PSYCHOLOGICAL AND ORGANIZATIONAL FACTORS INFLUENCING DECISION PROCESS INNOVATION: THE ROLE OF PERCEIVED THREAT TO MANAGERIAL POWER

Kelly E. See
Wharton School
University of Pennsylvania
3730 Walnut St.
Philadelphia, PA 19104
kelly@wharton.upenn.edu

Robert T. Clemen
Fuqua School of Business
Duke University
Box 90120
Durham, NC 27708
clemen@duke.edu

September 3, 2005

We are grateful to Cade Massey, Michael Roach, Scott Rockart, Carmen Weigelt, and the late Gerry DeSanctis for helpful comments and suggestions on previous versions of this manuscript.

PSYCHOLOGICAL AND ORGANIZATIONAL FACTORS INFLUENCING DECISION PROCESS INNOVATION: THE ROLE OF PERCEIVED THREAT TO MANAGERIAL POWER

ABSTRACT

Organizations often face complex choices involving uncertainty, trade-offs, and broad consequences, but responding to such situations in rational ways can be hampered by individual decision makers' cognitive limitations. The framework of decision analysis (DA) provides a unified collection of analytical decision-making tools and procedures that are designed to help managers cope with difficult decisions, yet little is known about what influences the ability of firms to innovate with respect to decision-making practices. This paper investigates factors that facilitate and impede adoption of *decision process innovations*. Integrating individual-level theories of technology acceptance and managerial innovation with organization-level theories of innovation, we present the results of a multilevel empirical survey of 160 senior managers from a variety of organizations. Our survey incorporates measures of individual psychological perceptions, organization structure, and environmental context. We find support for many of the variables that have previously been found to predict innovation, namely attitudes toward the innovation, organizational culture, degree of centralization, and concerns for legitimacy in the institutional environment. Furthermore, we examine a previously unexplored individual-level issue in innovation research, perceived threat to managerial value and control, and find that a key barrier to decision process innovation is the tendency for managers to perceive such innovations as threats to their own value, discretion, and control. This impediment to innovation is mitigated by highly formalized organizational structures, presumably because such structures are characterized by strict rules and hierarchy that are perceived to preserve authority and power.

Keywords: *decision processes; innovation; decision analysis; power; control; multilevel research*

In the face of uncertainty and change, managers must evaluate options, consider trade-offs, and anticipate consequences of choices that can have far-reaching effects. With a myriad of time, cost, and processing constraints, decision makers often fall short of rationality (March & Simon, 1958; Cyert & March, 1962/1992; Tversky & Kahneman, 1974; Payne, Bettman, & Johnson, 1993; Wilson & Brekke, 1994; Rabin, 1998). Many managerial tasks and situations can benefit from structured tools and approaches for appraising, framing, and analyzing decisions (Raiffa, 1968; Keeney & Raiffa, 1976; Clemen, 1996; Clemen & Kwit, 2001). Yet while such concepts and techniques are readily available and widely taught, little is known about the actual decision-making practices among organizations, and there has been no systematic empirical investigation into the issues that might influence the use of various types of decision-analytic practices. What psychological and organizational factors lead some individuals and organizations to adopt new decision practices while others cling to established procedures? We argue that this question fundamentally pertains to process innovation and organizational change, and we invoke the substantial theoretical work in these areas as a basis for investigating the unknown factors that facilitate or inhibit the adoption of *decision process innovations*.

Using the unified framework of decision analysis (DA) as our measure of decision process innovation, we undertake this research question from three levels of analysis: psychological factors of individuals within the organization, organizational culture and structure, and features of the industry or environmental context. We argue that studying the extent of decision process innovation adoption in organizations inherently requires consideration of multiple levels, because the ability of individual decision makers to change practices is likely to be affected both by their own personal characteristics and by prevailing norms, structural elements, and institutional forces faced by organizations as a whole. Indeed, the multilevel nature of innovation is acknowledged frequently by both macro-level innovation researchers (Rogers, 1962/2003; Hage & Dewar, 1973; Downs & Mohr, 1976; Pierce & Delbecq, 1977; Kimberly & Evanisko, 1981; Leonard-Barton & Deschamps, 1988; Isabella, 1990; Damanpour, 1991; Slappendel, 1996) and micro-level innovation and creativity researchers (McLean, 2005; Anderson, DeDreu, Nijstad, 2004; Choi, 2004; Oldham & Cummings, 1996). Moreover, the literature on acceptance

of technology sheds light on the relationship between the innovation characteristics and its adoption (e.g., Rogers, 1962/2003; Tornatzky and Klein, 1982; Davis, 1989; Karahanna & Straub. 1999), as well as the importance of individual attitudes toward an innovation (e.g., Davis, 1993; Lewis, Agarwal, & Sambamurthy, 2003), but researchers have noted the need to study these variables in conjunction with other relevant innovation predictors, such as organizational features (Tornatzky and Klein, 1982). By integrating these diverse literatures, we attempt to systematically incorporate key individual-level and organization-level theories and past predictors of innovation to gain insights into the factors affecting decision process innovation.

Furthermore, we draw on research in social psychology and organizational behavior to examine a previously unexplored issue in innovation research, perceived threats to managerial value, control, and power. Studies focused on the acceptance of specific new technologies have noted that organizational actors are often highly resistant to these new practices (e.g., Hoch & Schkade, 1996; Kaplan, Reneau, & Whitecotton, 2001; Kottemann & Davis, 1991), with some noting the importance of work autonomy and control over the choice to adopt the technology (Agarwal & Prasad, 1997; Green, Collins, & Hevner, 2004). We argue that there is a separate unexplored control-related barrier to innovation that arises from the fact that process innovation involves a change in current practices that may lead managers to perceive a threat to their value, control, and discretion over their own and others' outcomes. Finally, we consider how the organizational-level structure variables of centralization and formalization might interact with such individual perceptions of power and control to affect the extent of decision process innovation.

DECISION PROCESS INNOVATION

Rogers (1962/2003, p. 11) provides a straightforward definition of innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption." According to this definition, what is "new" is not an objective characteristic, but depends on the potential adopter's perception and experience with the object (Rogers, 1962/2003; Zaltman, Duncan, & Nolbeck, 1973). We chose to use the framework of *decision analysis* (DA) as our measure of decision process innovation for two main reasons. First, it is a framework that unifies a comprehensive group of tools, methods, and

approaches designed to help minimize decision-making biases and facilitate a more systematic decision-making process. Second, it is a substantial and coherent discipline within management science that has been taught in business and engineering schools for decades, thus it should be familiar to many organizational actors.

Based on Clemen (1996) and other widely accepted characterizations (e.g., Raiffa ,1968; Keeney & Raiffa, 1976; Bunn, 1984), we define decision analysis as *a framework that includes systematic processes and procedures to help decision makers focus on complexities and uncertainties in the decision situation, and identify preferences and value trade-offs for stakeholders.* DA may include any or all of the following: tools for framing a problem; tools for creating alternatives; systematic sensitivity analysis; processes for obtaining information from experts; methods for explicitly dealing with uncertainty; tools for addressing multiple conflicting objectives; and organizational processes that involve participants and decision makers. DA is founded on principles of expected utility theory and is thus akin to the way that organizational theorists have characterized the "rationality" of a decision process (e.g., Ford & Gioia, 2000, p. 712). DA can include not only traditional quantitative and technological decision tools (e.g., cost-benefit analysis, decision trees), but also systematic qualitative approaches that institutionalize specific steps in a decision-making process, involve stakeholders in the process, and delineate specific roles for decision makers (e.g., Keeney, 1992; Bodily & Allen, 1999).

We view the adoption and use of DA as a process innovation with respect to current decision making practices, or more specifically, as an internal administrative process innovation (Damanpour, 1991). DA is not a process innovation that is "installed" and subsequently used, such as a production process or hardware alterations, but rather typically relies on individual managers or units choosing to invoke DA techniques and tools as needed. Similar administrative processes have been fruitfully investigated as innovations in the past, such as such as TQM, HRM techniques, and Six Sigma (e.g., Baer & Frese, 2003; Choi, 2004).

In the following sections we draw on theoretical and empirical work spanning the literatures on change, innovation, technology acceptance, psychology, and organizational behavior to generate

multilevel hypotheses on the factors influencing the extent of adoption of decision process innovation. We organize the hypotheses based on the level of theory, moving from the individual level to the organization and finally to environmental and industry factors. In doing so, we introduce the unexplored individual-level issue of perceived threat to managerial value and control, and consider how these perceptions might interact with the organizational-level variables of centralization and formalization to affect the extent of decision process innovation. We then present the results of an empirical study of senior managers across organizations designed to test our multilevel predictions, and close with a discussion of the implications of our findings for innovation and decision-making research.

HYPOTHESES

Individual-Level Factors

*Individual Change Attitudes***.** Early innovation theories considered the role of individuals to be a fundamental issue behind the innovation, change, and adoption of new ideas and practices (Lewin, 1947; Rogers, 1962/2003). Change can be difficult, and individuals can be biased toward the status quo (Landman, 1987) and tend to regret action more than inaction (Spranca, Minsk, & Baron, 1991). Though a great deal of innovation research has focused more on the organization level of analysis (e.g., Burns & Stalker, 1961/1994; Damanpour, 1991; Zaltman et al. 1973), attitudes and values of individuals within an organization have been recognized as influential in the ability of the organization to innovate (Rogers, 1962/2003; Pierce & Delbecq, 1977; Isabella, 1990; Slappendel, 1996; Weaver, Trevino, & Cochran, 1999; Lewis, Agarwal, & Sambamurty, 2003). Moreover, some studies have found that values of senior managers explained more variance in innovation than structural variables (Hage & Dewar, 1973, Hambrick & Mason, 1984; Pettigrew, 1992, Wiesema & Bantel, 1992). Consistent with this past research, we expect that the general managerial disposition toward change will positively affect decision process innovation.

Hypothesis 1: The more favorable an individual's general disposition toward change, the greater the extent of innovation adoption.

Attitudes Toward Technical Material. Given that decision process innovations can sometimes involve technical or quantitative information or methods, innovation adoption might be shaped by general

attitudes toward technology and mathematical or statistical concepts (e.g., probability, risk). Early work in the management information systems literature by Lucas (1975) suggested that "attitudes and perceptions" are key determinants of technology use. Indeed, some individuals are fundamentally suspicious of technical and quantitative approaches (Berry, 1997). Individuals are often reluctant to rely on a quantitative model or technological tool for decisions of importance, especially high-risk situations where human welfare is in play (Kleinmuntz, 1990). Arkes, Dawes, and Christensen (1986) found that those who believed they possessed expertise in a domain were less likely to use a formal decision rule in a probabilistic task and were more confident in their performance, even though they actually performed worse. Incentives for accuracy have been shown to result in even less use of decision rules, suggesting that people ultimately view their own ability as more reliable and trustworthy when a decision "matters" in some way (Arkes et al., 1986; Hoch & Schkade, 1996). Managers might prefer unsophisticated methods of decision making because formal decision aids can introduce decisional conflict by making the risk, uncertainty, complexity, and trade-offs in a given situation more salient (Kottemann & Davis, 1991). Individuals generally only deal with the concept of risk in the context of emotionally disturbing issues, such as diseases and causes of death. Thus, it is conceivable that some individuals respond affectively to the *notion* of risk itself (Larrick, 1993; Loewenstein, Weber, Hsee, & Welch, 2001) and may wish to avoid such information. Taken together, we view aversion to computer models, quantitative treatments of risk and uncertainty, and other related technical activities as an individual difference variable that would negatively influence the adoption of decision process innovation.

Hypothesis 2: The greater the aversion to technical material and approaches, the lower the extent of innovation adoption.

Innovation Characteristics. Perhaps the most direct influences on decision process innovation stem from individuals' specific perceptions about the characteristics of the innovation. The substantial literatures on innovation characteristics and technology acceptance have pointed to the role of reasoned action, such that beliefs and attitudes about an object influence behavior and willingness to use that object (Fishbein & Ajzen, 1975; Davis, 1989; Karahanna & Straub, 1999). The influential work of Rogers (1962/2003) proposed five characteristics of an innovation that determine its use, including relative

advantage over existing practices, compatibility of the innovation with existing needs and values, complexity or difficulty of use, the extent to which an innovation can be tried before adoption, and observability of the outcome. A meta-analysis by Tornatzky and Klein (1982) examined the effects of these five characteristics on implementation of an innovation, finding the most influential characteristics to be compatibility, relative advantage, and complexity. In turn, technology acceptance studies have emphasized the role of perceived usefulness and perceived ease of use, and the importance of these factors appears to be fairly robust (Ives & Olson, 1984; Davis, 1989; Davis, Bagozzi, & Warshaw, 1989; Moore & Benbasat, 1991; Karahanna & Straub, 1999; Venkatesh & Davis, 2000).

Additionally, issues surrounding expected outcome quality and demonstrability of results from using the innovation have been found to be relevant (Moore & Benbasat, 1991; Karahanna & Straub, 1999; Venkatesh & Davis, 2000). When used appropriately, the innovation that we are studying here is designed to improve decision *process*, which presumably increases the chance of a favorable outcome, but such procedures cannot guarantee that a desired outcome will transpire. Neverthleless, we surmise that the actual demonstrability of the results is not likely to be as important as are the general perception that the innovation adds value and "gets results." Although many aspects of decision process innovation entail only qualitative problem structuring and involve no technology whatsoever, the basic characteristics discussed above should apply to any potential target of innovation, whether technological or not. Thus, we predict that the perceived usefulness, perceived ease of use, and perceptions that the innovation leads to valuable results will positively affect innovation adoption.

Hypothesis 3_a: The greater the perceived usefulness of the innovation, the greater the extent of innovation adoption.

Hypothesis 3_b: The greater the perceived ease of use of the innovation, the greater the extent of innovation adoption.

Hypothesis 3_c: The greater the perception that the innovation leads to demonstrable results, the greater the extent of innovation adoption.

Perceived Threats to Managerial Value and Control. In addition to perceived innovation characteristics that affect the logistics of usage such as ease of use, we propose that process innovation might raise potential instrumentality concerns for managers. Although decision process innovation can

provide a way for decision makers to identify preferences, resources, and the nature of the competitive landscape, the very presence of such approaches to "aid" decisions could make some individuals feel uncomfortable about their own ability to make effective decisions. Thus, managers may resist innovation adoption because they perceive that adoption is a signal or threat to their own value, contribution, or credibility as a leader. Despite the fact that decision process innovations rely entirely on decision makers to structure the information and make a choice, a manager may still feel that using such approaches is a threat to his or her professional expertise or intuition (sources of expert power), especially to the extent that such tools are perceived as having the capacity to provide a "best" or optimal alternative.

Several studies focused on the acceptance of specific technologies (e.g., Berry, 1997; Hoch & Schkade, 1996; Kaplan et al., 2001; Kottemann & Davis, 1991) have documented that organizational actors are often highly resistant to these new practices. Though some researchers considered the importance of perceived control in the acceptance of these technologies (e.g., Berry, 1997; Kaplan et al., 2001), they have generally been focused on the issue of *personal* control in terms of the extent to which individuals have the freedom to choose whether or not to adopt (Agarwal & Prasad, 1997; Green et al., 2004) or are otherwise involved in the innovation adoption process (Ives & Olson, 1984; Baronas & Louis, 1988; Kaplan et al., 2001). Such concerns for control, work autonomy, and freedom of choice could be relevant for many kinds of innovation and change, particularly in the case of heavily technological innovations or automated systems that are perceived as potentially displacing the worker (Berry, 1997; Kaplan et al., 2001). However, decision process innovation as defined above may involve little or no technology, the decision maker is both central and necessary, and use of the procedures is typically elective. We propose instead that decision making is viewed as an aspect of managerial control, including the power to choose among alternative courses of action and thereby influence one's own and others' outcomes. Thus, individuals may perceive decision making as a source of value, control, and power, a perception that may be threatened by changes in current practices inherent in decision process innovation. Suggestive evidence of this can be seen in a study of creativity in decision making by Ford and Gioia (2000, Table 1), in which decision processes that were characterized as more "rational" (as

measured by the extent which decision makers looked for information, considered alternatives, and used analytical techniques) were associated with less perceived managerial discretion and authority.

Moreover, one of the major tenets of decision theory is that sound decision making depends on thorough understanding of stakeholder preferences and collection of information from experts, which means involving people in the decision-making process. Early social psychological research on procedural justice showed that involving people in decision-making processes greatly increases their acceptance of the outcome, in part due to increased perceptions of process control and decision control (Thibault & Walker, 1975), especially for less powerful or lower status groups. Yet relative to lower status people, higher status people are expected to assign greater importance to *maintaining* their existing status (Chen, Brockner, & Greenberg, 2003). Hence, from the perspective of managers, involving others (i.e., stakeholders, experts) in decision making might be seen as reducing their own control and power. For all of the reasons provided above, we hypothesize that adoption of a decision process innovation will be reduced to the extent that the innovation is perceived to decrease a manager's control or diminish his or her sense of value.

Hypothesis 4: The greater the perception that the innovation threatens managerial value and diminishes control over the process, the lower the extent of innovation adoption.

Organization-Level Factors

Organizational Culture. In addition to managers' individual attitudes toward change, their perception of the organization's ability to change is expected to play a role in innovation adoption. Zaltman, et al. (1973) suggest that for innovation to occur and be successful, there must be a perception among managers and other users that the organization can adapt and implement the new processes. These perceptions are likely to derive from the prevailing organizational climate or culture and whether it embodies norms and expectations that support openness, change, and risk-taking (e.g., O'Reilly, 1989; Baer & Frese, 2003). Cultures that are able to signal support for change in this way have been studied in terms of their importance in fostering innovation and creativity (e.g., O'Reilly, 1989; Klein & Sorra, 1996; Tesluk, Farr, & Klein, 1997; Klein, Conn, & Sorra, 2001; Baer & Frese, 2003; McLean, 2005). Organizations and the individuals within them are entrenched in routines and standards that add

legitimacy to their activities and are critical to the ability of the organization to function effectively. Extensive change is in some ways a threat to the functioning of an organization, and organizational routines and core processes become a source of inertia against change (Nelson and Winter, 1982; Leonard-Barton, 1992). This is further confounded by the possibility that selection processes may favor organizations whose structures are difficult to change (Hannan & Freeman, 1984). Certain organizational cultures may place a value on the "traditional" way of conducting affairs, thus rejecting change as a threat to an established way of doing business. If the individuals within the organization sense that there is too much inertia to instigate and successfully implement changes in decision practices, they would be unlikely to innovate, while favorable perceptions of the organizational response to change will be associated with greater innovation adoption.

Hypothesis 5: The greater the perception that the organizational culture supports change, the greater the extent of innovation adoption.

Centralization. The extent to which decision making in an organization is concentrated within a few top managers reflects the degree of centralization in the organization structure (Hage & Aiken, 1969; Grover & Goslar, 1993). Centralization of decision making has been found to be negatively related to innovation (Hage & Aiken, 1967; Moch & Morse, 1977; Kimberly & Evanisko, 1981; Damanpour, 1991; Grover & Goslar, 1993). This may be due in part to the tendency for high centralization to be associated with a more bureaucratic structure that is difficult to change and slow to respond to external or internal pressures. In the case of decision process innovations, in particular, firms that are *de*centralized should find it easier to institute new decision practices because decision making processes across the organization should already occur in a relatively unstructured manner. Thus, we expect greater centralization to be negatively related to decision process innovation.

Hypothesis 6: The greater the degree of centralization, the lower the extent of innovation adoption.

Formalization. The extent to which an organization has a formalized structure generally pertains to the division of labor, the degree of hierarchy in the authority structure, and clearly delineated rules and tasks. It is operationalized in the current study in terms of the salience of rules, policies, and procedures in

the organization (Hage & Aiken, 1969; Grover & Goslar, 1993). Organizations can be viewed as the sum of their routines and scripts, and as such they seek to improve and replicate routines as their strategy for success (Nelson & Winter, 1982). These routines, however, can also cause inertia and prohibit adoption of new practices (Nelson & Winter, 1982), and formalization has generally been shown to be negatively related to adoption of innovations due to decreased autonomy, limited span of control (Burns & Stalker, 1961/1994), and less openness to new ideas (Pierce & Delbecq, 1977). However, once adoption has occurred, formalization might facilitate implementation of innovations, which rely on routines (Hage & Aiken, 1967; Zaltman, et al., 1983; Grover & Goslar, 1993) and the existing knowledge base (Cohen & Levinthal, 1990). Administrative innovations, in particular, are in a position to benefit from high formalization (Daft, 1978). Though more formalized organizations can be subject to inertial forces, decision process innovations require replication of routines, which should make them attractive to such organizations. Moreover, once decision process innovations are adopted, more highly formalized organizations have a greater probability of successfully replicating them.

Hypothesis 7: The greater the degree of formalization, the greater the extent of innovation adoption.

Legitimacy Concerns. Though rarely addressed in most studies of innovation, organizational needs for legitimacy are likely to influence the tendency for an organization to adopt decision process innovations (Suchman, 1995). For some organizations and the populations to which they belong, the perception of legitimacy in the institutional environment is required in order to ensure external investors, consumer loyalty, or regulatory compliance (Dimaggio & Powell, 1983). Decision process innovations could be adequate to deal with some types of *external* legitimacy needs, such as the need for standardization or legal documentation of decisions. Moreover, decision process innovation can address *internal* need for transparency in the decision making process, which adds accountability and consistency, key components of informational justice (Colquitt, 2001). Along these lines, Adams, Taschian, and Shore (2001) investigated the effects of formal ethics codes on perceptions of ethical behavior within organizations. In an exploratory survey they found that respondents employed in organizations with formal ethics codes rated the ethical behavior of those in their work set consistently greater than those

with no code, even though the actual content of the code was largely forgotten. Such findings imply that the mere presence of documented decision processes or "code" could communicate expectations of decision behavior within the organization, adding both external and internal legitimacy to decision practices and helping to manage the image or reputation of the organization.

Hypothesis 8: The greater the need for legitimacy, the greater the extent of innovation adoption.

Environment-Level Factors

Mimicry/Benchmarking. Many organization theorists have considered the role of industry characteristics in organizational innovation and change (Cyert & March, 1962/1992; Pierce & Delbecq, 1977; Aldrich, 1979; Dimaggio & Powell, 1983). Environmental characteristics are assumed to be relevant because innovation adoption is likely to vary depending on the type of industry and the nature of the competitive landscape. We argue that industry pressures could result in a process innovation being adopted if it is perceived that other organizations in the industry have adopted the process and found it to be valuable. That is, there is an institutional argument for the notion that adoption of decision process innovation might arise due to the strategic mimicry of organizations that learn about other firms in their industry using similar practices to improve decision making (Dimaggio & Powell, 1983). If there is very strong identification with the other organizations, either through similarity of structure and products or through interlocking directorates, decision process innovation adoption may be viewed as a necessary component for competitive position or even economic survival (Zaltman et al., 1973, Pettigrew, 1992). Haunschild and Miner (1997) found that organizational adoption was often the result of various distinct types of interorganizational imitation, and such imitation was especially driven by the degree of contextual uncertainty and the salience of favorable outcomes for other adopting firms. To the extent that innovation is perceived to have helped other organizations achieve salient favorable outcomes, adoption of the innovation by other firms should increase.

Hypothesis 9: The greater the perception that other organizations in the industry are adopting advantageously, the greater the extent of innovation adoption.

Uncertainty. Organizations must constantly interact with their environment and cope with environmental uncertainty (Cyert & March, 1962/1992; Pfeffer & Salancik, 1978). The degree of

uncertainty in the environment can arise from heterogeneity of products and services, dynamism of the environment, and perceived hostility in the environment (Miller & Friesen, 1982). To function in highly uncertain environments, organizations engage in greater sensing and search, and hence uncertainty has been found to be positively related to innovation (Utterback, 1974; Pierce & Delbecq, 1977; Aldrich, 1979; Kimberly & Evanisko, 1981; Dimaggio & Powell, 1983, Grover & Goslar, 1993). Decision process innovation, in particular, is likely to be viewed as a way to cope with uncertainty, as it provides a structured means of sensing the environment, gathering information, identifying alternatives, and quantifying unknowns. Thus, greater uncertainty in the industry environment should be positively related to innovation adoption.

Hypothesis 10: The greater the environmental uncertainty, the greater the extent of innovation adoption.

Cross-level Interactions

Perceived Managerial Threat and Organization Structure. Above we argued that a barrier to decision process innovation could arise from the tendency for managers to perceive such innovation as a threat to their own value, discretion, and control. Here we utilize the multilevel nature of the present investigation to consider the way in which the organizational-level structure variables of centralization and formalization might interact with these individual perceptions of value and control to affect the extent of decision process innovation. It is conceivable that the structure of the organization can be critical to an individual's adoption of new practices, as structure is often related to the resources and capabilities of the organization and can impose constraints on the individual actors. Stenfors et al (2005) interviewed executives across organizations in Finland about their strategic decision-making practices and the extent to which they incorporate operations research tools, concluding that individuals need for and resistance to various tools were profoundly dependent on the context in which they operated.

As noted, some studies have considered the importance of perceived control in the freedom to choose whether to accept specific technologies or autonomy in how to use them (e.g., Berry, 1997; Baronas & Lewis, 1998; Kaplan et al., 2001; Green et al., 2004). However, we surmise that decision process innovations as defined above are more often elective rather than organizationally imposed or

required. Managers in the position to adopt such processes are likely to be in higher status positions in the organization and may exercise greater discretion in deciding whether to adopt. We posit that the nature of concerns about control, therefore, depends critically on the status of the potential adopter, and we argue that a key overlooked reason why a manager may resist innovation stems from the manager's perception that the innovation poses a threat to his or her own value, control over outcomes, and hence power (Hypothesis 4). If this is the case, perceived threats to managerial value should interact with the degree of organizational centralization and formalization, such that the negative effect of perceived threat on innovation is *mitigated* by high formalization and high centralization. That is to say, the limited span of decision-making control that characterizes highly centralized organizations and the emphasis on rules and hierarchy that characterizes highly formalized organizations are perceived to preserve authority and power structures, thus reducing managerial concerns about threats from the innovation itself.

Hypothesis 11: The negative effect of perceived threat to value and control will have more influence on innovation adoption for organizations that are *de*centralized (statistical interaction of perceived threat and centralization).

Hypothesis 12: The negative effect of perceived threat to value and control will have more influence on innovation adoption for organizations that are low in formalization (statistical interaction of perceived threat and formalization).

METHODS

Data

We administered an Internet-based survey to gather data on organizational decision making practices. Our sample is comprised primarily of alumni of an executive MBA program from graduating years 1997 to 2005. Using an alumni email list provided by the university, we sent a message asking them to participate in a research study about their organizational decision making practices, and we inserted a link to the online survey. In addition, we asked them to recruit four or five of their colleagues (who were not alumni) in their current organization to participate in our study. In order to minimize non-response bias, we emphasized in our message the need for people to respond to the survey whether or not they used the particular decision making practices listed. Confidentiality was guaranteed to all participants. Because the survey was administered online, the specific responses of any given individual were anonymous, but

we requested the names of organizations in order to compare and aggregate multiple responses from individuals within an organization.

The total number of alumni included on the email list was approximately 446. However, we received a number of auto-reply email messages due to email accounts that were no longer active. A total of 160 people participated in the survey, 145 of which were alumni of the program, thus yielding a minimum response rate of approximately 33%. We found no systematic differences between the small group of non-alumni and the rest of the sample.

In measuring organization- or industry-level constructs (such as culture, centralization, formalization, and environmental uncertainty), it can be important to guard against single source bias (Klein, Dansereau, & Hall, 1994). Although we made repeated attempts to solicit multiple responses from each organization in order to validate our organization-level constructs, only six of the approximately 70 identified organizations in our sample provided multiple respondents. The remaining respondents did not provide the names of their organizations. However, we emphasize our respondents' high level of credibility in terms of assessing features of the organization and making decisions concerning adoption. All students in this executive program have a minimum of 10 years of management experience and are employed while pursuing the program. In our sample, tenure in the respondents' current position ranged from 1 to 25 years, and roughly half of the respondents were VP- or C-level managers, with the rest employed in other senior management positions.

Variable Measurement

The survey items and scale reliabilities associated with the variables in this analysis are included in Appendix 1. The ten independent variables are organized according to the three levels of analysis: individual perceptions, organizational characteristics, and environmental context. Multiple items were used to tap each of the eleven constructs, and nearly all of our constructs were measured using scales that were previously published and shown to be reliable. As indicated in Appendix 1, the items we used formed reliable scales in our sample (Cronbach's alpha ranged from .74 to .91).

Innovation Adoption. Our operationalization of decision process innovation draws on the framework of decision analysis (Clemen, 1996). We consulted leading experts in the decision analysis field in order to generate a comprehensive list that represented the universe of decision analysis tools and approaches typically taught in decision analysis courses. The measure of decision process innovation is provided in Appendix 2. We separated the activities into two broad categories: *Quantitative DA* (a mathematical or technological class of decision analysis), and *Qualitative DA* (a class of decision analysis involving qualitative problem-structuring approaches), in order to undertake a more fine-grained analysis.

We were primarily interested in the *extent of innovation adoption*, which we measured as a count variable indicating the number of different DA approaches adopted in the organization. Separate count dependent variables were created for the quantitative and qualitative categories of DA. Respondents were presented with the information in Appendix 2 and indicated the DA activities used in their organization in the past year, which produced a range of 0 to 17 tools in the quantitative category (mean = 7.1, s.d. = 6.2) and 0 to 7 in the qualitative category (mean = 3.2, s.d. = 2.6). In addition, we measured the *likelihood of adoption* as a binary categorical variable to indicate whether or not a particular individual's organization adopted DA in any form in the past year. We also asked a variety to questions to gauge the frequency and depth of decision process innovation, including the presence of standard operating procedures (or other documentation) for decision making, the availability of DA training resources, the percentage of decisions for which they use DA, and whether they ever outsource their DA needs.

Individual-Level Predictors. All independent variables use a 7-point Likert-type response scale unless otherwise noted, as shown in Appendix 1. Individual *attitudes toward change* were measured using four items designed to assess the extent to which the manager is comfortable about changes to their work practices and routines. Higher scores on this index reflect more favorable attitudes toward change. *Technical aversion* was measured by ratings of computers and quantitative analysis using pairs of adjectives that were anchored by positive and negative traits (adapted from Berry, 1997). Higher scores on this variable indicate greater aversion to technical materials and approaches. The perceived innovation

characteristics (perceived ease of use, usefulness, and demonstrability of results) were measured using items adapted from Davis (1989) and Venkatesh & Davis (2000). The *ease of use* variable items measured the extent to which the individual perceives that the innovation is clear and understandable, the *usefulness* items reflect the extent to which the innovation is perceived to improve managerial effectiveness, and the *demonstrability* items refer to the perception that the innovation yields valuable results. Higher ratings on all of these variables reflect more favorable perceptions of the innovation characteristics. Finally, perceived threat to managerial value and control is measured using two items adapted from Berry (1997). These items measured the perception that the innovation diminishes the manager's value and discretion. In addition, we asked respondents to indicate the extent to which they agreed with the statement that using DA reduced their control over the decision-making process. Though all three variables (value, discretion, control) are strongly correlated[1], the scale reliability was slightly less than advisable for combining into a single index (Cronbach's alpha = .67). Moreover, the control item was missing a substantial number of observations; thus we use the diminished value variable for all analyses.[2] Higher ratings reflect the view that the innovation diminishes managerial value.

Organization-Level Predictors. The *organizational culture* variable was measured using a 7-item scale measuring the extent to which the organizational norms encourage change and support risk taking, and whether the organization responds well to change. Higher ratings reflect the view that the organizational culture promotes change. *Centralization* is measured in terms of the extent to which responsibility for various types of organizational decisions are centralized at the top levels of management (Hage & Aiken, 1969; Grover & Goslar, 1993). Higher ratings on this scale reflect a greater degree of centralization. Formalization is operationalized in this study as the degree to which the organization has clearly enforced rules, procedures, and routines (Hage & Aiken, 1969; Grover & Goslar, 1993). Higher ratings on this scale reflect a greater degree of formalization. Finally, *concern for legitimacy* is measured

[1] Bivariate correlations were .55 ($p<.001$) for diminished value and diminished discretion, .37 ($p<.001$) for discretion and reduced control over the process, and .32 for reduced control and diminished value ($p<.001$).
[2] We ran a separate set of analyses (not reported here) using the diminished control variable and obtained a significant effect for this variable on innovation adoption. Moreover, regression analyses revealed that the diminished value variable was strongly predicted by the discretion and control variables.

by the extent to which the organization is held publicly, legally, or internally accountable for their decisions. Higher ratings on this measure reflect a greater need for legitimacy.

Industry-Level Predictors. Organizational *mimicry/benchmarking* is operationalized in our study as the extent to which other organizations are perceived to have adopted decision process innovations to improve decision making. Higher ratings on this item reflect stronger views that other organizations in the industry use decision process innovations to their advantage. The degree of environmental uncertainty is measured using a six-item scale that measures how quickly demand and technology changes in the industry, as well as sources of stability and unpredictability (Miller & Frisen, 1982; Grover & Goslar, 1993). Higher ratings on this scale reflect greater uncertainty in the industry environment.

Control Variables. Five control variables were included in order to address additional sources of firm-level variance. Size is a structural characteristic that is frequently found to be predictive of innovation activity, as it can be related to many other variables that affect firm behavior, such as age, financial resources, human capital, formalization, and reputation (Moch & Morse, 1977; Kimberly & Evanisko, 1981; Grover & Goslar, 1993; Rogers, 1962/2003). *Organizational size* is measured by the log number of employees (Rogers, 1962/2003). We also control for *industry classification*, as innovation adoption has been found to vary considerably across industries (Damanpour, 1991). We collected industry information by coarse (two-digit) Standard Industrial Classification (SIC) codes. Responding organizations represented eight different industries, with the majority falling into the manufacturing (30%), services (30.5%), and finance and banking industries (16%). Thus, we controlled for these three industries using dummy variables. Finally, we included a control variable that measured people's past *experience or history* with the particular innovation: "In my experience, DA has been poorly executed." We reverse-coded this item so that higher ratings on the item corresponded to more favorable past experience with the innovation.

Statistical Analysis

Table 1 presents the summary statistics and correlation matrix of the variables in our analysis.

INSERT TABLE 1 HERE

Extent of Innovation Adoption. We used poisson regression to analyze the extent of innovation adoption, a count variable indicating the number of different DA methods adopted within one year of the respondents answering the survey (see Appendix 2). Poisson regression is appropriate provided that the standard deviation of the dependent variable is not greater than the mean (Greene, 2000), and our data conform to this guideline. We ran separate analyses for the two different categories of decision process innovation (quantitative DA versus qualitative DA), in order to examine whether there might be meaningful differences in the factors that affect the extent of adoption of these different classes of DA methods.[3]

Likelihood of Innovation Adoption. Although we do not report the results here due to space constraints, we also used logistic regression to analyze the likelihood of innovation adoption. As with the extent of adoption, we ran separate models for the two different categories of decision process innovation (quantitative DA versus qualitative DA). No additional insights emerged from these analyses beyond those for the extent of innovation adoption.

For all analyses we entered the variables in five stages: the control variables, followed by the individual level variables, followed by the organizational level variables, followed by the environment variables, and finally the two interaction terms (H_{11} and H_{12}) to obtain the full model.

RESULTS

Incidence of Decision Process Innovation

Before testing the hypotheses of interest, we examined the data for general trends in the incidence of decision process innovation among the organizations in our sample. Approximately 70% of respondents indicated decision process innovation adoption within the past year, while 30% indicated that they had never used such practices. Thus, we do not perceive a non-response bias. Moreover, we found no significant differences in those who adopted and those who did not in terms of managerial tenure, organizational size (log number of employees), number of levels of hierarchy (self-reported), or annual R&D expenditures.

[3] As a conservative test we also ran negative binomial regressions on the two count variables (quantitative and

The mean number of decision-analytic procedures reportedly in use from the *qualitative* category was 3.21[4], and the top two most commonly used procedures were methods to create new alternatives (61%) and methods to understand objectives of decision makers and stakeholders/"value focused thinking" (59%). After this, the two group decision-making procedures were roughly tied: organizational process to ensure participation of decision makers/"dialogue decision process" (54%), and other group decision-making techniques/"Delphi, Nominal, Stepladder" (53%). The mean number of tools reportedly in use from the *quantitative* category was 7.08, and the top three most commonly used tools were multiattribute utility (67.5%); methods to identify ranges (best/worst cases) of outcomes (63.1%); and scenario analysis (59.4%). Participants estimated the percentage of decisions for which they use DA to be approximately 40% of decisions on average (median=30%). In addition, approximately 55% of participants reported outsourcing DA needs on a regular basis, 41% reported that their organization offered DA training resources to staff, and 36% reported that they had written documentation or "standard operating procedures" specifically for decision making.

Effects of Multilevel Factors on Extent of Decision Process Innovation Adoption

Tables 2 and 3 present the results for the factors influencing extent of decision process innovation adoption for the quantitative and qualitative categories, respectively. The chi-square statistics are significant for all models. Models 1 and 6 indicate that some of the control variables are indeed quite influential, particularly for the finance and banking industry classification, and for past history with the particular innovation.

INSERT TABLES 2 & 3 HERE

As shown in Models 2 and 7, the addition of the individual level variables resulted in a reduction in the log likelihood and significant increase in the chi-square for both quantitative and qualitative process innovation, respectively. The individual *change attitude* variable is not significant in any of the models, thus Hypotheses 1 is not supported. The *technical aversion* variable is significant and negatively related

qualitative DA); the results did not differ materially from the poisson regression.

[4] The estimates on incidence of decision process innovation include zeros (the non-users).

to extent of innovation adoption, as expected, thus Hypothesis 2 is supported. In terms of innovation characteristics, both perceived *ease of use* (Hypothesis 3b) and perceived *demonstrability of results* (Hypothesis 3c) are positively related to extent of innovation adoption, but perceived *usefulness* was generally not predictive of extent of adoption for either the quantitative or qualitative categories. Hypothesis 4 concerns our focal prediction that the extent of innovation adoption is affected by managers' perceptions that decision process innovation results in *diminished value and control*. We find very strong support for this hypothesis, as it is significant in all models for both quantitative and qualitative decision process innovation. We note that the coefficients appear to be greater in magnitude for the qualitative category (Table 2) than the quantitative category (Table 3); we will return to this result in the general discussion.

Addition of the organizational level variables reduced the log likelihood and increased the significance of the model. *Organizational culture* exerted a significant positive influence on extent of innovation for the quantitative category only, thus Hypothesis 5 was partially supported. Greater *centralization* exerts a significant negative effect on extent of innovation adoption in all four models, providing support for Hypothesis 6. Degree of *formalization* was predicted to have a positive effect on extent of innovation adoption due to the ability of formalized organizations to replicate routines. However, we found virtually no significant effects of formalization, with the exception of Model 5, where it exhibited a significant negative effect; Hypothesis 7 is not supported. Finally, concerns for *legitimacy* were found to be positively related to extent of adoption, such that greater need for legitimacy resulted in a great number of innovations used; thus, Hypothesis 8 is supported.

The addition of the environment level variables did not result in a statistically significant decrease in log likelihood or an increase in significance of the model. Neither the *mimicry/benchmarking* variable nor the *uncertainty* variable were related to extent of adoption for either category of innovation. Hypotheses 9 and 10 were not supported. It is possible that controlling for industry classification was sufficient to address the heterogeneity of industry influences.

Finally, Hypotheses 11 and 12 concern the interaction between the individual level variable of perceived threat to value/control with organizational centralization and formalization, respectively. Regarding the effects on quantitative innovation (Models 5), the interaction of perceived threat and formalization is highly significant, and the interaction of perceived threat and centralization is not significant. For the qualitative category (Model 10), the interaction of perceived threat and formalization is marginally significant, and the interaction of perceived threat and centralization is not significant. To investigate the nature of the significant interaction with formalization, we dichotomized the formalization variable using a median split and re-ran Models 4 and 9 broken out by high and low groups. Under low formalization, the effect of perceived threat on extent of quantitative decision process innovation was negative and significant ($b = -.22$, s.e.=.06, $p<.001$), but under high formalization, the effect of perceived threat was essentially eliminated ($b= -.02$, s.e.=.04, $p>.63$). Virtually identical results were obtained for effects on qualitative decision process innovation. Thus, Hypothesis 12 is strongly supported and Hypothesis 11 is not supported.[5]

DISCUSSION AND CONCLUSION

Although organizations often face difficult and complex decisions that can be aided by structured analytical approaches, organizational actors tend to resist using new practices. We sought to empirically examine the factors that might impede or facilitate the adoption of *decision process innovations* from a multilevel perspective. By incorporating individual- and organization-level theories of innovation, technology acceptance, and psychology, we simultaneously tested key multilevel predictors of innovation that have appeared previously in separate streams of research. We also introduced a formerly unexplored issue in innovation research, perceived threats to managerial value and control, and found that it is a critical variable in explaining why managers might not innovate. The multilevel investigation allowed us to hypothesize about cross-level interactions in innovation adoption, where we found that the degree of

[5] Though the interaction with centralization did not reach conventional levels of significance ($p=.12$, two-tailed; Model 10), we saw evidence for our prediction when we ran the analyses split out by low and high centralization groups for the *qualitative* category. Under low centralization, the effect of perceived threat on qualitative innovation was negative and significant ($b =-.18$, s.e.=.08, $p<.05$), but under high centralization the effect was eliminated ($b =-.11$, s.e.=.09, $p>.22$).

formalization in organizational structure moderated the effects of individual perceptions of power and control on decision process innovation. Taken together, the findings of our investigation contribute to the literatures in innovation, decision making, and organizational behavior.

We chose to use the framework of decision analysis (DA) as our measure of decision process innovation. The nature of this innovation differs somewhat from process innovations that are often studied in that DA is not "sticky"; i.e., it is not an innovation that is installed once and used permanently thereafter. Nevertheless, we find support for many of the variables that have previously been found to predict innovation. A summary of the hypotheses, predicted effects, and findings are presented in Table 4. We were surprised to find that individual change attitudes exerted no significant effect in any of the models. It is possible that the measure is too general and far-removed from the specific change agent, and hence attitudes that relate more directly to the innovation play a greater role. Along these lines, the technical aversion variable was found to exert a negative influence only for the quantitative innovation category. We also found strong support for the role of innovation-specific characteristics, especially perceived ease of use and valuable results. This suggests that findings in the literature on innovation characteristics and technology acceptance (Tornatzky & Klein, 1982) are robust to non-technological innovations, such as the qualitative category of DA. The importance of innovation characteristics, coupled with the robust negative effects of managerial concerns about diminished contribution and value, suggests an interesting tension. Even as managers recognize that innovation adoption leads to positive results, the fact that it also threatens their own expertise and power limits the extent of innovation adoption.

Another key finding from our investigation was the importance of organization-level variables, which explained the greatest amount of variance relative to the individual and industry level sets. These results were driven primarily by the strong effects of centralization and legitimacy needs. The negative effect of centralization on innovation adoption was very robust in our study, consistent with past research (Damanpour, 1991). Moreover, it appears that decision process innovation adoption is facilitated by legitimacy needs in organizations that face scrutiny for their decision making practices, yet this was only the case for quantitative innovation, suggesting that in our sample innovation might be driven more by

external than internal signaling needs. Moreover, we found that organizational cultures that promote change and risk-taking positively influenced innovation adoption, consistent with recent empirical work (Baer & Frese, 2003). Interestingly, organizational culture significantly affected quantitative but not qualitative innovation. This finding might reflect a view that the adoption of quantitative innovation is a more extensive change, perhaps because analytical tools require specific skills or knowledge training. Finally, we found that none of the environment-level factors were statistically significant in any of the models. However, it is possible that the inclusion of the industry classification dummy variables was sufficient to address heterogeneity introduced by characteristics of the environmental context. It is clear that industry context does matter, as the industry control variables were significant for many of the models.

Although we predicted a positive effect of formalization, we found that it exerted virtually no significant influence on innovation, and in one case it had a negative effect. However, formalization significantly interacted with the individual level of perceived threat to managerial value. The finding that more formalized organization structures actually *mitigated* concerns for diminished value and control is important for our understanding of managerial concerns regarding power. Though research on user acceptance of new technology has pointed to the importance of autonomy and personal control over one's own work activities (Kottemann & Davis, 1993; Kaplan, Reneau, & Whitecotton, 2001; Green, Collins, & Hevner, 2004), we surmise that this type of concern would be mitigated by low formalization, because such structures are characterized by less hierarchy and less autocratic decision making. The fact that we found the opposite pattern lends credence to our argument that the underlying issue is power and control over one's own and others' outcomes. Higher-status individuals need only fear a loss of control associated with innovation when they are in contexts that are structured loosely, with less formalization, less rigid hierarchy, and fewer codified rules and procedures. In contrast, highly formalized organizations are characterized by strict rules and narrow spans of influence that preserve authority and power structures. Future research should explore this issue of whether the status of the adopter reliably changes the nature

of control-related concerns about new practices, and whether this generalizes across different types of innovations and contexts.

These findings have intriguing implications not only for the innovation literature but also for research related to all aspects of decision processes. The field of procedural justice has long studied the importance of "voice" and involvement in decision making in terms of explaining people's reactions to decisions, particularly from the perspective of less powerful individuals (for a review, see Lind & Tyler, 1988). However, more recently justice researchers have begun to think about issues of status and how it might change the way decision processes are framed and interpreted (Chen, Brockner, & Greenberg, 2003). The results of the current investigation suggest that fairness-building initiatives that entail involvement of others might be met with resistance by managers and other high-status individuals to the extent that they view involvement as reducing their own control and power. To this point, we note that the coefficients for perceived threat were actually greater for qualitative DA (Table 3) than quantitative DA (Table 2), where the former includes non-technical approaches that involve groups or stakeholders (see Appendix 2). Future research in decision process and procedural justice should investigate whether the benefits of participative decision making for lower status individuals are simultaneously seen as costs for higher-status individuals, a tension that might reflect an underlying perception of power as a fixed resource that cannot be shared.

There are a number of limitations to the current investigation. First, an obvious issue is that the survey results are based on single-source, self-reported measures. Although we are confident that the respondents had the ability to assess features of the organization, caution must be taken in mapping their specific perceptions to the use of the innovation by the larger organization. This is an important issue for the questions assessing aspects of the organization, such as culture, degree of centralization and formalization, and industry context. Future research might address this issue by integrating objective control variables (e.g., organization size, industry classification) with aggregated individual-level data in a more comprehensive multilevel statistical analysis (see Klein, et al., 1994). A second limitation related to the cross-sectional nature of the study is that we are unable to infer causality of some of the proposed

relationships. For example, we find that stronger aversion to technical innovation characteristics reduces the extent of adoption, but it is conceivable the causality runs in the other direction, where more extensive use leads to less technical aversion. Although we were able to highlight a general association between adoption of innovations and threat to managerial value and control, it seems likely that causality runs in both directions: managers resist administrative process innovations because the fear they will lose control, and the more they use them the less control they feel they have. Future research focusing on a longitudinal study of decision process innovations would help to resolve such questions.

Our findings provide prescriptive insight for decision theorists and decision analysts on how to introduce and gain acceptance for DA in organizations. It may seem obvious to DA proponents that adoption is affected by individual-level variables like technical aversion and perceptions regarding DA's ease of use and ability to generate valuable results. What may be less obvious is the extent to which organizational-level variables matter. On one hand, organizations with cultures that do not value change or those with high degrees of centralization may experience difficulty implementing DA practices; on the other hand, firms with greater legitimacy needs may experience less difficulty. Thus, we speculate that it may be worthwhile to perform an organizational "audit" before trying to implement DA methods. Such an audit could highlight strengths and weaknesses in terms of decision process innovation and could provide useful guidance in designing an effective innovation program.

Finally, we believe proponents of decision analysis must come to terms with the fact that managers tend to perceive DA tools and approaches as a threat to their power and control. Many proponents advocate DA tools as a source of knowledge and guidance in the decision situation. In addition, they may emphasize that certain types of DA, particularly those that involve stakeholders, could provide other benefits, such as increased perceptions of fairness and trust and enhanced documentation and legitimacy. However, these messages must be tailored and delivered in a way that counteracts the perceived threat to power.

REFERENCES

Adams, J.S., A. Tashchian, T.H. Shore. 2001. Codes of ethics as signals for ethical behavior. *J. Bus. Ethics*. **29**(3) 199-211.

Agarwal, R., J. Prasad. 1997. The role of innovation characteristics and perceived voluntariness in the acceptance of information technologies. *Decis. Sci.* **28**(3) 557-582.

Aldrich, H.E. 1979. *Organizations and environments.* Prentice-Hall, New Jersey.

Anderson, N., C.K.W. DeDreu, B.A. Nijstad. 2004. The routinization of innovation research: A constructively critical review of the state-of-the-science. *J. Organ. Behav.* **25**(2) 147-173.

Arkes, H.R., R.M. Dawes, C. Christensen. 1986. Factors influencing the use of a decision rule in a probabilistic task. *Organ. Behav. Hum. Decis. Process.* **37**(1) 93-110.

Baer, M., M. Frese. 2003. Innovation is not enough: Climates for initiative and psychological safety, process innovations, and firm performance. *J. Organ. Behav.* **24**(1) 45-68.

Baronas, A., M. Louis. 1988. Restoring a sense of control during implementation: How user involvement leads to system acceptance. *MIS Q.* **12**(1) 111-124.

Berry, F.S. 1997. Explaining managerial acceptance of expert systems. *Public Productivity & Management Review.* **20**(3) 323-335.

Bodily, S.E., M.S. Allen. 1999. A dialogue process for choosing value-creating strategies. *Interfaces* **29**(6) 16-28.

Bunn, D. 1984. *Applied decision analysis*. McGraw-Hill, New York.

Burns, T., G.M. Stalker. 1994. *The management of innovation*, revised ed. Oxford University Press, New York.

Chen, Y., J. Brockner, & J. Greenberg. 2003. When is it "a pleasure to do business with you?" The effects of relative status, outcome favorability, and procedural fairness. *Organ. Behav. Hum. Decis. Process.* **92**(1-2) 1-15.

Choi, J. 2004. Individual and contextual dynamics of innovation-use behavior in organizations. *Hum. Perform.* **17**(4) 397-414.

Clemen, R.T. 1996. *Making hard decisions: An introduction to decision analysis*. Second Edition. Boston, MA: PWS-Kent Publishing Co.

Clemen, R.T., R. Kwit. 2001. The value of decision analysis at Eastman Kodak Company, 1990-1999. *Interfaces.* **31**(5) 74-92.

Cohen, W.M., D.A. Levinthal. 1990. Absorptive capacity: A new perspective on learning and innovation. *Adm. Sci. Q.* **35**(1) 128-152.

Colquitt, J.A. 2001. On the dimensionality of organizational justice: A construct validation of a measure. *J. Appl. Psychol.* **86**(3) 386-400.

Cyert, R.M, J.G. March. 1992. *A behavioral theory of the firm*, 2nd ed. Prentice-Hall, Englewood Cliffs, N.J.

Damanpour, F. 1991. Organizational innovation: A meta-analysis of effects of determinants and moderators. *Acad. Manage. J.* **34**(3) 555-590.

Daft, R.L. 1978. A dual-core model of organizational innovation. *Acad. Manage. J.* **21**, 193-210.

Davis, F.D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Q.* **13**(3) 319-340.

Davis, F.D. 1993. User acceptance of information technology: system characteristics, user perceptions, and behavioral impacts. *International Journal of Man-Machine Studies.* **38**(3) 475-487.

Davis, F.D., R.P. Bagozzi, P.R. Warshaw. 1989. User acceptance of computer technology: A comparison of two theoretical models. *Manage. Sci.* **35**(8) 982-1002.

Dimaggio, P.J., W.W. Powell. 1983. The iron cage revisited – Institutional isomorphism and collective rationality in organizational fields. *Am. Sociol. Rev.* 48(2) 147-160.

Downs, G.W., L.B. Mohr. 1976. Conceptual issues in the study of innovation. *Adm. Sci. Q.* **21**(4) 700-714.

Fishbein, M., I. Ajzen. 1975. *Attitude, intention, and behavior: An introduction to theory and* research. Addison-Wesley, Reading, MA.

Ford, C.M., D.A. Gioia. 2000. Factors influencing creativity in the domain of managerial decision making. *J. Manag.* **26**(4) 705–32.

Green, G.C., R.W. Collins, A.R. Hevner. 2004. Perceived control and the diffusion of software process innovations. *Journal of High Technology Management Research.* **15**(1) 123-144.

Greene, W.H. 2000. *Econometric analysis*, 4th ed. Prentice-Hall, Upper Saddle River, NJ.

Grover, V., M. Goslar. 1993. The initiation, adoption, and implementation of telecommunications technologies in U.S. organizations. *J. Manage. Inform. Syst.* **10**(1) 141-164.

Hage, J., M. Aiken. 1967. Relationship of centralization to other structural properties. *Adm. Sci. Q.* **12**(1) 72-91.

Hage, J., M. Aiken. 1969. Routine technology, social structure, and organization goals. *Adm. Sci. Q.* **14**(3) 366-376.

Hage, J., M. Dewar. 1973. Elite values versus organizational structure in predicting innovation. *Adm. Sci. Q.* **18**(3) 279-290

Hambrick, D.C.,P.A. Mason. 1984. Upper echelons: The organization as a reflection of its top managers. *Acad. Manage. Rev.* **9**(2) 193-206.

Hannan, M. T., J. Freeman. 1984. Structural inertia and organizational change. *Am. Sociol. Rev.* **49**(2) 149-164.

Haunschild, P.R., A.S. Miner. 1997. Modes of interorganizational imitation: The effects of outcome salience and uncertainty. *Adm. Sci. Q.* **42**(3) 472-500.

Hoch, S., D. Schkade. 1996. A psychological approach to decision support systems. *Manage. Sci.* **42**(1) 51-64.

Isabella, L.A. 1990. Evolving interpretations as change unfolds: How managers construe key organizational events. *Acad. Manage. J.* **33**(1) 7-41.

Ives, B., M. Olson. 1984. User involvement and MIS success: A review of the literature. *Manage. Sci.* **30**(5) 586-603.

Kaplan, S.E., J.H. Reneau, S. Whitecotton. 2001. The effects of predictive ability information, locus of control, and decision maker involvement on decision aid reliance. *J. Behav. Decis. Mak.* **14**(1) 35-50.

Karahanna, E., D.W. Straub. 1999. The psychological origins of perceived usefulness and ease of use. *Inf. Manage.* **35**(4) 237-250.

Keeney, R.L., H. Raiffa. 1976. *Decisions with multiple objectives: Preferences and value tradeoffs.* Wiley, New York.

Keeney, R.L.1992. *Value-focused thinking.* Harvard University Press, Cambridge, MA.

Kimberly, J.R., M.J. Evanisko. 1981. Organizational innovation: The influence of individual, organizational, and contextual factors. *Acad. Manage. J.* **24**(4) 689-713.

Klein, K.J., A.B. Conn, J.S. Sorra. 2001. Implementing computerized technology: An organizational analysis. *J. Appl. Psychol.* **86**(5) 811-824.

Klein, K.J., F. Dansereau, R.J. Hall. 1994. Level issues in theory development, data collection, and analysis. *Acad. Manage. Rev.* **19**(2) 195-229.

Klein, K.J., J.S. Sorra. 1996. The challenge of innovation implementation. *Acad. Manage. Rev.* **21**(4) 1055-1080.

Kleinmuntz, B. 1990. Why we still use our heads instead of formulas: Towards an integrative approach. *Psychol. Bull.* **107**(3) 296-310.

Kottemann, J.E., F.D. Davis. 1991. Decisional conflict and user acceptance of multicriteria decision-making aids. *Decis. Sci.* **22**(4) 918-926.

Landman, J. 1987. Regret and elation following action and inaction: Affective responses to positive versus negative outcomes. *Pers. Soc. Psychol. Bull.* **13**(4) 524-536.

Larrick, R.P. 1993. Motivational factors in decision theories: The role of self-protection. *Psychol. Bull.* **113**(3) 440-450.

Leonard-Barton, D.A. 1992. Core capabilities and core rigidities: A paradox in managing new product development. *Strateg. Manage. J.* **13**(Summer) 111-125.

Leonard-Barton, D.A., Deschamps, I. 1988. Managerial influence in the implementation of new technology. *Manage. Sci.* **34**(8) 1252-1265.

Lewin, K. 1947. *Group decision and social change. In T. M. Newcomb & E. L. Hartley (Eds.), Readings in social psychology.* Holt, Rinehart, and Winston, New York.

Lewis, W., R. Agarwal, V. Sambamurthy. 2003. Sources of influence on beliefs about information technology use: An empirical study of knowledge workers. *MIS Q.* **27**(4) 657-678.

Lind, E.A. Tyler, T.R. 1988. *The social psychology of procedural justice*. Plenum, New York.

Loewenstein, G.F., E.U. Weber, C.K. Hsee, N. Welch. 2001. Risk as feelings. *Psychol. Bull.* **127**(2) 267-286.

Lucas, H.C., Jr. 1975. Performance and use of an information system. *Manage. Sci.* **20**(8) 908-919.

March, J.G., H.A. Simon. 1958. *Organizations.* Wiley, New York.

McLean, L.D. 2005. Organizational culture's influence on creativity and innovation: A review of the literature and implications for human resource development. *Advances in Developing Human Resources.* **7**(2) 226-246.

Miller, D., P.H. Friesen. 1982. Innovation in conservative and entrepreneurial firms: Two models of strategic momentum. *Strateg. Manage. J.* **3**(1) 1-25.

Milliken, F.J. 1987. Three types of perceived uncertainty about the environment: State, effect, and response uncertainty. *Acad. Manage. Rev.* **12**(1) 133-143.

Moch, M., E. Morse. 1977. Size, centralization and organizational adoption of innovations. *Am. Sociol. Rev.* **42**(5) 716-725.

Moore, G.C., I. Benbasat, I. 1991. Development of an instrument to measure the perceptions of adopting an information technology innovation. *Inf. Syst. Res.* **2**(3) 192-222.

Nelson, R., S. Winter. 1982. *An evolutionary theory of economic change.* Harvard University Press, Cambridge, MA.

O'Reilly, C. 1989. Corporations, culture, and commitment: Motivation and social control in organizations. *Calif. Manage. Rev.* **31**(4) 9-25.

Oldham, G.R., A. Cummings. 1996. Employee creativity: Personal and contextual factors at work. *Acad. Manage. J.* **39**(3) 607-634.

Payne J.W., J.R. Bettman, E.J. Johnson. 1993. *The adaptive decision maker*, CUP: Cambridge.

Pettigrew, A.M. 1992. On studying managerial elites. *Strateg. Manage. J.* **13**(Winter) 163-182.

Pfeffer, J., G.R. Salancik. 1978. *The external control of organizations: A resource dependence perspective.* Harper & Row, New York.

Pierce, J.L., A.L. Delbecq. 1977. Organization structure, individual attitudes, and innovation. *Acad. Manage. Rev.* **2**(1) 27-37.

Rabin, M. 1998. Psychology and economics. *J. Econ. Lit.* **36**(1) 11-46.

Raiffa, H. 1968. *Decision analysis: Introductory lectures on choices under uncertainty.* Addison-Wesley, Reading, MA.

Rogers, E.M. 2003. *Diffusion of innovation*, 5th ed. Free Press, New York.

Slappendel C. 1996. Perspectives on innovation in organzations. *Organization Studies.* **17**(1) 107-129.

Spranca, M., E. Minsk, J. Baron. 1991. Omission and commission in judgment and choice. *J. Exp. Soc. Psychol.* 27(1) 76-105.

Stenfors, S., L. Tanner, M. Syrjänen, T. Seppälä, I. Haapalinna. 2005. Executive views concerning decision support tools. Unpublished manuscript, Stanford University, Palo Alto, CA.

Suchman, M.C. 1995. Managing legitimacy: Strategic and institutional approaches. Acad. *Manage. Rev.* **20**(3) 571-610.

Tesluk, P.E., J.L. Farr, S.A. Klein. 1997. Influences of organizational culture and climate on individual creativity. *J. Creat. Behav.* **31**(1) 27-41.

Thibault, J.W., W.L. Walker. 1975. *Procedural justice: A psychological analysis*. Lawrence Erlbaum Associates, Hillsdale, NJ.

Tornatzky, L.G., K.J. Klein. 1982. Innovation characteristics and innovation adoption-implementation: A meta-analysis of findings. *IEEE Trans. Eng. Manage.* **29**(1) 28-45.

Tversky, A., D. Kahneman. 1974. Judgment under uncertainty: Heuristics and biases. *Science.* **185**(Sept) 1124-1131.

Utterback, J.M. 1974. Innovation in industry and the diffusion of technology. *Science.* **183**(Feb) 620-626.

Venkatesh, V., F.D. Davis. 2000. A theoretical extension of the technology acceptance model: Four longitudinal field studies. *Manage. Sci.* **46**(2) 186-204.

Weaver, G.R., L.K. Trevino, P.L. Cochran. 1999. Corporate ethics programs as control systems: Influences of executive commitment and environmental factors. *Acad. Manage. J.* **42**(1) 41-57.

Wiersema, M.F., K.A. Bantel. 1992. Top management team demography and corporate strategic change. *Acad. Manage. J.* **35**(1) 91-121.

Wilson, T. D., N. Brekke. 1994. Mental contamination and mental correction: Unwanted influences on judgments and evaluations. *Psychol. Bull.* **116**(1) 117-142.

Zaltman, G., R. Duncan, J. Nolbeck. 1973. *Innovations and organizations.* John Wiley & Sons, Inc, New York.

TABLE 1. MEASURE CHARACTERISTICS AND CORRELATIONS

		N	Mean	S.D.	Min	Max	Correlations							
							1	2	3	4	5	6	7	8
1	Extent of Innovation Adoption (Quantitative)	160	7.08	6.16	0.00	17.00	1.00							
2	Extent of Innovation Adoption (Qualitative)	159	3.21	2.65	0.00	7.00	0.88**	1.00						
3	Likelihood of Adoption (Quantitative)	160	0.69	0.46	0.00	1.00	0.67**	0.72**	1.00					
4	Likelihood of Adoption (Qualitative)	160	0.69	0.46	0.00	1.00	0.68**	0.73**	0.96**	1.00				
5	Org Size (log number of employees)	148	7.25	2.90	0.69	12.83	0.10	0.04	0.07	0.08	1.00			
6	History with DA	151	3.74	1.34	1.00	7.00	-0.06	-0.05	0.02	0.03	-0.11	1.00		
7	Mfg Industry	160	0.01	0.11	0.00	1.00	0.00	-0.04	-0.05	-0.05	0.05	0.02	1.00	
8	Finance, Banking Industry	160	0.26	0.44	0.00	1.00	0.05	-0.01	0.04	0.04	0.16†	-0.04	-0.05	1.00
9	Services Industry	160	0.27	0.44	0.00	1.00	-0.19*	-0.16†	-0.17*	-0.20*	-0.19*	-0.07	-0.08	-0.29**
10	Managerial Change Attitudes	157	5.59	0.95	1.00	7.00	0.11	0.06	0.07	0.08	-0.12	0.13	0.03	0.09
11	Technical Aversion	157	5.48	1.16	1.00	7.00	0.04	0.02	0.01	0.00	-0.08	0.19*	0.03	-0.08
12	Threat to Managerial Value	155	2.98	1.25	1.00	7.00	-0.14†	-0.16†	-0.11	-0.11	0.10	-0.08	0.11	-0.04
13	Ease of Use of Innovation	154	4.65	1.17	1.00	7.00	0.19*	0.13	0.11	0.10	-0.13	0.21**	0.03	0.04
14	Usefulness of Innovation	157	5.47	0.91	1.00	7.00	0.11	0.13	0.15†	0.14†	-0.03	0.25**	0.04	0.09
15	Innovation gets Results	156	5.53	0.96	1.00	7.00	0.13†	0.15†	0.17*	0.17*	0.09	0.03	-0.13	0.05
16	Organizational Culture	158	4.26	1.17	1.00	6.71	0.16*	0.17*	0.16*	0.17*	-0.06	0.39**	-0.02	-0.06
17	Centralization	158	5.60	1.14	1.00	7.00	-0.27**	-0.29**	-0.30**	-0.32**	-0.19*	0.02	0.02	0.03
18	Formalization	158	3.81	1.40	1.00	7.00	0.14†	0.11	0.05	0.08	0.42**	-0.01	-0.08	0.17*
19	Legitimacy	158	4.14	1.25	1.00	6.83	0.23**	0.18*	0.10	0.13	0.39**	-0.03	-0.04	0.21*
20	Mimicry/Benchmarking	157	4.27	0.93	1.00	6.71	0.13	0.09	0.19*	0.16*	0.19	0.03	0.02	0.16†
21	Uncertainty	158	3.97	1.08	1.33	6.50	0.07	0.09	0.08	0.04	-0.05	0.07	-0.13	-0.24**

		Correlations, continued												
		9	10	11	12	13	14	15	16	17	18	19	20	21
9	Services Industry	1.00												
10	Managerial Change Attitudes	-0.14†	1.00											
11	Technical Aversion	-0.01	0.30**	1.00										
12	Threat to Managerial Value	0.04	-0.35**	-0.28**	1.00									
13	Ease of Use of Innovation	-0.08	0.30**	0.55**	-0.27**	1.00								
14	Usefulness of Innovation	-0.15†	0.42**	0.34**	-0.37**	0.43**	1.00							
15	Innovation gets Results	-0.04	0.38**	0.24**	-0.42**	0.30**	0.58**	1.00						
16	Organizational Culture	0.06	0.12	0.16†	-0.10	-0.02	0.16*	0.04	1.00					
17	Centralization	-0.01	0.16*	0.21**	-0.17*	0.24**	0.12	0.17*	-0.23**	1.00				
18	Formalization	-0.02	-0.06	0.02	0.00	0.04	0.00	0.10	0.07	-0.02	1.00			
19	Legitimacy	-0.11	-0.03	0.00	-0.04	-0.01	0.11	0.01	0.10	-0.21**	0.56**	1.00		
20	Mimicry/Benchmarking	-0.25**	0.01	0.04	-0.02	0.21**	0.36**	0.14†	-0.18*	-0.20*	0.08	0.34**	1.00	
21	Uncertainty	0.26**	-0.04	-0.03	-0.08	-0.06	0.01	0.09	0.09	-0.06	-0.10	-0.04	0.03	1.00

** Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed). †Correlation is significant at the 0.10 level (2-tailed).

TABLE 2. POISSON REGRESSION ESTIMATES OF EFFECTS ON EXTENT OF DECISION PROCESS INNOVATION ADOPTION (QUANTITATIVE CATEGORY)

(Positive coefficients = greater extent of innovation adoption)

		Model 1	Model 2	Model 3	Model 4	Model 5
	Intercept	1.76***	0.48	0.91*	1.20*	2.16**
		(0.14)	(0.38)	(0.45)	(0.50)	(0.70)
Individual	Managerial Change Attitudes		0.02	0.03	0.02	0.01
			(0.04)	(0.05)	(0.05)	(0.05)
	Technical Aversion		-0.070*	-0.077*	-0.085*	-0.090*
			(0.035)	(0.037)	(0.037)	(0.037)
	Threat to Managerial Value		-0.087**	-0.086*	-0.086*	-0.53*
			(0.033)	(0.035)	(0.036)	(0.22)
	Ease of Use of Innovation		0.21***	0.28***	0.30***	0.29***
			(0.04)	(0.04)	(0.04)	(0.04)
	Usefulness of Innovation		-0.04	-0.10*	-0.07	-0.090†
			(0.05)	(0.05)	(0.05)	(0.053)
	Results of Innovation		0.14**	0.24***	0.24***	0.25***
			(0.05)	(0.05)	(0.05)	(0.05)
Organization	Organizational Culture			0.11**	0.094*	0.090*
				(0.04)	(0.038)	(0.039)
	Centralization			-0.28***	-0.30***	-0.35***
				(0.04)	(0.04)	(0.07)
	Formalization			0.02	0.02	-0.11*
				(0.03)	(0.03)	(0.05)
	Legitimacy			0.13**	0.15***	0.16***
				(0.04)	(0.04)	(0.04)
Industry	Mimcry/Benchmarking				-0.087†	-0.07
					(0.050)	(0.05)
	Uncertainty				-0.01	-0.02
					(0.03)	(0.03)
Interactions	Managerial Threat * Centralization					0.03
						(0.04)
	Managerial Threat * Formalization					0.068**[a]
						(0.022)
Controls	Size	0.025*	0.034**	-0.01	-0.01	-0.01
		(0.012)	(0.013)	(0.01)	(0.01)	(0.01)
	Manufacturing Industry	0.92**	1.39***	1.46***	1.43***	1.47***
		(0.27)	(0.30)	(0.30)	(0.31)	(0.31)
	Finance, Banking Industry	0.26**	0.32***	0.55***	0.55***	0.55***
		(0.07)	(0.08)	(0.08)	(0.08)	(0.08)
	Services Industry	-0.10	-0.02	0.06	0.06	0.09
		(0.08)	(0.09)	(0.09)	(0.09)	(0.09)
	History with DA	0.02	0.02	0.096**	0.091**	0.081**
		(0.02)	(0.03)	(0.030)	(0.031)	(0.031)
	N	141	138	138	138	138
	Log Likelihood	-651.76	-591.1	-521.3	-519.7	-513.7
	Chi-square	34.6***	116.9***	256.5***	259.7***	271.6***

Unstandardized coefficients; standard errors are in parentheses.

[a] Stronger relationship between managerial threat and adoption for less formalized organizations.

***p<0.001; **p<0.01; *p<0.05; †p<0.10 (two-tailed tests).

TABLE 3. POISSON REGRESSION ESTIMATES OF EFFECTS ON EXTENT OF DECISION PROCESS INNOVATION ADOPTION (QUALITATIVE CATEGORY)

(Positive coefficients = greater extent of innovation adoption)

		Model 6	Model 7	Model 8	Model 9	Model 10
	Intercept	1.09***	0.35	0.98	1.25†	2.87**
		(0.21)	(0.56)	(0.65)	(0.73)	(1.04)
Individual	Managerial Change Attitudes		-0.03	-0.03	-0.04	-0.06
			(0.06)	(0.07)	(0.07)	(0.07)
	Technical Aversion		-0.04	-0.05	-0.05	-0.06
			(0.05)	(0.05)	(0.05)	(0.05)
	Threat to Managerial Value		-0.10*	-0.12*	-0.11*	-0.79*
			(0.05)	(0.05)	(0.05)	(0.35)
	Ease of Use of Innovation		0.12*	0.17**	0.19**	0.16**
			(0.06)	(0.06)	(0.06)	(0.06)
	Usefulness of Innovation		0.01	-0.02	0.01	-0.01
			(0.07)	(0.07)	(0.08)	(0.08)
	Results of Innovation		0.12†	0.20**	0.21**	0.20**
			(0.07)	(0.08)	(0.08)	(0.08)
Organization	Organizational Culture			0.10†	0.08	0.06
				(0.05)	(0.06)	(0.06)
	Centralization			-0.28***	-0.31***	-0.46***
				(0.05)	(0.06)	(0.11)
	Formalization			0.05	0.04	-0.07
				(0.05)	(0.05)	(0.08)
	Legitimacy			0.10†	0.12*	0.14*
				(0.06)	(0.06)	(0.06)
Industry	Mimcry/Benchmarking				-0.10	-0.08
					(0.07)	(0.08)
	Uncertainty				0.01	-0.01
					(0.05)	(0.05)
Interactions	Managerial Threat * Centralization					0.08
						(0.05)
	Managerial Threat * Formalization					0.054†[a]
						(0.032)
Controls	Size	0.003	0.00	-0.050*	-0.047*	-0.052*
		(0.017)	(0.02)	(0.022)	(0.022)	(0.022)
	Manufacturing Industry	0.59	0.95†	0.99*	0.98†	0.98†
		(0.47)	(0.50)	(0.50)	(0.51)	(0.51)
	Finance, Banking Industry	0.35**	0.41***	0.66***	0.66***	0.67***
		(0.11)	(0.12)	(0.12)	(0.12)	(0.12)
	Services Industry	-0.02	0.04	0.12	0.11	0.16
		(0.12)	(0.13)	(0.13)	(0.13)	(0.14)
	History with DA	0.02	0.02	0.080†	0.076†	0.075†
		(0.04)	(0.04)	(0.044)	(0.045)	(0.045)
	N	140	137	137	137	137
	Log Likelihood	-356.9	-334.3	-305.0	-304.0	-300.7
	Chi-square	12.9*	37.1***	95.7***	97.7***	104.3***

Unstandardized coefficients; standard errors are in parentheses.

[a] Stronger relationship between managerial threat and adoption for less formalized organizations.

***p<0.001; **p<0.01; *p<0.05; †p<0.10 (two-tailed tests).

TABLE 4. HYPOTHESIZED EFFECTS AND SUMMARY OF FINDINGS

Independent Variable	Hypothesis	Effect on Extent of Innovation Adoption	Finding
Individual Change Attitude	H_1	+	No support
Technical Aversion	H_2	–	Supported for quantitative only
Usefulness of Innovation	H_{3a}	+	Weak support for quantitative, no support for qualitative
Ease of Innovation Use	H_{3b}	+	Supported for all models
Results of Innovation	H_{3c}	+	Supported for all models
Threat to Managerial Value and Control	H_4	–	Supported for all models
Organizational Culture	H_5	+	Supported for quantitative only
Centralization	H_6	–	Supported for all models
Formalization	H_7	+	No support; opposite result in Model 5
Legitimacy Need	H_8	+	Supported for all models
Mimicry	H_9	+	No support
Uncertainty	H_{10}	+	No support
Managerial Threat * Centralization	H_{11}	Effect of Perceived Threat to Control is mitigated by High Centralization	Not supported (though see footnote 5)
Managerial Threat * Formalization	H_{12}	Effect of Perceived Threat to Control is mitigated by High Formalization	Supported

APPENDIX 1. SURVEY CONSTRUCTS, ITEMS, AND SCALE RELIABILITIES

Item	Variable/Construct	
In the past year, has your organization used any form of these two categories of DA listed above for its own internal purposes? (yes/no) Respondents then indicate all DA activities as shown in Appendix 2.	DV = Extent of Innovation Adoption (Count Variable)	
I am usually the first to try a new approach or procedure. I enjoy using new practices and approaches in my work. I have no problem with a major shift in the way I do my work. I prefer to avoid major changes in the routine of the way I do my work. (R) There is something refreshing about enthusiasm for change.	IV= Individual Change Attitude α =.83	INIDIVUDAL LEVEL
Respondents made separate ratings for (1) computers and technology and (2) mathematics, statistics, quantitative analysis using the pairs of adjectives below (anchored on a 7-point scale): Very harmful/Very helpful Threatening/Non-threatening Boring/Intriguing Difficult to use/Easy to use Frustrating to use/Enjoyable to use	IV= Aversion to technical material (Berry, 1997) α =.91	
Using DA helps people make decisions more quickly. Using DA improves my performance as a manager. Using DA enhances my effectiveness as a manager. DA is useful in my managerial duties. Using DA would help me make decisions more easily.	IV= Innovation Usefulness (Davis, 1989; Venkatesh & Davis, 2000) α =.82	
I am comfortable using DA tools and procedures. I find DA tools and procedures easy to use. Using DA tools and procedures is clear and understandable. I believe that using DA is cumbersome. Using DA is frustrating. I would not feel confident about my abilities using DA. (R)	IV= Innovation Ease of use (Davis, 1989; Venkatesh & Davis, 2000 α =.89	
DA increases the chances of a high quality decision. DA leads to demonstrably positive results. The positive results of using DA are apparent to me.	IV= Innovation Results (Davis, 1989; Venkatesh & Davis, 2000) α =.80	
DA diminishes my value as a manager. (Berry, 1997) DA diminishes my discretion as a manager. Using DA reduces my control over the decision making process.	IV= Perceived Threat to Managerial Value/Control	

We are encouraged to suggest changes in the organization. We are encouraged to take risks in the organization. Suggestions for new processes and procedures are taken seriously in the organization. In the past, the organization has adjusted well to changes in practices. The organization has the capacity to change when needed. The organization will not change unless forced to do so by some crisis. (R) The organization views change in practice as a threat to core business processes. (R)	IV= Organizational Culture α =.84	**ORGANIZATION LEVEL**
Respondents rate separately each of the following decisions in terms of the extent to which responsibility for those decisions is centralized at the top levels of management: (1) Capital budgeting decisions (2) New product introduction (3) Entry into major new markets (3) Pricing of a major product line (4) Hiring and firing of senior staff	IV= Centralization (Hage & Aiken, 1969; Grover & Goslar, 1993) α =.81	
No matter what situation arises, we have procedures to follow in dealing with it. When rules and procedures exist here, they are usually in written form. The employees here are constantly checked for rule violations. There are strong penalties for violating rules.	IV= Formalization (Hage & Aiken, 1969; Grover & Goslar, 1993) α =.78	
Our organization requires legal documentation of the decisions we make. Our organization is evaluated in terms of our decision processes. The organization's reputation is affected by the quality of our decision processes. Due to our line of work, our organization requires a transparent decision process. Due to our line of work, our decisions must be made with a standardized process. The organization is held publicly accountable for our decisions by the shareholders/ board of directors/ customers/ etc.	IV= Legitimacy Need α =.77	
I am aware of decision support tools and procedures being used in organizations with similar objectives and values as our organization. Organizations in my industry have used decision support tools effectively. To make effective decisions in my industry, it is necessary to use decision support tools. I have not seen other organizations in m industry obtain valuable outcomes with DA. (R) My competitors have used DA to make better decisions. My alliances have used DA to make better decisions. My suppliers have used DA to make better decisions.	IV= Mimicry/ Benchmarking α =.79	**ENVIRONMENT LEVEL**
How quickly does technology change in your industry? How quickly do products and services become obsolete? How predictable are the actions of competitors? How predictable are consumer demands and tastes? How stable is the nature of competition in your industry? How uncertain is the long-term market for your products/services? (Response scale is 1 to 7, where 7 indicates that quick change, unpredictability, instability, uncertainty)	IV= Uncertainty (Miller & Friesen, 1982; Grover & Goslar, 1993) α =.74	

APPENDIX 2. MEASUREMENT OF DECISION PROCESS INNOVATION

Throughout this survey, we refer to "decision analysis" (DA) as a formal decision making process or procedure that may include any or all of the following: tools for framing a problem; tools for creating alternatives; systematic sensitivity analysis, processes for gaining information from experts; methods for explicitly dealing with uncertainty, tools for addressing multiple conflicting objectives; organizational processes that involve participants and decision makers. Specific examples of DA are shown below. Please review the following two categories of DA.

***In the past year,* has your organization adopted any form of these two categories of DA listed above for its own internal purposes? Please indicate below the tools and approaches used in the past year by clicking on the box next to each option.**

DA Category 1: Non-quantitative Approaches

- ☐ Methods to understand objectives of decision makers, stakeholders, or other participants in the decision process ("Value-focused thinking")
- ☐ Methods to create new alternatives
- ☐ Strategy tables
- ☐ Decision hierarchy
- ☐ Influence diagrams
- ☐ Organizational process to ensure participation and buy-in of decision makers throughout the decision-making cycle ("Dialogue decision process")
- ☐ Other group decision making techniques (such as "Delphi Group," "Nominal Group," or "Stepladder")

DA Category 2: Quantitative and Technical Tools

- ☐ Scenario analysis
- ☐ Sensitivity analysis (e.g., tornado diagrams)
- ☐ Identifying ranges (best case/worst case) of possible outcomes
- ☐ Incorporating probability into analytical models
- ☐ Probability distributions for outcome variables (risk profiles)
- ☐ Use of expert judgment to assess probabilities
- ☐ Monte Carlo simulation
- ☐ Decision trees
- ☐ Value of information, value of control
- ☐ Real options analysis
- ☐ Optimization methods (e.g., linear, nonlinear, or integer programming)
- ☐ Risk tolerance of decision makers (utility functions)
- ☐ Cost-benefit analysis
- ☐ Explicit quantification of trade-offs
- ☐ Multiattribute utility
- ☐ Decision Support Systems (DSS), "expert systems"
- ☐ Computerized decision aids