to change (Cambell-Kelly, 1996; Grover, 1999; Josh, 1991; Newman and Noble, 1990; Piderit, 2000; Stoddard and Jarvenpaa, 1995). In response, planned organizational change models have appeared (Kolb and Frohman, 1970; Lewin, 1947, 1952) and improved change management techniques have been proposed (Grover, 1999; Stoddard and Jarvenpaa, 1995).

However, determinants contributing to users' committed and enthusiastic appropriation of administrative innovations such as packaged software have not received sufficient attention. Studies on organizational innovations have distinguished administrative innovations (i.e., technologies or practices that are related to management) from technical innovations (i.e., new products or services created that are related to the primary work activity of the organization) (e.g., Daft, 1978; Damanpour and Gopalakrishnan, 1998; Gopalakrishnan and Bierly, 2001; Nystrom et al., 2002). These two types of innovations "imply potentially different decision-making processes" (Damanpour and Gopalakrishnan, 1998, p. 560), and thus their adoptions are affected by potentially different sets of factors (e.g., Damanpour, 1991; Damanpour and Gopalakrishnan, 1998; Kimberly and Evanisko, 1981). Prior studies have examined the impact of individual factors (e.g., education, background, tenure)

(Damanpour, 1991; Kimberly and Evanisko, 1981; Tabak and Barr, 1999), organizational variables (e.g., organizational support) (e.g., Malik and Wilson, 1995; O'Connor and McDermott, 2004), and contextual variables (e.g., environment) (Damanpour and Gopalakrishnan, 1998); however, our understanding of how to obtain enthusiastic and committed innovation use, particularly for the adoption of administrative innovations, remains limited.

Judging by the high frequency and cost of IS implementation failure, professional managers need new and improved perspectives desperately. For example, a 5-year study of 23,000 implementations reveals that only 26% of companies in the United States completed their information systems implementation on time and within budget, and only 58% of these "successful" projects ultimately delivered the promised features and functions (Aiman-Smith and Green, 2002; The Standish Group International Inc., 1995). A similar study conducted in Canada concludes that only 39% of companies achieved expected benefits from their IS projects (Whittaker, 1999). It is alarming that despite tremendous efforts to promote IS adoption, system under-utilization or total lack of use causes massive losses annually (Markus and Keil, 1994).

Klein and Sorra (1996) provide a fundamentally new approach to understanding organizational change associated with innovation implementation. Their model integrates diverse factors studied in prior literature on innovation implementation, and then proposes two key determinants that lead to consistent and quality innovation appropriation. This model goes beyond simply describing user resistance, and offers a unique and more holistic theoretical perspective. To date there have been only two partial empirical examinations of Klein and Sorra's (1996) model. Klein et al. (2001) explored the direct relationships between implementation climate, implementation effectiveness, and innovation effectiveness, but did not focus on other antecedents of implementation effectiveness. Holahan et al. (2004) studied the relationships between implementation climate and innovation-values fit on implementation effectiveness (they ignored potential mediating variables that were posited in the original model—i.e., skills, incentives, absence of obstacles, and commitment).

The objective of this study is to test the full range of antecedents of implementation effectiveness, in the context of large-scale information system implementations. We focus on implementation effectiveness because we believe it is a critical link for understanding how and why users engage in enthusiastic and high quality use, a necessary condition for organizations to reap full innovation benefits. As described in the methodology section, the specific projects we selected for this study belong to the category of "administrative innovations" (Swanson, 1994), examples of which include accounting and finance information systems.

3. Conceptual background and hypotheses

Klein and Sorra's (1996) innovation implementation model asserts two key determinants of implementation effectiveness: (1) implementation climate (defined as "targeted employees' shared summary perceptions of the extent to which their use of a specific innovation is rewarded, supported, and expected within an organization" (p. 1060); and (2) innovation-values fit (defined as "the extent to which targeted users perceive that use of the innovation will foster (or, conversely, inhibit) the fulfillment of their values" (p. 1063). Implementation climate affects implementation effectiveness through skills, incentives, and absence of obstacles, while innovation-values fit impacts implementation effectiveness through user commitment. Implementation climate and innovation-values fit are posited to positively affect implementation effectiveness. The research model is presented in Fig. 1.

The determinants represent two important influence mechanisms. According to social influence theory (Sussmann and Vecchio, 1982), an individual may either: (1) *comply* with a social influence in order to gain specific rewards and to avoid punishments; or (2) *internalize* a social influence when it is congruent with his/her value systems or because it is intrinsically rewarding. An organization's implementation climate (rewards, supports, expectations) reflects a systematic attempt to assert compliance influence on individual IS adoption. On the other hand, when an individual employee experiences innovation-values fit, they will be drawn to internalize and embrace the system (Klein and Sorra, 1996).

Implementation climate delineates employees' perceptions of implementation practices, and represents an organization's push to encourage individual innovation adoption (Klein and Sorra,

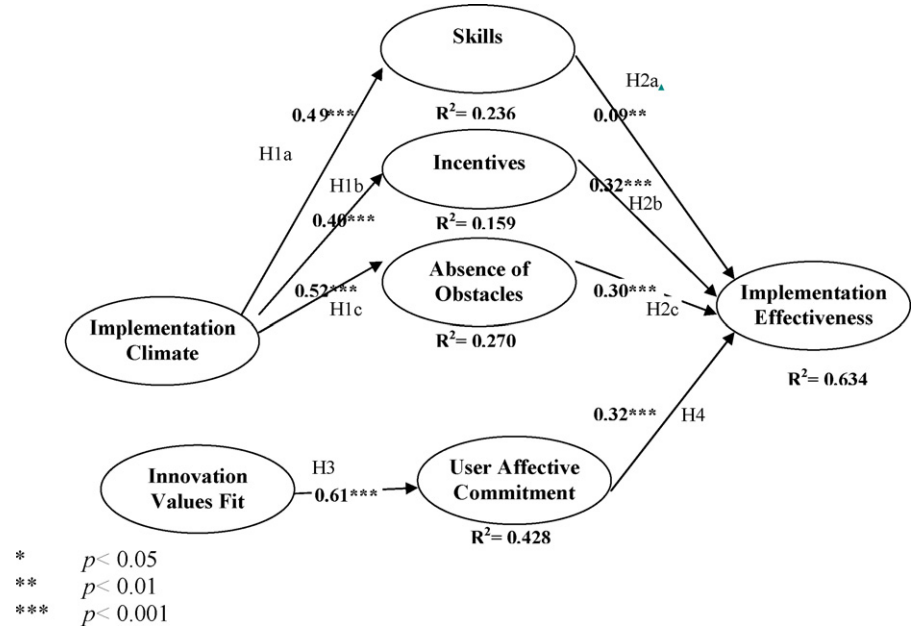

Fig. 1. Conceptual model and PLS results.

1996). An organization with a strong (positive) implementation climate will clearly define policies and practices, and provide "readily and broadly available" training programs (Klein and Sorra, 1996, p. 1060) as well as user assistance and incentives to use a new system. In contrast, in a weak (negative) implementation climate policies and practices are poorly defined. Employees feel little support to develop necessary skills, they are not rewarded for use, and they face many problems when trying to use the innovation. Klein and Sorra propose that a strong implementation climate would be marked by superior user skills, provision of user incentives, and active removal of implementation obstacles faced by users.

Several prior IS research studies support the relationships between implementation climate, skills, incentives, and obstacles. For example, Compeau and Higgins (1995b) have discovered that training helps increase self-efficacy ("the belief that one has the capability to perform a particular behavior" (Compeau and Higgins, 1995a, p. 189)). Venkatesh and Brown (2001) have uncovered that offering resources and necessary technical support reduces knowledge and resource barriers. Other researchers have found that users can also be motivated through the use of rewards (Josh, 1991) and the provision of training (Bostrom et al., 1988; Igbaria et al., 1995). Based on the above arguments, we propose the following hypotheses regarding the effects of a strong (positive) implementation climate:

Hypothesis 1a. Implementation climate is positively associated with user skills.

Hypothesis 1b. Implementation climate is positively associated with incentives.

Hypothesis 1c. Implementation climate is positively associated with absence of obstacles.

When users become skilled, motivated and supported, they tend to have more success when using an innovation (Klein and Sorra, 1996). This is consistent with self-efficacy theory, which argues that removing obstacles and increasing user competence will encourage a positive attitude toward an information system, and will increase the likelihood that users will apply the system effectively to their jobs (Compeau and Higgins, 1995a; Compeau et al., 1999). It also fits motivation theory and the equity-implementation model, which suggest that offering extrinsic rewards is effective in motivating

employees to do what is required (Hackman and Oldham, 1980; Josh, 1991). With an unobstructed path, enhanced user competencies, and concrete incentives, users will show passionate and skilful usage. Therefore,

Hypothesis 2a. User skills are positively associated with implementation effectiveness.

Hypothesis 2b. Incentives are positively associated with implementation effectiveness.

Hypothesis 2c. Absence of obstacles is positively associated with implementation effectiveness.

Values are "prescriptive or proscriptive beliefs about ideal models of behavior and end-states of existence that are activated by, yet transcend object, and situation" (Rokeach, 1973, p. 262). Examples of general values include love, friendship, happiness, a meaningful life, contribution to society, self-fulfillment, a comfortable life, economic security, and success. Work values are believed to be "expressions of more general life values" that occur in the work setting (Roe and Ester, 1999, p. 2). Accordingly, an individual who values love and friendship in their life will tend to value positive interpersonal relationships at work; one who values a comfortable life will appreciate work benefits under a working environment; and so on. Empirical studies have identified a close correlation and structural similarity between work values and general life values (e.g., Elizur and Sagie, 1999), suggesting that work values are very closely related to general values.

Just as work values are expressions of general values in the work environment, task-related values are specific expressions of work values across tasks. Some values are shared across tasks, while some values are very task specific. For example, in their testing of Klein and Sorra's model among primary and secondary teachers, Holahan et al. (2004) focus on teaching-specific values such as "wanting to be known as a very progressive science faculty with respect to the pedagogy used," and "wanting students to place high in inter-school science competitions" (p. 40).

A new information system often challenges users' entrenched work values. For example, prior to the implementation of a computerized inventory control system in one manufacturing company, employees had devised flexible business processes to better serve their customers (e.g., they sometimes switched an order created for one customer to another customer who placed a rush order for a similar product) (Klein et al., 1989). Unfortunately, the new inventory system now required users to track customer orders throughout the entire production process, making it impossible to recombine orders manually. The new system no longer allowed users to act on their value of meeting their customers' needs. Other empirical studies have shown that when facing a new information system implementation, users are often concerned about how the system will facilitate their task completion (e.g., Gill, 1996; Markus and Keil, 1994). Accordingly, we contend that the fit concept represents the extent to which characteristics of a new innovation match task requirements most valued by users. Applying the fit concept to IS implementations, we have chosen to explore some common general values that users hold when asked to apply a system that will change their ways of completing daily tasks.

Klein and Sorra posit that innovation-values fit results in commitment. Research on commitment identifies three dimensions: affective commitment, continuance commitment, and normative commitment, which respectively reflects an individual's desire, need, or obligation to perform a behavior (Meyer and Allen, 1991). While Klein and Sorra do not specify what kind of commitment results from innovation-values fit, we focus exclusively on affective commitment ("the employee's emotional attachment to, identification with, and involvement in the organization") (Meyer and Allen, 1991, p. 67). There are several reasons for this. First, in the context of an IS implementation, affective commitment has been associated with the time and effort that users are willing to spend learning and mastering the system (Roepke et al., 2000). Second, because innovation-values fit embodies an organization's internalization influence, it seems logical that commitment reflects the users' affect (rather than need or obligation) to learn and master the new innovation. Third, innovation-values fit reflects congruence between an innovation and users' high-intensity values, which we reason likely translates into an emotional/affective commitment response. Therefore, we posit that:

Hypothesis 3. Innovation-values fit is positively related to affective commitment.

Compliant employees "do what they are obligated to do and little else" (Roepke et al., 2000, p. 335). By contrast, committed employees feel "dishonest" in making a minimal effort, and attempt to do "whatever is necessary to make things work" (Roepke et al., 2000, p. 335). Meyer and Allen describe a causal relationship between affective commitment and individual performance: "From an internalization perspective, employees become committed to organizations with which they share values. Moreover, they work toward the success of these organizations, because in doing so they are behaving in a manner consistent with their own values" (Meyer and Allen, 1991, p. 76). In the same vein, when target users believe that a new information system fits their most valued requirements, they tend to feel intrinsically motivated and therefore become committed to learning the system (Venkatesh, 1999). Empirical studies have confirmed the positive relationship between user commitment and improved employee performance (Hackett et al., 1994; Meyer and Allen, 1991; Siders et al., 2001; Walton, 1985). As a result, we hypothesize:

Hypothesis 4. Affective commitment is positively associated with implementation effectiveness.

Although Klein and Sorra's (1996) work originally described a multilevel model, we have kept our focus exclusively at the individual level. There are three reasons for this. First, multilevel models are by definition more complex than single-level models. A multilevel model exists when "a relationship between two or more variables is hypothesized to hold at the individual, group, and the organizational levels" (Kozlowski and Klein, 2000, p. 44). Therefore, it is reasonable to examine the individual level as a starting point, and move to multilevel explanations after first establishing the single-level relationships. Second, our understanding of technology adoption at the individual level is still very limited, and exploring this phenomenon at that level offers "a rare look into technology implementation" (Aiman-Smith and Green, 2002, p. 421). As argued further by Aiman-Smith and Green, "for an implementation to succeed, macro-level research has led to important general insights about implementations, but it has told researchers little about individual users of technology... Researchers and managers need insights into how individual users master technology" (p. 421). Third, as this is the first study developing construct measures and examining relationships among these constructs, we feel that it is important to ensure a rigorous scale development and a thorough examination of the model at the individual level, before engaging in a full-fledged multilevel initiative.

4. Methodology

A two-phased methodology was designed to test the research model. In the first phase, we developed and evaluated measures for constructs that had not previously been operationalized for the implementation of large-scale administrative innovations. This included implementation climate, skills, incentives, absence of obstacles, and affective commitment (scales for innovation-values fit and implementation effectiveness were drawn from the literature). In the second phase, a survey was conducted to validate construct measures and investigate hypothesized relationships.

4.1. Phase one: scale development

A card-sorting procedure was used to develop implementation climate, skills, incentives, absence of obstacles, and affective commitment. We first created 60 candidate measurement items, primarily based on the definitions but also with reference to related scales found in the literature. This included 34 items for climate, 10 for skills, 5 for incentives, 5 for absence of obstacles, and 6 for affective commitment. The face validity of these items was assessed by four IS research experts as well as three practitioners who have participated in prior IS implementations. After adding, dropping and revising numerous candidate items based on the expert feedback, 50 revised items were entered into a card-sorting routine as described by Moore and Benbasat (1991). We then proceeded through four rounds of card sorting with four different sets of judges in each round (16 unique judges in total) (see Table 1). After each of the first three rounds, we examined misplaced items, dropped irrelevant items, reworded unclear items, and calculated Cohen's κ, a measure of inter-judge agreement (Cohen, 1960). This process yielded 35 measurement items: climate (17), skills (6), incentives (3), absence of obstacles (3),

Table 1
Card-sorting results.

Judges A–D	Round 1	Round 2	Round 3	Round 4
A&B	0.50	0.71	0.86	0.88
A&C	0.60	0.77	0.85	0.86
A&D	0.51	0.68	0.85	0.86
B&C	0.56	0.75	0.81	0.89
B&D	0.65	0.70	0.91	0.88
C&D	0.65	0.74	0.87	0.85
Average	0.58	0.72	0.86	0.87
No. of items	50	44	40	35

and affective commitment (6). The final Cohen's κ score was 0.89, well in excess of the generally accepted level of 0.65.

4.1.1. Implementation climate (CLIMATE)

Starting with the implementation climate construct definition from Kopelman et al. (1990), we developed 34 items for the card-sorting procedure. Seventeen items remained after the process, which captured four core dimensions of climate: mean emphasis, goal emphasis, task support, and reward emphasis. Mean emphasis (three items) was defined as the extent to which a manager makes known the methods and procedures that employees are expected to use in performing their jobs (e.g., "Employees were told about the new work procedures for using the system"). Goal emphasis (three items) was defined as the extent to which managers make known the types of outcomes and standards that employees are expected to accomplish (e.g., "Employees were told what they needed to accomplish in using the system").

Task support (six items) was defined as the extent to which employees perceive that they are being supplied with the material, equipment, services, and resources necessary to perform their jobs (e.g., "Employees were provided all computer technology (e.g., hardware and software) necessary to perform their tasks with the system"). Reward emphasis (five items) was defined as the extent to which employees perceive that various organizational rewards are to be allocated on the basis of their job performance (e.g., "Employees knew how their individual performances in using the new system were evaluated"). Average scores were computed for each of the four dimensions, and so the implementation climate construct was measured with four aggregate items.

4.1.2. Innovation-values fit (FIT)

This construct was operationalized using measures from the literature and did not go through the card-sorting process. As previously stated, we defined innovation-values fit in terms of how well the new information system innovation matched the task requirements valued by users. We focused on three characteristics of an information system and the task requirements they support: quality of work output (Goodhue and Thompson, 1995); information locatibility and accessibility (Goodhue and Thompson, 1995); and collaborative flexibility and cooperation (Klein and Sorra, 1996). Three dimensions were thus developed to reflect these values.

The first, fit-quality (Fit_{QL}, six items), measures the extent to which an information system provides information that is current, up-to-date and useful for an individual employee (e.g., "Sufficiently detailed data are maintained by the system"). The second, fit-locatibility (Fit_{LO}, four items), measures the extent to which an information system helps the individual employee locate information easily (e.g., "It is easy to find out what data the system maintains on a given subject"). The third, fit-flexibility and cooperation (Fit_{FC}, three items), assesses the extent to which an information system enhances work process flexibility and cooperation (e.g., "The system supports the repetitive and predictable work processes"). Measurement items for the first two dimensions were adapted from Goodhue (1995), and those for the third dimension came from Valle et al. (2000). Mean scores were taken on each of the three dimensions to give us three aggregate measurement items for the innovation-values fit construct.

4.1.3. Skills (SKILL)

Six items emerging from the card-sorting process were used to measure skills. These were based, in part, on training material from a leading enterprise system vendor (e.g., see http://www50.sap.com/useducation/curriculum/curriculum.asp?rid=193&vid=2). This material described three levels of users: (1) level-one users have gained a basic understanding of the technology, including the core applications and their interrelationships; (2) level-two users are competent at using the required modules within the users' functional area, including understanding the functional processes, inputting and interpreting information in the system, and performing queries; and (3) level-three users understand how relational databases work and are capable of basic troubleshooting. A sample item includes: "I understand all of the special features of the system."

4.1.4. Incentives (INCENT)

Three items for incentives emerged from the card-sorting process. These were based on Klein and Sorra's definition that assesses the extent to which an individual felt motivated and encouraged to use the system (e.g., "I am motivated to use the system").

4.1.5. Absence of obstacles (ABSENCE)

Three of the five items originally proposed to measure obstacles emerged from the card-sorting process. These items were developed using Klein and Sorra's definition to examine the extent to which an individual's use of an information system was supported or blocked (e.g., "Due to the lack of organizational resources (e.g., time, training), I have faced a lot of difficulties in learning to use the system").

4.1.6. Affective commitment (COMMIT)

We adapted the measure of affective commitment created by Meyer and Allen (1991) and developed a six-item measure to assess users' emotional attachment to a newly adopted information system (e.g., "Using the system is personally meaningful to me"). These items passed through the card-sorting process.

4.1.7. Implementation effectiveness (IE)

Implementation effectiveness was not operationalized using the card-sorting process. Seven items for implementation effectiveness were adapted from the scale developed by Klein et al. (2001) to capture the extent to which employees utilize a system with skillfulness, commitment and enthusiasm. Klein et al. (2001) used three sub-scales to measure implementation effectiveness—avoidance, endorsement, and quality of use (the Cronbach's α were 0.68, 0.85, and 0.75, respectively). Measurement items for avoidance and endorsement were specified at the individual level, and measures for quality of use were specified at the group level. Since our focus for this study was the individual level, we included only measures of avoidance (e.g., "If I can avoid using the system, I do" [reverse coded]) and endorsement (e.g., "I think the system is a waste of time and money for our organization" [reverse coded]).

4.2. Phase two: survey

The survey was carried out by searching for candidate companies at two sources: "Canada Top 1000" online database (from *The Globe and Mail 2002*), and SCOTT, a comprehensive database of Canadian companies. A letter was sent to 800 mid- to large-sized Canadian manufacturing companies, introducing the study and inviting participation from firms that had recently implemented a large-scale information system (e.g., SAP, Oracle, Peoplesoft). Ninety organizations responded to our survey, and 15 organizations gave us initial consent to pursue research. Further correspondence with these organizations resulted in seven firms that met our study conditions. A total of 422 questionnaires were distributed, 239 (56.6%) were returned, and 209 were usable. Demographic information for the sample is shown in Table 2.

There are several explanations for this low participation rate. First, many of the 800 firms that were originally contacted did not meet the basic condition of having recently implemented an enterprise-

Table 2
Demographic information.

	Count (%)	Mean (S.D.)
Gender		
Male	76 (56.3%)	
Female	59 (43.7%)	
Age		40.2 (11.0)
Educational background		
High school	4 (3.0%)	
Completed high school	14 (10.4%)	
Some college or university	36 (26.7%)	
Completed university	46 (34.1%)	
Some graduate work	10 (7.4%)	
Completed graduate work	25 (18.5%)	
Type of position		
Manager	57 (43.3%)	
Employee	76 (56.7%)	
Training		
Yes	59 (44.0%)	
No	75 (56.0%)	
Implementation experience		
None	91 (43.5%)	
1 prior implementation	24 (11.5%)	
2 or more prior implementations	81 (45.0%)	
Tenure in current position (year)		5.0 (5.6)

level information system; among the 90 initial respondents, only 35 firms met this condition. Second, among the 15 remaining organizations willing to engage in a research study, only seven met the condition of having completed their implementations within the previous 18 months. Third, we relied on a single contact person in each firm; multiple contacts would likely have boosted response rates (Dillman, 2000).

According to Armstrong and Overton (1977), late respondents are apparently less eager to participate in a survey, so they may serve as proxy's for non-respondents by comparing early responses to late responses. Therefore, we assessed non-response bias by comparing the demographic characteristics from the first batch of respondents (i.e., those received within the first 2 weeks after the survey was delivered) with those from the last batch (i.e., those received 2 months after delivery of the survey package). There were no significant differences in age, work experience, or job tenure (Hotelling's Trace = 1.034, $p = 0.235$), nor any significant discrepancies in position ($\chi^2 = 1.29$, $p = 0.256$), gender ($\chi^2 = 1.718$, $p = 0.190$), or education ($\chi^2 = 2.992$, $p = 0.224$).

The sample size for each organization varied from 30 to 42. The average respondent age was 40 years, the average time spent in service of the organization was approximately 8 1/2 years, and the average time holding the current position was a little more than 5 years. Of the 209 participants, 81 (38.8%) had completed a university or graduate degree, and 54 (25.8%) had completed high school or some college or university. Approximately 56% of respondents were male.

5. Results

We conducted data analyses using partial least squares (PLS), a structural equation modelling (SEM) technique that allows for the simultaneous assessment of the measurement and structural models. PLS differs from the more widely known covariance-based SEM techniques such as those implemented in LISREL or AMOS in that it maximizes variance explained (in a regression sense) in the dependent constructs. PLS is especially appropriate for early stage research where the purpose is theory exploration and prediction (Chin, 1998a,b). It does not demand multivariate normal data

(Barclay et al., 1995) and has less restrictive demands on sample size compared with other SEM techniques. For example, our sample size of 209 respondents easily exceeded the "10 times" PLS sample size heuristic described by Chin et al. (2003). Statistical significance of structural paths was tested using a bootstrap technique with 500 re-samples.

With PLS (as with other SEM techniques), the first step in assessing the measurement model is to evaluate individual item reliability. This was accomplished by examining the loadings of items on constructs, which as a general rule should exceed 0.70 (Chin, 1998a) as this implies that the construct explains at least 50% of the variance in the item. The first assessment of the measurement model revealed unacceptable loadings for two implementation effectiveness items ($\lambda = 0.57$, 0.63), two affective commitment items ($\lambda = 0.38$, 0.44), and one incentive item ($\lambda = 0.46$). Upon closer inspection we concluded that one of the weak implementation effectiveness items ("I am happy to do my part to make the system effective in my organization") did not fit conceptually with the others, which had to do with respondents' objective evaluations of the system), and so this item was dropped.

We reasoned that for both of the questionable affective commitment items ("I am not emotionally attached to using the system" and "I could not easily become as enthusiastic about using another system as I am about using the system"), users may have felt reluctant or unable to describe favourable feelings towards an adopted information system as an "emotional attachment," or to compare feelings

Table 3
Factor loadings and reliabilities.

	CLIMATE	FIT	SKILL	ABSENCE	COMMIT	INCENT	IE
$CLIMATE_{task}$	**0.87** (*T*-statistics = 87.6294[a])	0.46	0.44	0.60	0.34	0.39	0.47
$CLIMATE_{rew}$	**0.65** (*T*-statistics = 16.8789[a])	0.36	0.34	0.22	0.36	0.21	0.26
$CLIMATE_{mean}$	**0.89** (*T*-statistics = 78.6174[a])	0.33	0.39	0.41	0.30	0.36	0.35
$CLIMATE_{goal}$	**0.90** (*T*-statistics = 76.1169[a])	0.39	0.44	0.43	0.35	0.33	0.33
FIT_{FC}	0.36	**0.93** (*T*-statistics = 125.6148[a])	0.61	0.45	0.61	0.50	0.64
FIT_{QL}	0.38	**0.93** (*T*-statistics = 110.1553[a])	0.57	0.46	0.60	0.53	0.63
FIT_{LQ}	0.51	**0.86** (*T*-statistics = 57.6472[a])	0.63	0.57	0.57	0.47	0.63
SKILL1	0.35	0.48	**0.81** (*T*-statistics = 38.0387[a])	0.34	0.47	0.33	0.47
SKILL2	0.40	0.45	**0.79** (*T*-statistics = 21.7477[a])	0.43	0.40	0.35	0.42
SKILL3	0.32	0.56	**0.77** (*T*-statistics = 30.8285[a])	0.25	0.54	0.32	0.40
SKILL4	0.40	0.52	**0.74** (*T*-statistics = 32.0146[a])	0.27	0.49	0.28	0.34
SKILL5	0.40	0.54	**0.77**[a]	0.42	0.51	0.38	0.55
SKILL6	0.40	0.53	**0.71**[a]	0.35	0.42	0.31	0.39
ABSENCE1	0.48	0.41	0.42	**0.84**[a]	0.31	0.27	0.47
ABSENCE2	0.41	0.53	0.47	**0.80**[a]	0.33	0.37	0.50
ABSENCE3	0.33	0.33	0.12	**0.73**[a]	0.16	0.28	0.39
COMMIT1	0.30	0.41	0.45	0.29	**0.75**[a]	0.33	0.46
COMMIT2	0.24	0.27	0.30	0.14	**0.69**[a]	0.25	0.34
COMMIT3	0.36	0.66	0.62	0.38	**0.82**[a]	0.53	0.61
COMMIT4	0.26	0.52	0.41	0.18	**0.77**[a]	0.36	0.46
INCENT1	0.23	0.28	0.11	0.26	0.18	**0.70**[a]	0.40
INCENT2	0.39	0.56	0.50	0.35	0.57	**0.89**[a]	0.60
IE1	0.35	0.51	0.34	0.40	0.43	0.53	**0.77**[a]
IE2	0.27	0.41	0.32	0.35	0.36	0.46	**0.74**[a]
IE3	0.29	0.64	0.54	0.48	0.62	0.51	**0.85**[a]
IE4	0.40	0.62	0.51	0.50	0.61	0.55	**0.83**[a]
IE5	0.36	0.47	0.38	0.49	0.42	0.42	**0.67**[a]

[a] $p < 0.001$.

of emotional enthusiasm between systems. Finally, one incentive item was eliminated ("I was given incentives to use the system"). We reasoned that respondents may have considered this item related to concrete rewards, whereas the other two items measured respondent perceptions (i.e., "I am discouraged from using the system," and "I am motivated to use the system").

After dropping the unreliable items the model was retested using PLS (see loadings and cross-loadings in Table 3). Although four items in this analysis did not meet the strict 0.7 cutoff we elected to include them as they were very close (Wixom and Watson, 2001). Item wording for all construct measures is presented in Appendix A.

Convergent validity was evaluated by calculating the average variance extracted (AVE) for each construct; all constructs exceeded 0.5 (Fornell and Larcker, 1981). Internal consistency reliability was evaluated using the composite reliability approach developed by Werts et al. (1974), which is based on the actual item loadings, and therefore is considered a superior approach to Cronbach's α in assessing internal consistency (Chin and Gopal, 1995). As shown in Table 4, all composite reliabilities were above 0.70, indicating satisfactory internal consistency reliability.

To evaluate discriminant validity we examined item loadings and cross-loadings, as well as the square root of the average variance extracted for each construct. In terms of loadings and cross-loadings, each item loaded more highly on its associated construct than it did on other constructs in the model (i.e., as shown in Table 3, item loadings were higher than cross-loadings). Additionally, Table 4 shows that the square root of the average variance extracted for each construct (shown on the diagonal of the correlation matrix) was larger than the correlations with other constructs (Chin, 1998a).

With a satisfactory measurement model, the next step was to examine the structural relationships among constructs. As shown in Fig. 1, the model explains 63.4% of the variance in implementation effectiveness, which is significantly determined by skills ($\beta = 0.09$, $p < 0.01$), incentives ($\beta = 0.32$, $p < 0.001$), absence of obstacles ($\beta = 0.30$, $p < 0.001$), and affective commitment ($\beta = 0.32$, $p < 0.001$).

The results also show that implementation climate is a significant predictor of skills ($\beta = 0.49$, $p < 0.001$), incentives ($\beta = 0.40$, $p < 0.001$), and absence of obstacles ($\beta = 0.52$, $p < 0.001$) and explains 23.6%, 15.9%, and 27.0% of their variances, respectively. As predicted, innovation-values fit is also significantly and positively related to affective commitment ($\beta = 0.61$, $p < 0.001$), and explains 42.8% of the variance in commitment.

5.1. Testing the combined effect of climate and fit

We investigated Klein and Sorra's claim that an organization tends to achieve implementation effectiveness when it has a strong implementation climate and there is innovation-values fit (Klein and Sorra, 1996). To accomplish this we took the mean score for implementation climate and innovation-values fit and created two dichotomized variables (i.e., strong vs. weak climate, strong vs. weak fit). This gave rise to four categories (i.e., strong climate–strong fit, strong climate–weak fit; weak climate–strong fit, weak climate–weak fit) which we tested using an ANOVA with implementation effectiveness as the dependent variable. Results of the analysis showed that the mean of implementation effectiveness in the strong climate–strong fit group was significantly higher

Table 4
Construct correlations.

	# Items	Mean	S.D.	Composite reliability	CLIMATE	FIT	SKILL	INCENT	ABSENCE	COMMIT	IE
CLIMATE	**4**	**3.98**	**1.06**	**0.90**	**0.83**						
FIT	**3**	**4.65**	**0.99**	**0.93**	0.46	**0.91**					
SKILL	**6**	**4.40**	**1.25**	**0.90**	0.49	0.66	**0.75**				
ABSENCE	**3**	**3.49**	**1.33**	**0.83**	0.52	0.54	0.45	**0.79**			
COMMIT	**4**	**3.99**	**1.13**	**0.84**	0.39	0.65	0.62	0.35	**0.76**		
INCENT	**2**	**5.40**	**1.13**	**0.78**	0.40	0.55	0.43	0.39	0.51	**0.80**	
IE	**5**	**5.33**	**1.19**	**0.89**	0.43	0.70	0.56	0.58	0.64	0.64	**0.75**

Cells on diagonal contain square root of the average variance extracted. Cells on off-diagonal show construct correlations.

Table 5
Sobel test.

Independent variable	Mediators	Sobel test statistic	*p*-Value	Path coefficient (direct effect to IE)	*p*-Value
Implementation climate	Skills	0.635	n.s.	−0.03	n.s.
	Absence of obstacles	6.602	<0.001		
	Incentives	6.464	<0.001		
Innovation-values fit	Commitment	6.997	<0.001	0.25	<0.001

than that in the weak climate–weak fit group (difference = 1.80, $p < 0.001$), strong climate–weak fit group (difference = 1.48, $p < 0.001$), and weak climate–strong fit group (difference = 0.67, $p < 0.001$). Thus, we concluded that when implementation climate is strong and innovation-values fit is present, an implementation was more likely to succeed than when either climate or fit were weak.

5.2. Testing mediation effects

Previous studies of Klein and Sorra's model have examined the direct impact of implementation climate and innovation-values fit on implementation effectiveness (Holahan et al., 2004; Klein et al., 2001). Our model did not test such relationships. A question thus arises as to whether skills, incentives, and absence of obstacles, mediates the relationship between climate and effectiveness and whether commitment mediates the relationship between fit and effectiveness.

To test the mediating effects of these constructs, we conducted Sobel tests (Baron and Kenny, 1986; Preacher and Kayes, 2004; Sobel, 1982). For the mediating relationships between climate and effectiveness, the indirect path through skills was not significant, but the indirect paths through incentives (Sobel = 6.5; $p < 0.001$) and absence of obstacles (Sobel = 6.6; $p < 0.001$) were significant. Since the direct path from climate to effectiveness was insignificant (see Table 5), it appears that incentives and absence of obstacles fully mediated the relationship between climate and effectiveness. For the mediating relationship between fit and effectiveness Sobel's test was significant (Sobel = 7.0; $p < 0.001$). Furthermore, the direct path between fit and effectiveness remained significant as shown in Table 5. This led us to conclude that commitment partially mediated the relationship between fit and effectiveness. A summary of all test results is presented in Table 6.

Table 6
Summary of results.

No.	Hypothesis testing	Results
H1a	Implementation climate is positively associated with user skills	Supported
H1b	Implementation climate is positively associated with incentives	Supported
H1c	Implementation climate is positively associated with absence of obstacles	Supported
H2a	User skills are positively associated with implementation effectiveness	Supported
H2b	Incentives are positively associated with implementation effectiveness	Supported
H2c	Absence of obstacles is positively associated with implementation effectiveness	Supported
H3	Innovation-values fit is positively related to affective commitment	Supported
H4	Affective commitment is positively associated with implementation effectiveness.	Supported
Testing of the combined effect of climate and fit		
	Implementation effectiveness is the highest when climate is strong and fit is present	Confirmed
Testing of mediation effect		
	Mediating role of skills between implementation climate and implementation effectiveness	Not confirmed
	Mediating role of incentives between implementation climate and implementation effectiveness	Confirmed
	Mediating role of absence of obstacles between implementation climate and implementation effectiveness	Confirmed
	Mediating role of user commitment between innovation-values fit and implementation effectiveness	Partially confirmed

6. Limitations

Prior to discussing the results there are several limitations that should be addressed. First, our use of a cross-sectional survey may have resulted in common method bias. We attempted to address this concern by applying several techniques recommended by Podsakoff et al. (2003), including separating predictor variables from criterion variables, protecting respondent anonymity, and using high quality measurement items. Second, there is a potential endogeneity/reverse causality in Klein and Sorra's model—i.e., it is possible that incentives and the absence of obstacles contribute to a positive implementation climate. To reduce the likelihood of endogeneity, we used different verb tenses when constructing the wording of items in order to convey implied causality to the subject (i.e., past tense was used for the implementation climate items, and present tense was used for skills, absence of obstacles, and incentives). To further alleviate concerns of potential endogeneity between implementation climate and skills, and absence of obstacles and skills, a two-stage least squares regression was conducted (Bae and Lawler, 2000; Westphal, 1999).

We first selected an instrument variable readiness for change, a construct that is closely related to climate, but not to incentives, skills, and absence of obstacles. We then regressed implementation climate on readiness for change, and obtained factor scores for implementation climate, which were entered into PLS along with data for the remaining constructs in the Klein and Sorra model. The results indicated support for all hypotheses tested. To alleviate concerns as to the tautology between the measures of absence of obstacles and those of implementation effectiveness, we conducted two sensitivity tests by first dropping from the model one item from implementation effectiveness ("if I can avoid using the system, I do"), and then dropping one item from absence of obstacles ("there are a lot of organizational barriers that prevent me from using the system"). In both cases we re-ran the PLS model, and results continued to support all hypotheses.

Finally, Klein and Sorra's model was proposed as a multilevel model with constructs such as climate and innovation-values fit being considered as organizational-level variables, whereas this study examined these relationships at the individual level only, and thus deviated from Klein and Sorra's theoretical positioning. In response, we contend that the individual level results shown here provide an excellent starting point for examining large-scale information system innovations at different/multiple levels. Nevertheless, the individual-level orientation is a potential limitation of the current research, and we acknowledge that it does not fully represent Klein and Sorra's theory. Clearly, a study of multiple organizations with multiple users, using hierarchical linear modelling to understand both organizational and individual sources of variation, might be an ideal analytical method of choice going forward.

7. Discussion and conclusions

This article provides the first empirical test of a full range of antecedents of implementation effectiveness as proposed in Klein and Sorra's innovation implementation model, at the individual level, in the context of large-scale enterprise resource planning systems implementations. PLS results showed that 63.4% of the variance in implementation effectiveness was explained by skills, incentives, obstacles, and affective commitment, which in turn were significantly affected by implementation climate and innovation-values fit. Additionally, ANOVA analyses showed that a high level of implementation effectiveness was present only when implementation climate and innovation-values fit were strong. Furthermore, mediation analyses revealed the direct and indirect influence of innovation-values fit on implementation effectiveness, but failed to confirm the mediating effect of skills. We believe these findings present strong preliminary support for Klein and Sorra's model and its relevance to IS implementations.

First, our research offers an enriched understanding of salient predictors of implementation success of administrative innovation, which has been lacking in the innovation research to date (Damanpour and Gopalakrishnan, 1998). The systems investigated in this study were administrative innovations that bring radical changes to organizations. By comparing the findings of this research with those of the other two model-testing articles on technical innovations (Holahan et al., 2004; Klein et al., 2001), our study sheds light on the salient factors conducive to adoption of administrative

innovations, and potential differences in key variables resulting in the adoption of technical and administrative innovations.

Second, our findings confirm the importance of both compliance and internalization influence mechanisms, and also show that innovation-values fit exercises both direct and indirect influences on implementation effectiveness. This finding enriches the understanding of individual use of enterprise resource planning (ERP) systems, for which individual use is typically mandated by organizations. Research on ERP system usage speculates that user's favourable attitudes lead to system usage (Brown et al., 2002). Our research, however, indicates that it is the fit of the innovation with users' task-related values that determines consistent and quality system usage. This direct relationship of innovation-values fit sheds light on the hesitancy of users to adopt a new information system despite its technological soundness (Gill, 1995; Markus, 1983; Markus and Keil, 1994).

The findings warrant further research on antecedents of innovation-values fit. For example, experienced users are more likely to perceive an innovation as a fit than novice users. In the same vein, users with strong self-efficacy may see a strong fit, while those with lower self-efficacy may tend to feel the opposite way. Aside from individual characteristics, organizational factors (e.g., management supportive behaviors) may affect users' perception of innovation-values fit. For example, managers may engage in transformational leadership behaviors to encourage users to challenge the existing ways of doing things and to enhance users' self-efficacy. Additionally, future studies might include additional work-related values (e.g., creativity, autonomy) in the measures of innovation-values fit, and explore how various types of values-fit affect implementation outcomes. Furthermore, it would be intriguing to examine the effect of using values at different levels (general values, work values, or task-related values) on research outcomes.

Lastly, by testing the direct and indirect impacts of implementation effectiveness and innovation-values fit, we offer a unique understanding of the construct relationships at the individual level. The findings from this study are only applicable to ERP implementations in the manufacturing industry. However, the measurement items developed here may be used in future innovation implementation studies to examine direct and indirect relationships, at multiple levels and in different research contexts, in order to enrich our understanding of various IS adoption and implementation related issues. These measures, however, are mainly perceptual; future research should examine how objective measures differ from perceptual measures in engendering less within-group variability (Kozlowski and Klein, 2000).

This study has two important implications for professional managers. First, our results confirm that a successful implementation depends on a strong implementation climate and innovation-values fit. An organization's chance of success in their innovation implementation is in jeopardy if either aspect is overlooked. Second, our study directs managers' attention to the critical aspects of successful innovation implementations—to enhance skills, offer incentives, remove obstacles, and achieve a fit between the new innovation and potential users' daily work. In other words, providing hardware and software and offering training programs may not be effective if users feel that the problems they encounter have not been solved, or if they lack incentives to try the new innovation.

Organizations need to help potential users internalize the new innovation while creating a strong environment to facilitate the adoption process. Likewise, the strong influence of innovation-values fit on implementation effectiveness necessitates the involvement of potential users throughout the entire innovation implementation process. This supports many previous studies on the importance of user participation and involvement (e.g., Gill, 1996; Hartwick and Barki, 1994). In particular, organizations need to understand the ways in which users prefer to work, and by comparing the values held by users with the values embedded in the adopted innovation, organizations must develop a strategy to help users internalize the new innovation.

In summary, organizations have been facing challenges in achieving successful innovation implementations and need guidance in how to achieve implementation success. The Klein and Sorra model has the potential to provide such guidance. By testing the full range of antecedents of implementation effectiveness, our result highlights the importance of two influence mechanisms – implementation climate and innovation-values fit – in the implementation

process, and reveals that each influence mechanism exerts a different effect on implementation effectiveness.

Appendix A. Construct measures

A.1. Implementation climate (CLIMATE)

- Mean emphasis
  - Employees were told about the new work procedures for using the system.
  - Employees were told about the changes in the work procedures due to the implementation of the system.
  - Employees were told about the methods for using the system.
- Goal emphasis
  - Employees were told that what they needed to accomplish in using the system.
  - Employees were told the standards they had to meet in using the system.
  - Employees were told the types of outcomes that they needed to accomplish in using the system.
- Task support
  - Employees were provided all computer technology (e.g., hardware and software) necessary to perform their tasks with the system.
  - Helpful books, manuals, and online documents were available when employees had problems with the new system.
  - Employees were given sufficient time to learn the new system before they had to use it.
  - A "Help Desk" was available whenever people needed help with the system.
  - Additional training for the new system was available on request.
  - Money was readily available to support activities related to the implementation of the system.
- Reward emphasis
  - Employees were told the potential risk if they did not use the new system.
  - Employees perceived that the more they knew about the new system, the better their chances were of getting a job promotion.
  - Employees perceived that the better they were at using the new system, the more likely they were to get a bonus or raise.
  - Employees knew how their individual performances in using the new system was evaluated.
  - Employees perceived that they were going to be recognized for time and effort they spent in learning the system.

A.2. Innovation-values fit

- Fit re: Quality (FIT_{QL})
  - The system keeps data up-to-date for my task.
  - The system is missing critical data that would be very useful to my task.
  - The system helps me to get data that is current enough to meet my business needs.
  - The system maintains data I need to carry out my task.
  - Sufficiently detailed data are maintained by the system.
  - The system keeps data at an appropriate level of details so that I can complete my tasks.
- Fit re: Locatibility (FIT_{LO})
  - The definition of data fields relating to my task is easy to find out in the system.
  - The system helps me locate corporate or department data very easily.
  - It is easy to find out what data the system maintains on a given subject.
  - The system helps me understand the meaning of data very easily.
- Fit re: Flexibility and cooperation (FIT_{FC})
  - The system supports the repetitive and predictable work processes.
  - The system supports cooperation between departments.

The system assists me in developing diverse abilities and capabilities that are required to complete my job.

A.3. Skills

I am very knowledgeable about how the system works.
I understand all of the special features of the system.
I can enter data into the system whenever I need to.
I know how data in my functional department links to data in other departments.
I know which departments receive the information I input into the system.
I can interpret the data shown in the system without problems.

A.4. Absence of obstacles

Due to the lack of organizational resources (e.g., time, training), I have faced a lot of difficulties in learning to use the system.
Due to the lack of technical support, I have found the system difficult to use.
There are a lot of organizational barriers that prevent me from using the system effectively.

A.5. Incentives

I am discouraged from using the system.
I am motivated to use the system.

A.6. Commitment

Using the system is personally meaningful to me.
I enjoy discussing my experiences in using the system with my colleagues.
I really feel as if the system is my system.
I like to spend time mastering the system.

A.7. Implementation effectiveness

I think the system is a waste of time and money for our organization (reverse).
If I had my way, this plant would go back to the old way and forget the system (reverse).
If I can avoid using the system, I do (reverse).
When I can do a task either using the system or not using the system, I usually choose not to use it (reverse).
Even when I can do a task using the system, I sometimes use other ways to complete the task (reverse).

References

Aiman-Smith, L., Green, S.G., 2002. Implementing new manufacturing technology: the related effects of technology characteristics and user learning activities. Academy of Management Journal 45 (2), 421–430.
Armstrong, J.S., Overton, T.S., 1977. Estimating nonresponse bias in mail surveys. Journal of Marketing Research 14 (3), 396–402.
Bae, J., Lawler, J.J., 2000. Organizational and HRM strategies in Korea: impact on firm performance in an emerging economy. Academy of Management Journal 43 (3), 502–517.
Barclay, D., Higgins, C., Thompson, R.L., 1995. The partial least square (PLS) approach to causal modeling: personal computer adoption and use as an illustration. Technology Studies 2 (2), 285–309.
Baron, R.M., Kenny, D.A., 1986. The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology 51, 1173–1182.
Bostrom, r.P., Olfman, L., Sein, F M.K., 1988. End-user computing: a research framework for investigating the training/learning process. In: Carey, J.M. (Ed.), Human Factors in Management Information Systems. Ablex, New York, pp. 221–250.

Brown, S.A., Massey, A.P., Montoya-Weiss, M.M., Burkman, J.R., 2002. Do i really have to? User acceptance of mandated technology. European Journal of Information Systems 11 (4), 283–295.
Cambell-Kelly, M., 1996. Information technology and organizational change in the British census 1801–1911. Information Systems Research 7 (1), 22–36.
Chin, W.W., 1998a. Issues and opinion on structural equation modeling. MIS Quarterly 22 (1), vii–xvi.
Chin, W.W., 1998b. The partial least squares approach to structural equation modeling. In: Marcoulides, G.A. (Ed.), Modern Methods for Business Research. Lawrence Erlbaum Associates, New Jersey, pp. 295–336.
Chin, W.W., Gopal, A., 1995. Adoption intention in GSS: relative importance of beliefs. Database for Advances in Information Systems 26 (2/3), 42–64.
Chin, W.W., Marcolin, B., 2001. The future of diffusion research. Database for Advances in Information Systems 32 (3), 8–12.
Chin, W.W., Marcolin, B., Newstead, P., 2003. A partial least squares latent variable modeling approach for measuring interaction effects: results from a Monte Carlo simulation study and an electronic mail emotion/adoption study. Information Systems Research 14 (2), 189–217.
Cohen, J., 1960. A coefficient of agreement for nominal scales. Educational and Psychological Measurements 20 (1), 37–46.
Compeau, D., Higgins, C., 1995a. Computer self-efficacy: development of a measure and initial test. MIS Quarterly 95 (9), 189–211.
Compeau, D., Higgins, C., 1995b. Application of social cognitive theory to training for computer skills. Information Systems Research 6 (2), 118–144.
Compeau, D., Higgins, C., Huff, S., 1999. Social cognitive theory and individual reactions to computing technology: a longitudinal study. MIS Quarterly 23 (2), 145–159.
Daft, R.L., 1978. A dual-core model of organizational innovation. Academy of Management Journal 21 (2), 193–210.
Damanpour, F., 1991. Organizational innovation: a meta-analysis of effects of determinants and moderates. Academy of Management Journal 34 (3), 555–590.
Damanpour, F., Gopalakrishnan, S., 1998. Theories of organizational structure and innovation adoption: the role of environmental change. Journal of Engineering and Technology Management 15 (1), 1–24.
Davenport, T.H., 1998. Putting the enterprise into the enterprise systems. Harvard Business Review 76 (4), 121–131.
Davenport, T.H., 2000. Mission Critical: Realizing the Promise of Enterprise Systems. Harvard Business School Press, Boston, MA, 352 pp.
Davis, F.D., 1989. Perceived usefulness, perceived ease of use and user acceptance of information technology. MIS Quarterly 13 (3), 319–340.
DeLone, W.H., McLean, E.R., 2003. The DeLone and McLean model of information systems success: a ten-year update. Journal of Management Information Systems 19 (4), 9–30.
DeSanctis, G., Poole, M.S., 1994. Capturing the complexity in advanced technology: adaptive structuration model. Organization Science 5 (2), 121–147.
Dillman, D.A., 2000. Mail and Internet Surveys: The Tailored Design Method. John Wiley & Sons Inc., 480 pp.
Elizur, D., Sagie, A., 1999. Facets of personal values: a structural analysis of life and work values. Applied Psychology: An International Review 48 (1), 73–87.
Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research 18 (1), 39–50.
Giddens, A., 1984. The Constitution of Society: Outline of the Theory of Structure. University of California Press, Berkeley, CA, 417 pp.
Gill, T.G., 1995. Early expert systems: where are they now? MIS Quarterly 19 (1), 51–76.
Gill, T.G., 1996. Expert systems usage: task change and intrinsic motivation. MIS Quarterly 20 (3), 301–329.
Goodhue, D.L., 1995. Understanding user evaluations of information systems. Management Science 41 (12), 1827–1844.
Goodhue, D.L., Thompson, R.L., 1995. Task-technology fit and individual performance. MIS Quarterly 19 (2), 213–236.
Gopalakrishnan, S., Bierly, P., 2001. Analyzing innovation adoption using a knowledge-based approach. Journal of Engineering and Technology Management 18 (2), 107–130.
Grover, V., 1999. From business reengineering to business process change management: a longitudinal study of trends and practices. IEEE Transactions on Engineering Management 46 (1), 36–46.
Hackett, R.D., Bycio, P., Hausdorf, P.A., 1994. Further assessments of Meyer and Allen's (1991) three-component model of organizational commitment. Journal of Applied Psychology 79 (1), 15–23.
Hackman, J.R., Oldham, G.R., 1980. Work Redesign. Addison-Wesleyx, Reading, MA, 330 pp.
Hartwick, J., Barki, H., 1994. Explaining the role of user participation in information system use. Management Science 40 (4), 440–465.
Holahan, P.J., Aronson, Z.H., Jurkat, M.P., Schoorman, F.D., 2004. Implementing computer technology: a multiorganizational test of Klein and Sorra's model. Journal of Engineering and Technology Management 21 (1), 31–50.
Igbaria, M., Gamers, T., Davis, G.B., 1995. Testing the determinants of microcomputer usage via a structural equation model. Journal of Management Information Systems 11 (4), 87–114.
Josh, K., 1991. A model of users' perspective on change: the case of information systems technology implementation. MIS Quarterly 15 (2), 229–242.
Kimberly, J.R., Evanisko, M.J., 1981. Organizational innovation: the influence of individual, organizational, and contextual factors on hospital adoption of technological and administrative innovations. Academy of Management Journal 24 (4), 689–713.
Klein, K.J., Conn, A.B., Sorra, J.S., 2001. Implementing computerized technology: an organizational analysis. Journal of Applied Psychology 86 (5), 811–824.
Klein, K.J., Ralls, R.S., Carter, P.O., 1989. The Implementation of a Computerized Inventory Control System. University of Maryland, College Park.
Klein, K.J., Sorra, J.S., 1996. The challenge of innovation implementation. Academy of Management Review 21 (4), 1055–1080.
Kolb, D.A., Frohman, A.L., 1970. An organizational development approach to consulting. Sloan Management Review 12 (1), 51–65.

Kopelman, R.E., Brief, A.P., Guzzo, R.A., 1990. The role of climate and culture in productivity. In: Schneider, B. (Ed.), Organizational Climate and Culture. Jossey-Bass Inc., San Francisco, CA, pp. 282–318.
Kozlowski, S.W.J., Klein, K.J., 2000. A multilevel approach to theory and research in organizations: contextual, temporal, and emergent processes. In: Klein, K.J., Kozlowski, S.W. (Eds.), Multilevel Theory, Research, and Methods in Organizations. Jossey-Bass, San Francisco, pp. 3–90.
Kwon, T.H., Zmud, R.W., 1987. Unifying the fragmented models of information systems implementation. In: Hirschheim, B.R. (Ed.), Critical Issues in Information Systems Research. John Wiley and Sons Ltd., New York, pp. 227–252.
Leonard-Barton, D., 1988. Implementing as mutual adaptation of technology and organization. Research Policy 17 (5), 251–267.
Lewin, K., 1947. Frontiers in group dynamics II: channels of group life: social planning and action research. Human Relations 1 (2), 143–153.
Lewin, K., 1952. Group decision and social change. In: Newcomb, T.M., Hartley, E.L. (Eds.), Readings in Social Psychology. Henry Holt, New York, NY, pp. 459–473.
Lucas Jr., H.C., Ginzberg, M.J., Schultz, R.L., 1990. Information Systems Implementation: Testing a Structural Model. Ablex Publishing Corporation, Norwood, New Jersey, 192 pp.
Malik, S.D., Wilson, D.O., 1995. Factors influencing engineers' perceptions of organizational support for innovation. Journal of Engineering and Technology Management 12 (3), 201–218.
Markus, L.M., 1983. Power, politics, and MIS implementation. Communications of the ACM 26 (6), 430–444.
Markus, L.M., Axline, S., Petrie, D., Tanis, C., 2000. Learning from adopters' experiences with ERP: problems encountered and success achieved. Journal of Information Technology 15 (4), 245–265.
Markus, L.M., Keil, M., 1994. If we build it, they will come: designing information systems that people want to use. Sloan Management Review 35 (4), 11–25.
Markus, L.M., Tanis, C., 2000. The enterprise systems experience from adoption to success. In: Zmud, R.W., Price, M.F. (Eds.), Framing the Domains of it Management: Projecting the Future Through the Past. Pinnaflex Educational Resources Inc., Ohio, Pinnaflex, pp. 173–209.
Mathieson, K., 1991. Predicting user intentions: comparing the technology acceptance model with the theory of planned behavior. Information Systems Research 2 (3), 173–191.
Mathieson, K., Peacock, E., Chin, W.W., 2001. Extending the technology acceptance model: the influence of perceived user resources. Database for Advances in Information Systems 32 (3), 86–112.
Meyer, J.P., Allen, N.J., 1991. A three-component conceptualization of organizational commitment. Human Resource Management Review 1 (1), 61–89.
Moore, G.C., Benbasat, I., 1991. Development of an instrument to measure the perceptions of adopting an information technology innovation. Information Systems Research 2 (3), 192–222.
Newman, M., Noble, F., 1990. Use involvement as an interaction process: a case study. Information Systems Research 1 (1), 89–113.
Nystrom, P.C., Ramamurthy, K., Wilson, A.L., 2002. Organizational context, climate and innovativeness: adoption of imaging technology 19 (3) 221–247.
O'Connor, G.C., McDermott, C.M., 2004. The human side of radical innovation. Journal of Engineering and Technology Management 21 (1), 11–30.
Piderit, S.K., 2000. Rethinking resistance and recognizing ambivalence: a multidimensional view of attitudes toward an organizational change. Academy of Management Review 25 (4), 783–794.
Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., Podsakoff, N., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. Journal of Applied Psychology 88 (5), 879–903.
Preacher, K.J., Kayes, A.F., 2004. SPSS and SAS procedure for estimating indirect effects in simple mediation models. Behavior Research Methods, Instruments, & Computers 36 (4), 717–731.
Roe, R.A., Ester, P., 1999. Values and work: empirical findings and theoretical perspective. Applied Psychology: An International Review 48 (1), 1–21.
Roepke, R., Agarwal, R., Ferratt, T.W., 2000. Aligning the IT human resource with business vision: the leadership initiative at 3m. MIS Quarterly 24 (2), 327–353.
Rokeach, M., 1973. The Nature of Human Values. Free Press, New York, 438 pp.
Siders, M.A., George, G., Dharwadkar, R., 2001. The relationship of internal and external commitment foci to objective job performance measures. Academy of Management Journal 44 (3), 570–579.
Sobel, M.E., 1982. Asymptotic intervals for indirect effects in structural equations models. In: Leinhart, S. (Ed.), Sociological Methodology. Jossey-Bass, San Francisco, pp. 290–312.
Stoddard, D.B., Jarvenpaa, S.L., 1995. Business process redesign: tactics for managing radical change. Journal of Management Information Systems 12 (1), 81–107.
Sussmann, M., Vecchio, R.P., 1982. A social influence interpretation of worker motivation. Academy of Management Review 7 (2), 177–186.
Swanson, E.B., 1994. Information systems innovation among organizations. Management Science 40 (9), 1069–1092.
Tabak, F., Barr, S.H., 1999. Propensity to adopt technological innovations: the impact of personal characteristics and organizational context. Journal of Engineering and Technology Management 16 (3-4), 247–270.
Taylor, S., Todd, P.A., 1995. Understanding information technology usage: a test of competing models. Information Systems Research 6 (2), 144–176.
The Standish Group International Inc., 1995. Chaos (Application Project Failure and Success). Access http://www.standishgroup.com/chaos.html.
Valle, R., Fernando, M., Romero, P.M., Dolan, S.L., 2000. Business strategy, work processes and human resource training: are they congruent? Journal of Organizational Behavior 21 (3), 283–297.
Venkatesh, V., 1999. Creation of favorable user perceptions: exploring the role of intrinsic motivation. MIS Quarterly 23 (2), 239–260.
Venkatesh, V., Brown, S.A., 2001. A longitudinal investigation of personal computers in homes: adoption determinants and emerging challenges. MIS Quarterly 25 (1), 71–102.

Venkatesh, V., Morris, M.G., Davis, G.B., Davis, F.D., 2003. User acceptance of information technology: toward a unified view. MIS Quarterly 27 (3), 425–478.
Walton, R.A., 1985. From control to commitment in the workplace. Harvard Business Review 63 (2), 77–84.
Werts, C.E., Linn, R.L., Jöeskog, K.G., 1974. Intraclass reliability estimates: testing structural assumptions. Educational and Psychological Measurement 34 (1), 25–33.
Westphal, J.D., 1999. Collaboration in the boardroom: behavioral and performance consequences of CEO-board social ties. Academy of Management Journal 42 (1), 7–24.
Whittaker, B., 1999. What went wrong? Unsuccessful information technology projects. Information Management & Computer Security 7 (1), 23–29.
Wixom, B.H., Watson, H., 2001. An empirical investigation of the factors affecting data warehousing success. MIS Quarterly 25 (1), 17–41.