Diffusion of Collaboration Technology
In
A Global Government Organization

by

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A Dissertation
Submitted to the School of Business at
The George Washington University
In partial fulfillment of the requirements for the
Degree of Doctor of Philosophy

Washington, DC
March, 2007

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REPORT ON FINAL DOCTORAL DISSERTATION EXAMINATION

The undersigned Committee has examined Mr. Archie Andrew Turner, a candidate for the Doctor of Philosophy degree, on his dissertation entitled: "Diffusion of Collaboration Technology in a Global Government Organization." The Committee has found the candidate's work to be acceptable and recommends to the Board of Trustees that he be granted the Doctor of Philosophy degree on May 20, 2007.

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1.0 Introduction

1.1 Purpose of the Research

This research investigates the factors that affect the diffusion of an information technology (IT) innovation within an adopting organization. The IT innovation studied is video teleconferencing (VTC), installed to enhance collaboration among numerous geographically dispersed host organization sites/locations. The objective of the research is to generate empirical evidence that helps to explain why the individuals of some organizational sites/locations embrace an IT innovation while individuals of other, seemingly similar sites/locations either ignore completely, or significantly underutilize the same innovation. Individual innovation acceptance behavior characterized by extremes of this nature has been documented in scholarly research (e.g., Fichman, 2000; Agarwal, 2000) and identified as a contributing factor to organizations' failure to achieve expected IT investment benefits.

An innovation is any idea, practice, or tool new to the individual or entity considering its adoption (Zaltman et al., 1973). Diffusion refers to "the process by which an innovation is communicated through certain channels over time among the members of a social system" (Rogers, 1995, p. 35). Information technology is broadly "defined as computers as well as related digital communications technology" (Brynjolfsson & Hitt, 2000, p. 24). In this study, the IT innovation is VTC, the social system of interest includes the employees who are targeted users – or adopters – of an IT innovation that has been adopted by their organization.

Swanson (1994, p. 1070) noted "while the literature on organizational innovation is very large, relatively little of it focuses on IT innovation." Others (e.g., Downs & Mohr, 1976; Fichman, 2000; Rogers & Adhikarya, 1979) observe that organizational innovation research has focused on adoption at the organizational level. These studies endeavor to discern what kind of organizations are "innovative"; measured most often by the number of innovations adopted and/or the relative earliness or lateness of adoption.

Survey of the literature reveals little comparative empirical research focused on what happens after an innovation is adopted by an organization, and why; i.e., how does the innovation diffuse within the organization following organizational adoption and what conditions/factors influence the extent of its diffusion or acceptance. The extent of innovation diffusion within an organization following its adoption by the organization is critical. "Systems that are not accepted by their intended users will not result in any sought after benefits" (Agarwal & Prasad, 1998, p. 204). Given this obvious reality, and the dominant role of modern IT in organizational transformation, it is puzzling this topic has received relatively little research attention.

Successful diffusion of an organizational innovation follows from the innovation's widespread adoption or acceptance by target employees. Innovations that are not accepted and used by targeted employees do not diffuse – and do not provide anticipated organizational benefits. Because of this inextricable linkage, organizational innovation diffusion can be studied in terms of individual employee innovation acceptance behavior. An important premise of this study is that organizational innovation diffusion is a direct consequence of individual IT acceptance behavior in the organizational environment. Because of the interdependence of these phenomena, large and rich bodies of innovation diffusion and individual IT acceptance research contribute to the theoretical foundation of this research. Because this behavior occurs in the social environment of the modern organization, theories and findings of organizational behavior research and social psychology provide important theoretical grounding.

There has been substantial innovation diffusion research; however, the majority has studied volitional, individual adoption of relatively simple individual-user personal use innovations (Fichman, 1992; Tornatzky & Fleischer, 1990). Because of the behavioral context, organizational innovation diffusion involves a more complex individual adoption phenomenon. Innovation adoption by an employee following organizational adoption is referred to in the literature as contingency adoption (Rogers, 1995), secondary adoption (Gallivan, 2001), or two-step adoption (Fichman, 2000), and is widely acknowledged to involve a broader set of factors than has been addressed in previous innovation diffusion research (Fichman, 2000; Gallivan, 2001; Zmud & Apple, 1992).

Individual IT acceptance has also been heavily researched. However, this research has also largely focused on volitional personal adoption of single-user technologies. In addition, much IT acceptance has been situated in educational or other non-organizational settings. Individual IT acceptance in the social environment of a modern organization involves a more complex phenomenon than has been addressed thoroughly in previous IT acceptance research. This research is also distinguished by the fact that it compares diffusion and acceptance of an IT innovation within multiple independent units of a large organization.

Theories and findings of organizational behavior research illuminate factors that influence individual attitudes and behavior in the social setting of the organization. Derived largely from social psychology, they explain linkages that enable extension of previous individual innovation diffusion and IT acceptance research to the organizational context.

Innovation diffusion, IT acceptance, and organizational behavior research each contribute uniquely to the theoretical foundation supporting research of organizational IT innovation diffusion. The research also embraces, albeit implicitly, important factors and findings emerging from the study of organizational change management. No subset of these interrelated domains presently addresses this important behavior adequately. This study endeavors to synthesize their theories and research findings to develop a richer explanation of this important phenomenon.

1.2 Problem Overview

Organizations around the world, facing global competition that increases daily, continue to invest heavily in sophisticated enterprise IT innovations (Devaraj & Kohli, 2003). Global IT spending in 2003 was estimated at $1.9 trillion and forecast to reach or exceed $2 trillion in 2004 (Metcalf, 2004). Evidence of massive organizational IT investment abounds. One U.S. firm reportedly budgeted over $4 billion for IT in a single year (Jeffery & Leliveld, 2004). Organizations often invest over $100 million to implement enterprise resource planning (ERP) and ERP investment alone in the 1990's is estimated at $300 billion (Jasperson, Carter & Zmud, 2005). Several sources estimate that half of all corporate capital investment in the 1990's was for IT (Venkatesh et al., 2003; Carr, 2003; Metcalf, 2004). U.S. firms spent $780 billion in IT in 2002 (Jeffery & Leliveld, 2004). The role of modern IT in organizational change/transformation is difficult to exaggerate.

Businesses are not the only organizations investing heavily in IT. Governments (and, prominently their militaries), health care, and educational institutions, to mention only a few are also investing heavily in IT. The U.S. government invested $278 billion in IT in fiscal years 2004 and 2005 and plans to invest $200 billion more in 2006 (Aviation Week & Space Technology, 5 December 2005, p. 23).

"IT has now become the dominant capital expense" (Carr, 2003, p. 49) as "organizations increasingly depend upon information technology (IT) for the execution of a variety of operational, tactical, and strategic processes (Lewis et al., 2003, p. 658). Given the magnitude of these investments, there is intense pressure to understand how IT's contribution to organizational performance can be maximized. Efforts to link IT investment and organizational performance have yielded mixed results. Scholars and practitioners have learned the hard way that simply investing heavily in IT provides no assurance of organizational benefit. As Agarwal (2000, p. 85) observes, "acquiring appropriate IT is a necessary, but not a sufficient condition for utilizing it effectively."

Agarwal and Prasad (1997, p. 557) find that "the often paradoxical relationship between investment in information technology and gains in productivity has recently been attributed to a lack of user acceptance of information technology innovations."

Venkatesh and Davis (2000, p. 186) find similarly "low usage of installed systems has been identified as a major factor underlying the "productivity paradox" surrounding lackluster returns from organizational investments in information technology." "Systems do not improve organizational performance or create business value; users and their managers do" (Markus & Keil, 1994, p. 24).

Ramiller and Swanson (2003, p. 24) found that "implementation of IT-based innovations is notoriously problematic." Sharma & Yetton (2003, p. 533) concluded similarly that "successful implementation of information systems remains a theoretical as well as a managerial challenge...many IS innovations introduced by organizations are either rejected by end users or are underused"; an outcome which "has an important bearing on the competitive position of organizations as strategic initiatives are underpinned increasingly by IS innovations." IT "diffusion and assimilation rarely unfold in a smooth and predictable fashion" (Fichman, 2000, p. 110). "Relying on IT to provide the magic bullet" is a "main reason" organization change efforts fail (Morgan, 2001, p. 2).

Fichman and Kemmerer's conceptualization and research of IT innovation "assimilation gaps"[1] evolved from findings that "new technology may be introduced amid great enthusiasm and enjoy wide-spread initial acquisition, but nevertheless still fail to be thoroughly deployed" (Fichman & Kemmerer, 1999, p. 256). Liker, et al. (1992, p. 75) found that despite widespread organizational adoption, "true CAD/CAM [utilization was] quite rare." Cooper and Zmud (1990) discovered that

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[1] Instances in which an IT innovation adopted and acquired by an organization is subsequently not widely adopted or accepted for use by its sub-units and, or employees. The assimilation gap is defined in terms of the difference between the number units acquired and the number of units deployed or actually being utilized by employees.

despite widespread organizational adoption of material resource planning tools (by 73% of organizations surveyed) their use in organizations studied usually did not exceed the most basic or rudimentary levels. Fifteen years later, Jasperson, et al. found that almost half of ERP implementations fail to meet organizational expectations (Jasperson et al., 2005).

Synthesizing individual IT acceptance research, Agarwal found "individual users can exhibit a variety of different behaviors when confronted with a new information technology: they may completely reject it and engage in sabotage or active resistance, they may only partially utilize its functionality, or they may wholeheartedly embrace the technology and the opportunities it offers." "The problem of individual acceptance of information technology is a crucial one for those responsible for implementing technologies as well as those responsible for demonstrating the business value of an IT" (Agarwal, 2000, p. 85).

Research increasingly shows that organizational adoption of an IT innovation is only the necessary first step in bringing to bear a strategically important resource. Events occurring thereafter are at least as important in the determination of the benefits the organization will realize from its investment.

While "many innovations...are adopted by organizations...once a decision to adopt is made in an organization, implementation does not always follow." (Rogers, 1995, p. 373) "Even after formal adoption, individuals within the organization often have broad discretion about whether and how to use an innovation" (Fichman, 2000, p. 117). Traditionally the focus of organizational innovation diffusion research, organization-level adoption can be seen as relatively less significant.

Zmud and Apple's (1992) research of supermarket scanning technology use led them to conclude "the extent to which the expected benefits of an innovation, as well as unexpected difficulties, are realized is largely reflected in the success by which an innovation has been incorporated within an organization's operational and/or managerial work systems" (Zmud & Apple, 1992, p. 148). Organizational adoption of an IT innovation is no assurance it will be used effectively by employees – or that its planned benefits will be realized. "The capability of organizations to fully leverage their current (and future) investments in installed IT are inextricably bound to the collective knowledge that exists regarding post-adoptive behaviors." (Jasperson, Carter, Zmud, 2005, p. 549) "To maximize the benefits from IT investments, organizations must understand and manage their implementation processes" (Cooper & Zmud, 1990, p. 136).

Given the enormous magnitude of global IT investment and the vast potential of the technology to benefit individuals, organizations, and society as a whole, a better understanding of the factors contributing to successful implementation is imperative. This research contributes to this much-needed knowledge through empirical investigation of a diverse set of factors that theory suggests influence organizational IT innovation diffusion. While organizational-level adoption is well researched, subsequent diffusion within the organization remains an under-studied phenomenon that merits more scholarly attention. (Fichman, 2000; Gallivan, 2001; Zmud & Apple, 1992; Wynekoop & Senn, 1992)

1.3 Innovation Diffusion

> "Few issues are characterized by as much agreement as the role of innovation and entrepreneurship for social and economic development. Schumpeter's (1942) emphasis on the importance of innovation for the business firm and society as a whole is seldom disputed." (Van De Ven, 1986, p. 590)

"The ability to innovate has always been an important contributor to organizational success." (Fichman, 2000, p. 128) Some predict that the ability to innovate will become, if it is not already, the most important determinant of organizational survival. Recent organizational innovation has placed great emphasis on IT. Some scholars worry organizations have become too dependent on IT; attributing to it almost mystical powers to "enable radical and innovative organizational designs that carry the potential for enormous economic and social advantage" or to "transform organizations rather than to simply automate or improve their business processes" (Robey & Boudreau, 2000, p. 52).

Innovation diffusion research attempts to understand how and why individuals, groups, and, or organizations adopt new ideas, practices, or tools. Everett Rogers is recognized as a pioneer in the field and it's most influential contributor. Rogers defined innovation diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system" Rogers (1995, p. 100). In their study of organizational innovation, Zaltman, et al. (1973, p. 14) define diffusion as "the process by which an innovation is spread through communication channels to members of a social system." Fichman (1992, p. 2) defines diffusion similarly, as "the process by which innovations spread through populations of potential adopters."

An innovation is "an idea, practice, or object perceived as new by an individual or other unit of adoption" (Rogers, 1995, p. 35). Zaltman, et al. (1973, p. 10) add that "it matters little......whether or not the idea is 'objectively' new as measured by the lapse of time since its first use or discovery....if the idea seems new and different to the individual, it is an innovation." Tornatzky and Fleischer (1990, p. 10-11) term any "new idea, method, or device" an innovation, and technological innovation "a significant part of the *renewal* function of social organizations."

These expansive conceptualizations of innovations and their diffusion highlight the importance of studying how and why innovations diffuse. Technological innovation has become crucial as societies enter what is widely referred to as the knowledge age. It is not surprising researchers in diverse fields study how and why individuals, groups, organizations, and, or societies decide to accept new ideas, practices, and, or tools. Nor does it seem implausible to view the study of innovation diffusion as virtually indistinguishable from the study of change. Tornatzky and Fleischer (1990, p. 4) observed that "withholding judgment about whether technology causes everything in a society or whether it is merely one important part of a larger fabric, it is undeniable that the processes of technological innovation are critical to the evolution of a society."

A succession of distinguished scholars, including Downs and Mohr (1976), Meyers and Goes (1988), and Rogers (1962; 1995) have commented forcefully regarding the importance, and applicability of innovation diffusion research. Nevertheless, the process of organizational innovation remains a puzzle. Almost two decades ago Meyers & Goes (1988, p. 897) observed that "from both theoretical and practical perspectives, our cumulative knowledge of why and how organizations adopt and implement innovations is considerably less than the sum of its parts." Fichman's more recent observation (2000, p. 107) that "no single theory of innovation exists, nor does it seem likely that one will emerge" suggests that despite heavy research, little has changed regarding development of a theory of organizational innovation. His recommendation that researchers strive for theories of more limited scope also implicitly acknowledges the complexity of the innovation diffusion.

Some (e.g., Fichman, 1992; Tornatzky & Fleischer, 1990) attribute lack of progress in the understanding of organizational innovation to scholars' tendency to rely on theories and findings of Rogers' classical diffusion research. They note most of his research studied relatively simple innovation adoption scenarios that are not generalizable to organizational innovation. Thus, Fichman (1992, p. 1) notes:

> "When borrowing theory, researchers must take care to ensure that the context to which the theory is being applied matches well with the context in which the theory was developed, or alternatively, to tailor the theory to account for contextual differences. Much of diffusion theory was developed in the context of adopters making voluntary decisions to accept or reject an innovation based on the benefits they expect to accrue from their own independent use of the technology. Yet, adoption of IT may be encouraged by management (Leonard-Barton and Deschamps, 1988) or even mandated (Moore and Benbasat, 1991). Adopters, rather than making a binary decision to adopt or reject, may choose differing levels of IT use (Bayer and Melone, 1989). In addition, the adoption decision of individuals or organizations may depend on the dynamics of community-wide levels of adoption (i.e., whether "critical mass" has been established) because of network externalities (Katz and Shapiro, 1986; Markus, 1987). These sorts of complicating factors are quite common in the context of IT adoption; hence, the opportunities to apply classical diffusion "as is" may be rare indeed."

Tornatzky and Fleischer (1990, p. 123) concluded similarly, noting that:

> "Problems arise when the diffusion model is applied in situations where its basic assumptions are not met - that is to say, virtually every case involving complex, advanced technology. Like the elephant and the blind men, a complex technology means different things to different participants in deployment activities. Communication channels in complex social systems are hard to define, as they function on many different levels simultaneously. As we have discussed earlier, it is extremely difficult to determine just what the act of adoption in the incorporation of a complex new technology might be."

Acknowledging these shortcomings, Fichman (1992) recommends researchers develop methods for dealing with factors found in the organizational environment such as managerial influences, adopter interdependencies, the intertwining of innovations with organizational routines, and the existence of diffusion effects such as network externalities which are not accounted for in the classical diffusion model.

Another shortcoming of previous innovation diffusion research is its heavy focus on adopter and, or macro-diffusion studies (Fichman, 1992; Downs & Mohr, 1976) which focus on organizational indicators of "innovativeness" (typically defined in terms of a count of the innovations adopted and, or not adopted) and, or the time of adoption (i.e., adoption "earliness", or "lateness" relative to the first availability of an innovation). These studies typically seek to identify "innovators" based on these "innovativeness" measures and/or some set of attributes/characteristics.

Some emphasize that previous innovation diffusion research orientations have contributed little to our understanding of how innovations diffuse within an adopting organization. Zmud and Apple (1992) found that while "much research has been directed towards understanding how to achieve broad adoption [at the organizational level], little has been directed towards a similar understanding of how best to achieve broad incorporation" (Zmud & Apple, 1992, p. 148) [where "incorporation is defined as the implementation activities directed towards embedding an adopted innovation within an organization" (Zmud & Apple, 1994, p. 148)]. Kwon & Zmud (1987, p. 233) note "incorporation occurs when the innovation becomes embedded within an organization's routine and when the innovation is being applied to its full potential within an organization."

Rogers and Adhikarya (1979, p. 77) also found that in innovation research:

> "Usually the dependent variable was organizational innovativeness, defined as the degree to which an organization is responsive to adopting new ideas. The concept of innovativeness was usually operationalized as the number of innovations (out of a list of 10 to 25 selected innovations, for example) that a particular organization had adopted at a specific point in time. From such investigations, we have been able to learn something about the characteristics of innovative and non-innovative organizations. Unfortunately, such studies have told us little about the *process* through which a new idea is put into use in an organization."

"Their 'bottom line' is implementation (including institutionalization), not just the adoption-decision".....but "most diffusion scholars focused on adoption, not implementation, as their dependent variable of study" (Rogers & Adhikarya, 1979, p. 79).

Downs and Mohr (1976) find that issues clouding the focus of innovation diffusion research are reducible to the matter of how one chooses to operationalize "innovation." Like Rogers and Adhikarya (1979), they found researchers typically operationalize organizational innovativeness as the number of innovations adopted, simple binary adopt/non-adopt data, or earliness of innovation adoption. The assumption being that those who adopt frequently and/or early are more innovative. They suggest routine selection of these innovation measures may be attributable to "the relative ease with which pertinent data can be gathered" (Downs & Mohr, 1976, p. 149).

Downs and Mohr (1976, p. 149) assert that "the extent to which an organization has implemented an innovation" is a more important innovation measure. They go on to note:

> "On the other hand, it is often the case that operationalizing innovation by the extent of implementation comes closer to capturing the variations in behavior that we really want to explain. While it is useful to know what determined the sequence in which states first experimented with a new hybrid strain of corn, it is much more desirable that the researcher uncover 'What determines variation across states in the extent to which the hybrid strain has replaced the traditional strain?'" (Downs & Mohr, 1976, p. 149)

Midgely and Dowling (1978) also caution against low level conceptualizations of innovativeness. Arguing for a more abstract conceptualization of "innate innovativeness" they assert that by conceptualizing and measuring innovativeness as simply the time of innovation adoption or the number of innovations adopted from some set, "researchers have largely been misled into understating the effects of the complex causal chain between trait and behavior" (Midgely & Dowling, 1978, p. 237).

By focusing on the diffusion of an IT innovation following organizational adoption, this study attempts to address the important innovation research shortfall identified by numerous scholars (e.g., Fichman, 2000; Downs & Mohr, 1976; Rogers & Adhikarya, 1979). Its empirical investigation of the influence of a diverse set of factors on IT innovation diffusion in an organizational setting should contribute to a better understanding of this important phenomenon.

1.4 Information Technology Acceptance

Davis, et al. (1989, p. 982) observed that "understanding why people accept or reject computers has proven to be one of the most challenging issues in information systems (IS) research." More recently, Lewis, et al. (2003) noted "determinants of individual acceptance and use of information technology in organizations continues to be a significant area of inquiry for IS researchers" (Lewis et al., 2003, p. 658). Substantial research in the intervening years has taught us a great deal; however, scholars agree there is still a great deal to be learned about the factors affecting individual acceptance and use of IT innovations.

Agarwal's (2000) synthesis of IT acceptance research led her to conclude that the accumulated body of knowledge points to five categories of factors that influence individuals' IT innovation acceptance decisions: beliefs and attitudes, individual differences, social influences, situational differences, and managerial interventions. Her "Phenomenon of Individual Acceptance of IT" (Agarwal, 2000, p. 86) model is depicted in Figure 1.1.

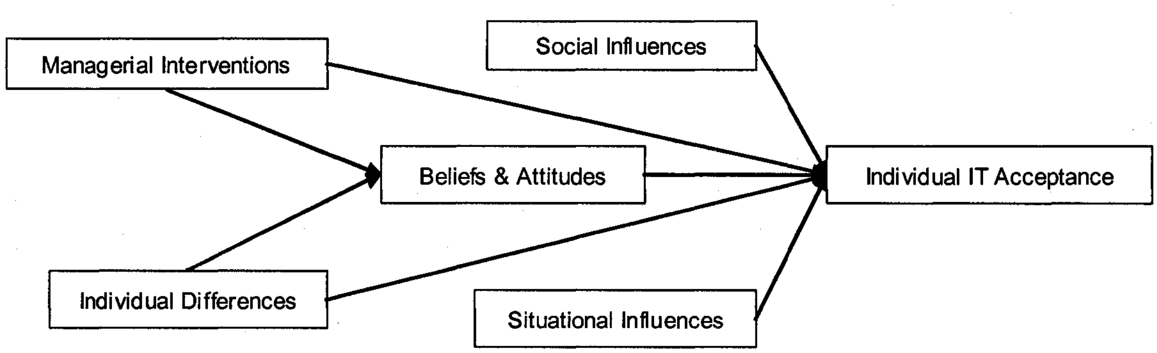


Figure 1.1
"Phenomenon of Individual Acceptance of IT" (Agarwal, 2000, p. 86)

Beliefs and Attitudes: The importance of beliefs and attitudes as determinants of behavior derives strong support from the social psychology domain. Beliefs are characterized as the result of cognitive evaluations individuals make regarding the consequences of a behavior (here, use/non-use of IT). Attitudes are affective responses that individuals form with respect to a target behavior. Attitudes reflect the direction and strength of an individual's "like" or "dislike" for a behavior. Beliefs are conceptualized as antecedents of attitudes. Attitudes are conceived as an expectancy-value formulation derived by summing the products of a person's salient beliefs and the evaluative weight assigned to each belief (Ajzen, 1991, p. 191). Evidence of the importance of beliefs and attitudes in the shaping of behavior can be found in their prominent role in widely accepted behavioral models (e.g. theory of planned behavior, theory of reasoned action).

Individual Differences: The importance of individual differences in the acceptance/non-acceptance of technology derives strong support from the fields of marketing and production (Agarwal, 2000). Individual differences considered important to IT acceptance behavior include cognitive style, personality, and demographic/situational variables, cosmopolitanism, education, role involvement, age, and job tenure (Zmud, 1979; Kwon & Zmud, 1987).

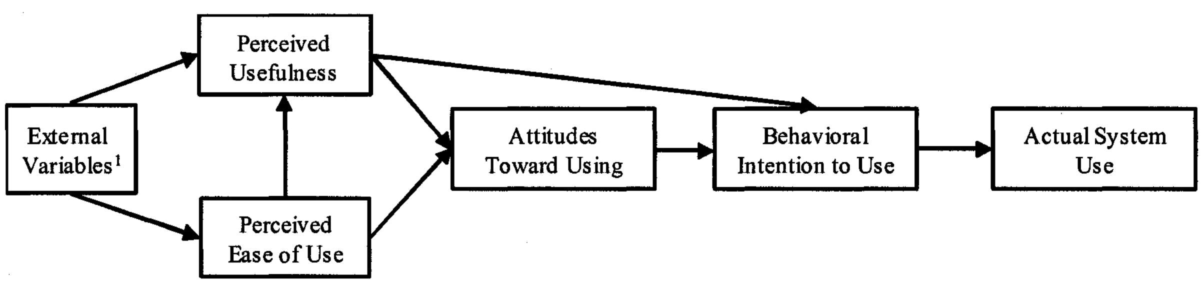
Social Influences: Social influences affect attitudes and behavior in a group setting. Although most individual IT acceptance research has tended to downplay the importance of social influences in IT acceptance (with the possible exception of mandatory-use situations), some scholars including Fulk (1993), Orlikowski (1992), Markus (1990), and Kraut, et al. (1998) advocate the importance of the attitudes, beliefs, and, or accepted norms and values of coworkers in the formation of an individual's attitude toward, perception of, or use of a technology. They note that the individual technology use or non-use decision "occurs in a very social world which is far from neutral in its effects" (Fulk et al., 1990, p. 117). Williams and Huber (1986, p. 4) also find that "the more deeply we study people in organizations, the more obvious it becomes that individual behavior cannot be understood apart from the many interacting aspects of the individual's environment, including the actions of other people and groups."

Situational Influences: Agarwal terms situational influences "idiosyncratic combination of person and situation that can influence technology acceptance." She notes "considerably less attention has been paid to situational influences" (Agarwal, 2000, p. 98). This relative inattention is likely due to their frequent conceptualization as not being separate constructs, but as "complex combinations of managerial interventions, individual differences, and, or social influences" (Agarwal, 1000, p. 98). The perceived behavioral control (PBC) construct in Ajzen's (1991) Theory of Planned Behavior and Goodhue's (1995) task-technology fit construct are situational influence factors that have received a modest research attention.

Managerial Interventions: Managerial interventions are conceptualized as "specific management actions and policies posited to influence technology acceptance outcomes" (Agarwal, 2000, p. 99). Gallivan (2001, p. 61) defines managerial interventions as "actions taken and resources made available by managers to facilitate or expedite secondary individual acceptance." Managerial interventions can be tangible, e.g., provision of suitable resources, or intangible. A widely researched and accepted intangible managerial intervention is the visible support of organizational leaders for an IT innovation.

While individual IT acceptance is typically conceptualized as a complex phenomenon subject to a diverse set of influences (e.g., Agarwal, 2001), most IT acceptance research is based on a model known widely for its parsimony; the Technology Acceptance Model (TAM) (Davis et al., 1989).

TAM is an intentions-based model derived from the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1980), but tailored to meet the broad needs of IT research. TAM has experienced broad and growing acceptance, and has proven to be a reasonably good predictor of users' intentions to use IT, and of system usage. Davis' original TAM is depicted in Figure 1.2. Evidence of TAM's broad acceptance can be



1. External Variables include system design characteristics, user characteristics (e.g., cognitive style and other personality variables), and task characteristics, nature of the development or implementation process, political influences, and organizational structure

Figure 1.2

Technology Acceptance Model (Davis et al., 1989)

found in the fact that the Institute for Scientific Information Citation Index reports more than five hundred journal citations of the first published TAM research paper (i.e., Davis et al., 1989).

Like TRA, TAM is based on the social psychology finding that "a person's performance of a specified behavior is determined by his or her behavioral intention (BI) to perform the behavior" (Davis et al., 1989, p. 983). TAM differs from TRA in several ways that will be detailed in chapter two. However, two fundamental differences are TAM's reliance on two general beliefs as attitude determinants and its exclusion of the subjective norm construct.

Whereas TRA requires elicitation of situation-specific beliefs regarding a behavior, TAM employs perceived usefulness and perceived ease of use as general beliefs salient to IT acceptance. In TRA, attitude reflects an expectancy value sum of the products of situation-specific salient beliefs and their respective evaluative weights. In TAM, usefulness and ease of use perceptions are assumed a'priori to determine an individual's attitude toward an IT

TRA's subjective norm construct is formulated using an expectancy-value summation of the products of individuals' normative beliefs and their motivations to comply with these beliefs. Davis did not include subjective norm in TAM due primarily to the construct's "uncertain theoretical and psychometric status" (Davis et al., 1989, p. 986).

Other theoretical bases for individual IT acceptance research that are less-widely researched include the task-technology fit concept advanced by Goodhue (1995), the Social Cognitive Theory of Albert Bandura as typified by Compeau and Higgins' (1995) computer self-efficacy research, and, or innovation diffusion research based on the work of Rogers (e.g., Gallivan, 2001; Fichman, 2000; Agarwal, 2000; Venkatesh et al., 2003).

TAM has proven to be a good model of user intentions to accept or use an IT innovation. A large and growing body of IT acceptance research is based on the TAM. Various TAM versions and extensions have also been researched. Although viewed by many as strength, some researchers (e.g., Taylor and Todd, 1995; Mathieson, 1991) find that TAM's parsimony detracts from its value due to the general nature of its belief constructs.

A consistent finding of TAM IT acceptance research is that perceived usefulness ("the degree to which a person believes using a particular system would enhance his or her job performance" (Davis, 1989, p. 320)) is the most powerful determinant of individual intention to accept and/or use IT. Individuals are consistently found most receptive to IT they perceive will enhance their job performance. Davis (1993) found that perceived usefulness was 50% more influential than perceived ease of use in explaining individuals' intention to use IT.

There is no similar consensus regarding the effect, and/or the importance of perceived ease of use ("the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320)) in the formation of individual attitudes toward an IT.

Citing factor analysis suggesting that it was an independent construct, Davis (1989) originally hypothesized perceived ease of use influenced both attitude and perceived usefulness directly. When statistical analysis showed the effect of perceived ease of use on behavioral intention was almost completely mediated by perceived usefulness, Davis (1989) suggested perceived ease of use might be an antecedent to usefulness rather than a direct determinant of intention. This suggested perceived ease of use might be a dimension of usefulness; not an individual construct. Debate continues over how perceived ease of use affects behavioral intention. However, perceived ease of use has been consistently found a less important influence on IT acceptance intentions than perceived usefulness.

Gefen and Straub (2000) proposed the effect of perceived ease of use on user acceptance might be task dependent. When a task was "extrinsic" to the IT (e.g., buying from an e-commerce site) they speculated perceived ease of use was not a determinant of adoption. However, when a task was "intrinsic" to an IT (e.g., gathering information), they believed perceived ease of use would affect the usage intentions. Their research tentatively supported this hypothesis, but did little to resolve lingering questions over the construct's role.

Venkatesh, et al. (2003) completed a comprehensive synthesis of IT acceptance research. Their longitudinal research assessed eight widely accepted models of individual IT acceptance (Technology Acceptance Model (TAM), Theory of Planned Behavior (TPB), Theory of Reasoned Action (TRA), Social Cognitive Theory (SCT), Motivational Model (MM), Model of PC Usage (MPCU), extended TAM incorporating TPB (ETAM), and Innovation Diffusion Theory (IDT)). This research led to development and validation of the Unified Theory of Acceptance and Usage of Technology (UTAUT); a synthesis of the models studied in the research. A depiction appears in Figure 1.3.

UTAUT accounted for up to 70% of the variance in potential user's intentions to use IT in four diverse settings (Venkatesh et al., 2003). UTAUT incorporates four IT acceptance constructs (performance expectancy, effort expectancy, social influence, and facilitating conditions) and four moderator variables (voluntariness, age, gender, and experience). A particularly significant result of this research was its reinforcement of the dominant roles of the performance-expectancy and effort-expectancy constructs in IT acceptance behavior. Social influence and facilitating condition constructs were significant only in limited conditions and when moderated by gender, age, experience, and or the perceived usage voluntariness. These

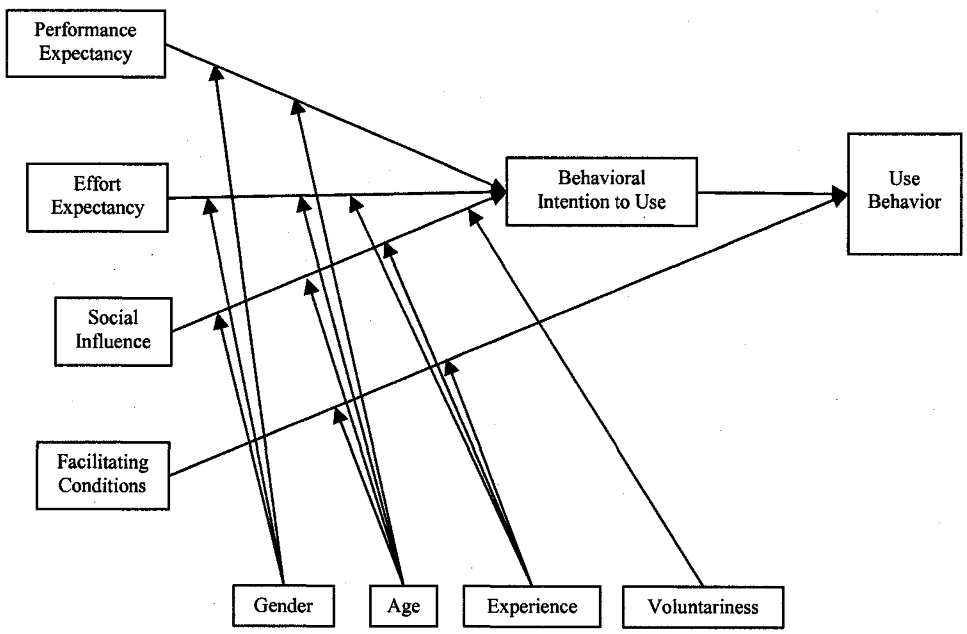


Figure 1.3

Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003, p. 447)

research findings support those characteristic of the body of TAM IT acceptance research; instrumentality perceptions are the most salient factors in individual IT acceptance behavior.

1.5 Factors Influencing Individual Behavior

Organizational leaders usually choose which innovations to adopt, but employee behavior determines which ones ultimately succeed or fail. (Lewis et al., 2003; Agarwal, 2000) Research has shown employee behavior towards innovations can vary dramatically. Employees can completely ignore an innovation, embrace it enthusiastically and find unanticipated innovative ways of using it, or behave in a way that falls somewhere between these extremes. Employee behavior is particularly critical in the case of malleable modern IT innovations since organizations may only realize competitive advantage through "non-imitable ways of utilizing technologies that are discovered within the firm by its knowledge workers at the confluence of business and technical knowledge" (Agarwal, 2000, p. 86). Jasperson, et al. (2005) found "the capability of organizations to fully leverage their current (and future) investments in installed IT are inextricably bound to the collective knowledge that exists regarding post-adoptive behaviors" (p. 549). Understanding the factors that shape employee attitudes and behaviors in the social environment of the organization is critical to successful IT innovation diffusion.

Behavioral theories from social psychology including the social cognitive theory (SCT) (Bandura, 1986), the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980) (and its theoretical extension, the theory of planned behavior (TPB) (Ajzen, 1991)), and social information processing (Salancik & Pfeffer, 1978) acknowledge explicitly the important effects of social influences on individual behavior.

SCT (Figure 1.4) is a "widely accepted, empirically validated model of individual behavior" (Compeau & Higgins, 1995, p. 191). SCT postulates a bidirectional interactive relationship among personal and environmental characteristics, and behavior. "People are both products of and producers of their environment." (Wood & Bandura, 1989, p. 361) The aspect of SCT of specific importance here pertains to the role of social influence on individual self-efficacy; one of SCT's two cognitive determinants of individual behavior (with outcome expectations). "Perceived self-efficacy concerns people's beliefs in their capabilities to mobilize the motivation, cognitive resources and coursed of action needed to exercise control over events in their lives." (Wood & Bandura, 1989, p. 364)

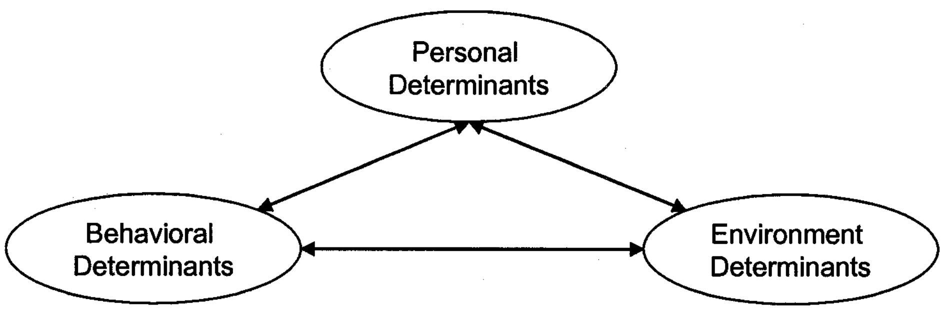


Figure 1.4
Social Cognitive Theory Causal Model (Bandura, 1991)

Individuals with high levels of self-efficacy undertake more challenging behaviors, are more perseverant in pursuit of these behaviors, and typically more successful. Self-efficacy has been shown to be a significant factor in computers use (Compeau & Higgins, 1995; Venkatesh, 2000; Compeau et al., 1999).

Individuals' self-efficacy (Figure 1.5) – and, consequently their propensity to undertake and persevere in certain behaviors – can be affected through the social influences of vicarious learning and persuasion that occur in group settings. Vicarious learning occurs through a modeling process in which individuals imitate – or "learn" – the behaviors of others. Bandura (2001, p. 270) observes "if knowledge and skills could be acquired only by response, human development would be greatly retarded, not to mention exceedingly tedious and hazardous" and that "virtually all behavioral cognitive, and affective learning from direct experience can be achieved vicariously by observing people's actions and its consequences for them." Vicarious experience affects self-efficacy because "people partly judge their own capabilities in comparison with others. Seeing similar others succeed by sustained effort raises observers' beliefs about their own capabilities" (Wood & Bandura, 1989, p. 364). The encouragement of others, or "verbal persuasion" is another mechanism through which social influence can influence individual behavior through self-efficacy. Persuasion effects are attributable to individuals' tendency to "rely, in part, on the opinions of others in forming judgments about their own abilities" (Compeau & Higgins, 1995).

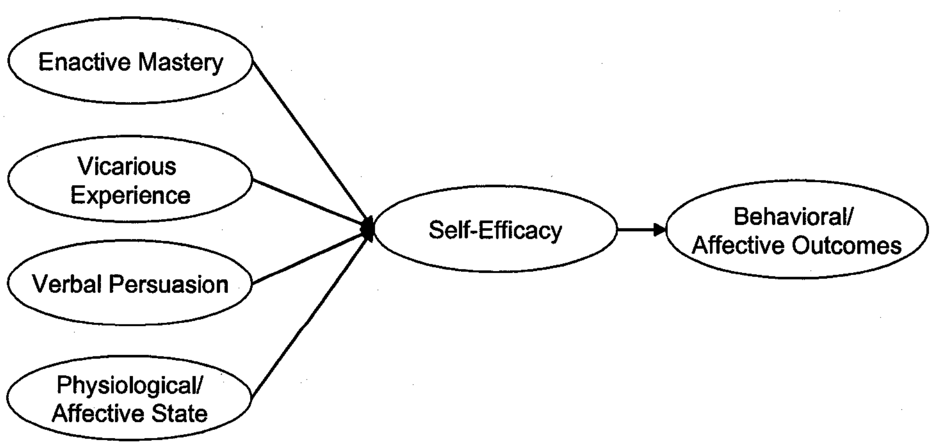


Figure 1.5

Self-Efficacy (Bandura, 1986)

TRA (Figure 1.6) and TPB provide the theoretical foundation for most IT acceptance and innovation diffusion research. Both theories recognize explicitly the role of subjective norm ("the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975, p. 302)) in the formation of attitudes toward behavior. TPB differs from TRA in the addition of the perceived behavioral control (PBC) construct ("perceptions of internal and external constraints on behavior" (Taylor & Todd, 1995a, p. 149)) to account for situations in which behavior is not completely volitional. Addition of PBC to TRA acknowledges that in addition to an individual's attitude and the effect of subjective norm, "resources and opportunities available to a person must to some extent dictate the likelihood of behavioral achievement" (Ajzen, 1991, p. 183).

Fulk (1990) highlighted the social information processing model (SIP) of Salancik and Pfeffer (1978) as an important source of social influence in the organizational setting. SIP postulates a strong relationship among social context, the attitudes of individuals, their perceived needs, and their behavior. SIP holds that "social context

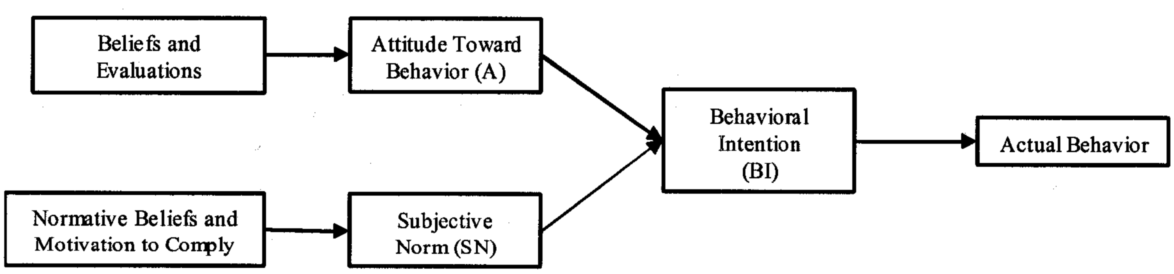


Figure 1.6
Theory of Reasoned Action (Ajzen & Fishbein, 1980)

binds people to behavior through a process of commitment" (Salancik & Pfeffer, 1978, p. 233), and that "pressures for conformity emanating from the social environment" (Salancik & Pfeffer, 1978, p. 233) affect individuals' attitudes and behavior and the relative salience to them of information and, or events. SIP asserts these socially generated forces "make behavior in work organizations different from individual behavior and individual cognitive processes considered in isolation" (Salancik & Pfeffer, 1978, p. 233).

Much organizational research finds that individual behavior in the social setting of the organization is shaped by a more complex set of factors. In their pioneering study of innovation in the Scottish electronics industry Burns & Stalker (1961) noted:

> "The sets of patterns of considerations taken into account in decision making may therefore be regarded as aspects either of the individual person (biographically determined) or of the social context in which a decision is made. Neither will yield by itself, a comprehensive statement about the framework of belief in which a decision is made. But in working organizations decisions either in the presence of others or with the knowledge that they will have to be implemented, or understood, or approved by others. The set of considerations called into relevance on any decision-making occasion has therefore to be one shared with others or acceptable to them" (Burns & Stalker, 1961, p. 118).

Fidler and Johnson (1984) noted that "interpersonal influence processes often are viewed as playing a determinant role in the implementation of innovations within organizations (Holland et al., 1976; Picot et al., 1982: Rice & Rogers, 1981). And subformal channels are the primary conduits of this type of influence" (p. 709).

Behavioral theories which serve as a basis for much individual IT acceptance and innovation diffusion research explicitly acknowledge social influence mechanisms through which individuals' beliefs, attitudes, and/or behaviors can be affected, and/or shaped in a social context. It seems implausible that these well-researched social influences do not affect individual employees facing an IT innovation acceptance decision situated in an organizational setting. This research hypothesizes that social influences do play a role in shaping this important behavior and intends to investigate the nature of their influence.

1.6 IT Enabled Organizational Change

Reminiscent of Markus & Benjamin's (1997) "Magic Bullet Theory of Information Technology and Organizational Change" (i.e., a belief couched in "technological determinism" that "IT changes people and organizations by empowering them to do things they couldn't do before and by preventing them from working in old and unproductive ways" (Markus & Benjamin, 1997, p.57)), Boudreau & Robey (2005, p. 16) observe "the prevailing rhetoric in practice is that information technology is an indispensable enabler of organizational transformation." Their research, however, demonstrates the critical influence of human agency and technology enactment even in the implementation of an IT innovation widely thought to be less vulnerable to misappropriation than most; an enterprise resource planning system (ERP). They discovered "improvised learning" (informal, self-generated learning among employees within the government agency setting) enabled the organization to move from an extended initial period of "inertia" in which employees found (largely inefficient) ways to circumvent intended patterns of ERP use, to a stage of "reinvention" in which employees gradually adapted the system to their work patterns and found ways of compensating for its deficiencies.

Project leaders initially considered the ERP implementation a "great success" (p.17) and users "eagerly anticipated using the new system" (Boudreau & Robey, 2005, p. 17). However, Boudreau and Robey concluded "users are likely to enact information technology applications in ways that are neither predictable nor easy to control" (Boudreau & Robey, 2005, p. 17). In their research, voluntary formal ERP training was largely ignored by employees. While reluctant to exercise hindsight, the researchers speculated "mandated formal training coupled with economic incentives" might have resulted in a more expeditious system usage learning process. They recommend increased research of "user actions following technology implementation" (Boudreau & Robey, 2005, p. 17) finding that most research attention is devoted to adoption and initial implementation of new technologies.

Markus (2004) makes explicit an important linkage between IT implementation and organizational change through her conceptualization of "technochange" which she defines as "technology driven organizational change" (Markus, 2004, p. 4). She recommends a distinction between "IT projects, which focus on improving technical performance" (e.g., a server upgrade virtually transparent to users except perhaps for improved system performance) and technochange which "involves great potential impact on 'the users'" (Markus, 2004, p.5).

"As many of 75% of organizational change efforts involving technology fail (even when the technology performs acceptably) because of people's negative reactions to changes in their work, organizational business processes, and the technology they use" (Markus, 2004, p. 5). Markus attributes this high failure rate to the tendency of organizations to adopt either an IT project management mindset focused on technical aspects (e.g., project cost, schedule, and/or system functionality) or an "organizational change management approach" which "relies on interventions that focus on people, organizational structures, and human resource management policies" (Markus, 2004, p. 6) and which 'take as a given the IT 'solutions' developed by a technical team" (Markus, 2004, p. 4).

Noting that "no one technochange solution or implementation process can be right for every situation" (Markus, 2004, p. 16), Markus prescribes an iterative incremental approach in which large innovations are implemented incrementally in small steps and the focus is on behavior change and organizational results.

Markus recommends this technochange approach when an IT change; affects people outside the IT department and/or the organization, affects a larger number of people, occupations, and/or organizational units, has larger rather than smaller effects on employees (e.g., need to learn a new software package), affects some employees/organizational units in ways that could be perceived as negative, is very expensive, is likely to take a long time and/or disrupt organizational performance, and/or is revolutionary vice evolutionary (Markus, 2004).

Markus' (2004) technochange approach requires a "partnership between IT specialists, organizational managers, and human resource management specialists" to shape a complete solution (i.e., includes "complementary changes" such as new/revised business processes/workflows, new job designs, new skills training, new metrics/incentives (Markus, 2004, p. 14)) and implementable ("a solution that can be, and is, adopted and used" (Markus, 2004, p. 14)) in terms of its fit with business processes, culture, and incentives.

Brynjolfsson's (2003) research of how organizations best capitalize on IT also highlights the importance of associated organizational change. His research of more than eleven hundred companies revealed "the greatest IT benefits are realized when an IT investment is coupled with a specific set of complimentary business investments" (Brynjolfsson, 2003, p.2). Analysis of firms achieving high IT benefits revealed a "cluster of related innovations, notably organizational changes outside the IT department" (Brynjolfsson, 2003, p.2) that Brynjolfsson termed the "digital organization." Attributes of digital organizations include; automation of routine tasks, use of highly skilled employees, decentralization of decision making, improved horizontal/vertical information flows, performance based incentives, and increased emphasis on employee recruitment/training (Brynjolfsson, 2003, p.3-4). Digital organization attributes reflect complementary organizational change investments Brynjolfsson estimated to be ten times the cost of the IT technology. However, they confer on organizations adopting them the ability to "work differently from their competitors" (Brynjolfsson, 2003, p. 2) and to derive the greatest productivity benefits from IT innovations. Brynjolfsson's research to resolve the "IT productivity paradox" revealed that while "IT is a promising source of productivity growth" "it makes little contribution to the overall performance of a company or the economy until it's combined with complimentary investments in work practices, human capital, and organizational restructuring" (Brynjolfsson, 2003, p. 4). He noted in conclusion that "IT hardware can be easily purchased, but implementing the digital organization requires a more difficult process of 'coinvention' by IT users" (Brynjolfsson, 2003, p.4).

1.7 Research Questions

This research investigates three overarching research questions:

1. How do various categories of factors such as individual perceptions of innovating, social influences, management interventions, organizational environment/structure affect individual IT innovation acceptance/usage behavior in the organizational setting?
2. Which specific factors within these categories are most important in determining individual IT innovation acceptance/usage and consequent organizational diffusion of the innovation?
3. What combination of factors from these categories provides the most statistically significant predictive/explanatory value for individual innovation acceptance/usage behavior?

1.8 Conceptual Framework

Social Cognitive Theory (SCT) (Bandura, 1977) and the Theory of Planned Behavior (TPB) (Ajzen, 1991) provide the conceptual foundation of this research. SCT and TPB are important complementary behavioral theories from social psychology.

This research attempts to extend existing innovation diffusion and IT acceptance research to provide a foundation for theory-based empirical investigation of individual IT innovation adoption/acceptance behavior in the organizational environment. Individual innovation acceptance/usage behavior is conceived as a necessary and sufficient condition of organizational innovation diffusion following adoption at the organizational level. The foundational role of SCT and TPB in these two source research streams provides needed linkages between the conceptual framework of this research and its model constructs and sub-constructs, which are drawn from innovation diffusion and IT acceptance research.

As Compeau, et al. (1999) noted, "TAM and DOI [diffusion of innovation] perspectives focus almost exclusively on beliefs about the technology and the outcomes of using it" (Compeau et al., 1999, p. 146), whereas "SCT and TPB include other beliefs that might influence behavior, independent of perceived outcomes" (Compeau et al., 1999, P. 146). Among "other beliefs" that could reasonably be expected to influence individual innovation adoption behavior are perceptions of resource and opportunity availability, management commitment, and social influences such as behavior modeling and vicarious learning based on the behavior of colleagues.

SCT was discussed briefly in the overview of IT acceptance literature and is depicted graphically in Figure (1.4). SCT is an accepted model of individual behavior that has been widely researched and empirically validated (Compeau & Higgins, 1995). Venkatesh et al. (2003, p. 432) termed SCT "one of the most powerful theories of human behavior."

This research applies two important SCT precepts. The most important of these is the proposition that individual behavior and the environment in which it occurs are interactively and reciprocally determined. The important role of the environment surfaces in the work of other important organizational innovation scholars such as Tornatzky and Fleischer (1990) who find context an important factor in shaping individual behavior. The importance of behavioral context emerges in this research through hypotheses that individuals deciding whether or not to accept the IT innovation are influenced by a more diverse set of factors than just their own individual perceptions of innovating. In this research, the individual behavior of interest – innovation acceptance/usage – is hypothesized to be influenced by several categories of organizational environment factors; social influences, organization structure, and managerial interventions.

Another SCT precept important to this research is that individual behavioral choices are influenced by the outcomes one expects to derive from a behavior. Outcome expectations have been investigated extensively in both innovation diffusion and individual IT acceptance research. Instrumentality constructs similar to outcome expectations play a dominant role in both research streams. All important models of individual IT acceptance include a construct to capture individual perceptions of the instrumental benefits of accepting/using the IT (Venkatesh et al., 2003). In innovation research, Tornatzky and Klein (1982) found relative advantage, a construct very similar to outcome expectations, one of only three innovation perceptions consistently (positively) associated with adoption. Consistent with SCT and the contributing research streams, this study expects individual perceptions of the relative advantage of adopting an IT innovation to be an important factor in the adoption decision.

TPB is the second pillar of the conceptual framework of this research. TPB was derived from the Theory of Reasoned Action (TRA) to facilitate research of situations in which behavior may not be entirely volitional (Ajzen, 1991). A depiction of TPB from Ajzen (1991, p. 182) appears in Figure 1.7. Like TRA, TPB postulates an individual's intention to perform a behavior derives from his/her attitude toward the behavior (i.e., affective disposition), and his/her perception and valuation of the beliefs of important others as to whether or not he/she should perform the behavior (i.e., subjective norm). Also like TRA, a fundamental premise of TPB is a strong relationship between intentions and behavior. Behavioral intention is a "measure of the strength of one's intention to perform a specified behavior" (Davis et al., 1989, p. 983). Ajzen (1991, p. 181) points out "intentions are assumed to capture the motivational factors that influence a behavior" and that, "as a general rule, the stronger the intention to engage in a behavior, the more likely should be its performance." Existence of a strong intentions-behavior relationship hypothesized by TRA and TPB has been researched and well-documented (e.g., Sheppard et al., 1988).

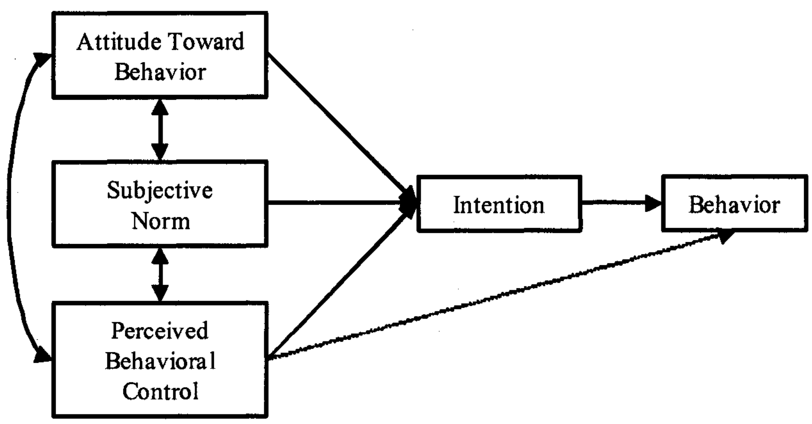


Figure 1.7

Theory of Planned Behavior (Ajzen, 1991)

TPB differs from TRA in the addition of the perceived behavioral control (PBC) construct. TPB hypothesizes that PBC influences both intentions and behavior directly. Addition of PBC to TRA was "made necessary by the original model's limitations in dealing with behaviors over which people have incomplete volitional control" (Ajzen, 1991, p. 181). PBC acknowledges that "a behavioral intention can find expression in behavior only if the behavior in question is under volitional control, i.e., if the person can decide at will to perform or not perform the behavior" (Ajzen, 1991, p. 182). PBC is meant to reflect an individual's perceptions of the opportunities and resources available in the performance of a target behavior. Like TPB's other constructs, the influence of PBC "can and usually does, vary across situations and actions" (Ajzen, 1991, p. 183).

TPB's theoretical validity is conditioned on three criteria: "intentions and perceptions of control must be assessed in relation to the particular behavior of interest, and the specified context must be the same as that in which the behavior is to occur" (Ajzen, 1991, p. 185), "intentions and perceived behavioral control must remain stable in the interval between their assessment and observation of the behavior" (Ajzen, 1991, p. 185), and "prediction of behavior from perceived behavioral control should improve to the extent that perceptions of behavioral control realistically reflect actual control" (Ajzen, 1991, p. 185).

The influence of PBC is negatively related to individual perceptions of the degree to which the behavior is truly volitional (Ajzen, 1991, p. 185). If the behavior is perceived to be completely volitional, PBC's effect is expected to be small. If the behavior is perceived to be less volitional, PBC's role is expected to be greater. (Ajzen, 1991, p. 185)

TPB is an appropriate conceptual foundation for this research because it accounts explicitly for important factors that are characteristic of the organizational environment and which can affect individuals' IT innovation behavior. These include social influences in the form of the subjective norm constructs, and a potentially diverse set of situational control factors within the PBC construct. Specific factors in this research traceable to PBC include managerial interventions such as organizational commitment, facilitating conditions, and perceptions of the voluntariness of innovation acceptance/usage.

1.9 Research Model

A high level depiction of the research model appears in Figure 1.8. Because organizational IT innovation diffusion involves elements of both innovation diffusion and individual IT acceptance, the model includes constructs from both research domains. Because these research streams exhibit considerable conceptual overlap, it is not surprising that some research model constructs appear prominently in both literatures. The model also draws from the literature of organizational change by incorporating important constructs shown to be significant in that research domain.

There has been no formal synthesis or convergence of the innovation diffusion and IT acceptance research streams. However, scholars have increasingly recognized their conceptual relationship. Cooper and Zmud (1990, p. 124) observed that "viewed from a technological diffusion perspective, IT implementation is defined as an organizational effort directed toward diffusing appropriate information technology within a user community." Fichman (1992, p. 1) noted that "innovation diffusion is becoming an increasingly popular reference theory for empirical studies of information technologies (IT)." Kwon and Zmud (1987, p. 231) concluded "the functional parallels between IS implementation and diffusion of technological innovation are clear."

References and linkages to innovation diffusion theory and research appear in the individual IT acceptance literature. In rationalizing TAM's perceived usefulness and ease of use constructs, Davis (1989) borrowed from innovation diffusion research. He noted "the accumulated body of knowledge regarding self-efficacy, contingent decision behavior and adoption of innovations provides theoretical support for perceived usefulness and ease of use as key determinants of behavior" (Davis, 1989, p. 323).

Agarwal and Prasad (1997) investigated the role of individual IT innovation perceptions to acceptance and continued usage, finding "new information technologies or systems represent innovations for the target audience of potential adopters" and that "an important theoretical paradigm underlying research of individual adoption of information technologies derives its roots from the adoption and diffusion of innovations" (p. 558). Agarwal (2000) and Venkatesh, et al. (2003) are other prominent IT acceptance scholars citing important linkages between these two research streams.

Karahanna, et al. (1999) synthesized individual IT acceptance and innovation diffusion theories/constructs to research the role of attitudes and subjective norms in the adoption and continued use of Windows. Their research model was based on TRA but included individual perceptions of innovating from innovation diffusion research. They found individual adoption and continued-use decisions affected by different belief sets and social influences.

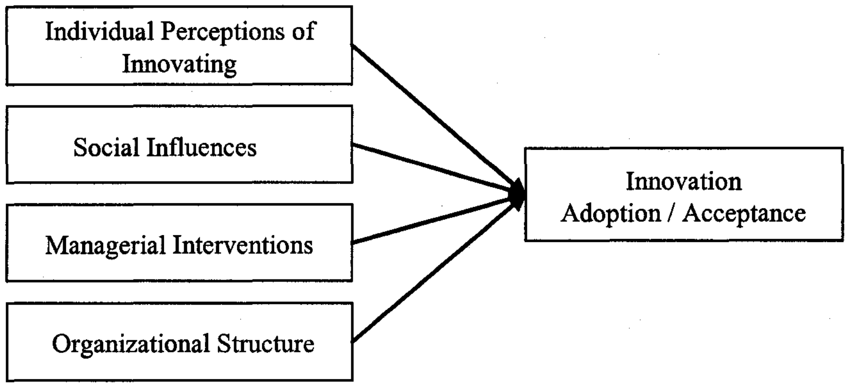


Figure 1.8
Top Level Research Model

Individual Perceptions of Innovating: An individual's perceptions of the likely outcomes of a behavior are important predictors of whether or not he/she will choose to engage in that behavior. This accepted premise of social psychology provides an important foundation for both innovation diffusion and IT acceptance research. In their research of organizational innovation, Tornatzky and Fleischer (1990) emphasized the role of perceptions by noting "it is critical to remember…that often what matters most is not what the thing *is* but rather what people *think* it is and how they respond as a consequence" (Tornatzky & Fleischer, 1990, p. 22). The model includes three individual perceptions of innovating; relative advantage, ease, and compatibility. All three have played an important role in one or both research domains.

The strong influence of individual perceptions of instrumentality (e.g., relative advantage) on behavior is well-documented in both innovation diffusion and IT acceptance research. In their recent synthesis of IT acceptance research, Venkatesh, et al. (2003) found "performance expectancy" ("the degree to which an individual believes that using the system will help him or her to attain gains in job performance" (Venkatesh et al., 2003, p. 447)), a construct synthesized from similar measures found in five of the acceptance models studied, was "the strongest predictor of intention" (Venkatesh et al., 2003, p. 447) to use an IT. This reinforced the finding of considerable TAM research that perceptions of usefulness are a powerful IT acceptance determinant.

Perceptions of instrumentality have also played an important role in innovation diffusion research. Rogers' survey of over five-hundred innovation diffusion studies led him to conclude that "diffusion scholars have found relative advantage ['the benefits and the costs resulting from adoption of an innovation" (Rogers, 1995, p. 216)] to be one of the best predictors of an innovation's rate of adoption" (Rogers, 1995, p. 216). Tornatzky and Klein also found relative advantage ("the degree to which an innovation is perceived as being better than the idea it supersedes" (Tornatzky & Klein, 1982, p. 34)) one of only three of thirty-one innovation attributes studied in their meta-analysis consistently related to innovation adoption. Perceptions of complexity and compatibility were the other two.

In research of IT assimilation ("the extent to which the use of the technology diffuses across the organizational projects or work processes and becomes routinized in the activities of those projects and processes" (Purvis et al., 2001, p. 121)) Purvis, et al. (2001, p. 121) found "users are more likely to use technologies that are perceived as: being easy to use, having a clear relative advantage over existing ways of doing work, being less complex, and being compatible with the existing work domain."

Social Influence: Social influence captures the degree to which individual innovation acceptance/adoption decisions are influenced by the attitudes, beliefs, and behavior of others in a group setting (Agarwal, 2000). Burns and Stalker's (1961) showed individual decisions in the organizational setting are influenced by both personal and social factors. Fidler and Johnson (1984, p. 709) assert that "interpersonal influence processes often are viewed as playing a determinant role in the implementation of innovations within organizations." Fulk (1990) observed that well known sources of social influence can be found in the social learning theory of Bandura and in the social information processing theories of Salancik and Pfeffer (1978). Purvis, et al. noted that "institutional theory suggests that the behaviors of individuals within organizations are significantly influenced by the prevailing organizational norms, values, culture, and history (Purvis et al., 2001, p. 120). Agarwal (2000, p. 98) found research findings of the importance of social influence in IT innovation acceptance "equivocal" and called for "additional research that clarifies the precise role of social pressure in technology acceptance." Agarwal echoes the call of Davis, et al. (1989) upon their finding no significant subjective norm effect in foundational TAM research.

Managerial Interventions: Managerial interventions are actions taken and resources made available by managers to facilitate or expedite individual innovation adoption/acceptance (Gallivan, 2001, p. 61). Agarwal (2000, p. 99) defined managerial interventions as "specific management actions and policies that are posited to influence technology acceptance outcomes"; either directly or indirectly because of their influence on individuals' beliefs and, or attitudes toward innovating. Agarwal (2000) and Lewis, et al. (2003) highlight the correspondence between managerial interventions and institutional factors which have "long been a subject of interest in IS research" (Lewis et al., 2003, p. 661). Numerous managerial interventions have been studied including user training, knowledge management, and organizational support; managerial/organizational commitment is "one institutional factor that has received consistent attention in the literature as an important influence on technology adoption" (Agarwal, 2000, p. 100). Others include training and management efforts to "orchestrate key organizational processes" that "have an effect on user acceptance" (Agarwal, 2000, p. 101). Agarwal asserts "deliberate managerial action can have a profound impact on individual acceptance of information technology" (Agarwal, 2000, p. 101).

The research model includes three previously researched managerial interventions; management commitment/support, facilitating conditions, and perceptions of voluntariness. Substantial research (e.g., Keen, 1981; Sharma & Yetton, 2003; Zmud, 1984; Jarvenpaa & Ives, 1991; Premkumar & Potter, 1995; Lewis et al., 2003; Kling, 1980) has shown management support/commitment an important determinant of organizational innovation success. Organizational scholars (e.g., Markus, 2004; Brynjolfsson, 2003) find management support commitment a key factor in the successful management of IT-enabled organizational change. Other scholars (e.g., Taylor & Todd, 1995a; Mathieson, 1991; Hartwick & Barki, 1994) have confirmed the importance of innovation resource and opportunity factors similar to Ajzen's perceived behavioral control. Similar constructs have also been found to play an important role in successful organizational change.

Voluntariness of innovation adoption has not been heavily researched. "Voluntariness of use" ("the degree to which use of the innovation is perceived as being voluntary or of free will" (Moore & Benbasat, 1990, p. 195)) was conceived and developed by Moore and Benbasat (1990). Their research showed that voluntariness perceptions, which proved to be normally distributed, affected the degree to which attitudes predict behavior.

Hartwick and Barki (1994) found subjective norms were only a significant factor in innovation adoption when perceived voluntariness of adoption was low (i.e., a perceived organizational mandate to adopt). Where perceived voluntariness was high (i.e., no perceived management mandate), subjective norms did not influence innovation adoption.

Karahanna, et al. (1999) found potential adopters and current users of Windows in the same setting reported significantly different voluntariness perceptions. Windows users reported lower perceptions of voluntariness and stronger intentions to continue use.

Consistent with Hartwick and Barki (1994), Venkatesh and Davis (2000) found subjective norms were not a significant factor in IT acceptance when voluntariness was perceived to be high, but were a significant factor when voluntariness perceptions were low.

Organizational Structure: An organization's "most salient characteristic is its structure" (Zaltman et al., 1973, p. 106). Organizational structure is typically described in terms of its hierarchy of authority, decision making impersonality, decision making participation, division of labor, and the prevalence and enforcement of rules and procedures (Zaltman et al., 1973, p. 132). Like Burns and Stalker (1961) who classified organizations along a "mechanistic-organic" continuum depending upon their structural characteristics, Zaltman, et al. found organizational structural characteristics affect organizational innovation. Rogers (1995) also hypothesized that organizational structural characteristics such as formalization, centralization, and complexity would affect organizational innovation behavior and success.

This research examines the influence of organizational formalization on innovation diffusion. Formalization reflects "the extent to which work activities are defined formally by administrative rules, policies, and procedures" (Michaels et al., 1988, p. 377) and constitutes an effort to structure employee activities. A popular premise of innovation diffusion research is that high organizational formality inhibits innovation adoption at the organizational level but is conducive to the diffusion of innovations once they are adopted.

1.10 Research Tenets

This research is based upon and guided by tenets and propositions derived from previous relevant IT acceptance, innovation diffusion, and organizational behavior research.

- IT is a critical enabler of organizational change/transformation.
- Organizational IT innovation implementation can be characterized as a process of innovation diffusion within the adopting organization.

- Diffusion of an innovation within an adopting organization depends upon widespread individual innovation acceptance/usage.
- Classical innovation diffusion research has focused almost exclusively on volitional decisions by individuals regarding adoption of simpler personal use innovations.
- Because classical innovation diffusion research has not addressed the full range of factors that can affect individual adoption of more complex innovations in the organizational environment, its theories and findings are not necessarily applicable to organizational innovation diffusion.
- Organizational innovation diffusion research has examined organizational level innovativeness, focusing primarily on frequency and, or time of adoption by the organization. This research has sought to characterize innovative organizations, but has largely overlooked the critical process by which innovations diffuse within the organization once they have been adopted.
- Individual IT acceptance research, based primarily on TAM has focused primarily on volitional individual adoption of personal use IT and has not addressed the full range of factors theorized to influence innovation acceptance behavior in the organizational environment.
- Research and theories from individual IT acceptance, innovation diffusion, and organizational behavior can be synthesized to model individual innovation adoption in the organizational environment.
- Social psychology theories of individual behavior that undergird IT acceptance and innovation diffusion research explicitly recognize the importance of social

influences on individual behavior. However, to date, these influences have not played a prominent role in either research domain.

1.11 Research Contribution

This research contributes a candidate model of individual IT innovation adoption/acceptance in the organizational environment. The model is traceable to concepts from TPB and SCT and incorporates constructs found in IT acceptance, innovation diffusion, and social psychology research. Because individual adoption/acceptance is an antecedent of organizational IT diffusion, this model contributes to our current understanding of this important phenomenon. The findings of this research provide tentative evidence of the explanatory value of the candidate model and the relative influence of the included factors on individual innovation acceptance/usage and organizational IT diffusion.

1.12 Study Procedure and Data Sources

Data for this cross-sectional factor/variance study was collected via an anonymous web-based survey posted on the host organization's intranet. The survey consisted of established construct measurement instruments drawn from scholarly research appearing in peer-review journals. The survey also included a limited number of demographic and organizational context items. All organization units equipped with the target IT innovation were solicited for inputs and provided access to the survey. Accepted statistical procedures in SAS 8e for Windows were used in the data analysis.

1.13 Organization of the Dissertation

Chapter Two presents an overview of relevant literature from the innovation diffusion, individual IT acceptance, and organizational behavior research domains.

Chapter Three provides a comprehensive overview of the methods used in this research. The research model and all included constructs and measurement instruments are presented and discussed.

Chapter Four provides a comprehensive overview of the data analysis phase of the research. The chapter includes sample descriptive statistics and a detailed report of the analysis of the data and findings relative to each research hypothesis.

Chapter Five presents the conclusions supported by the research and their potential implications for future research. The discussion includes identification of research limitations that must be considered when generalizing the findings of this research.

1.14 Summary

Most research contributing to the current understanding of innovation diffusion has focused on volitional individual decisions regarding personal adoption/non-adoption of relatively simple single-user innovations. Similarly, most IT acceptance research has studied individual volitional decisions regarding personal acceptance of single-user ITs.

The majority of research in both domains has focused almost exclusively on the influence of individual perceptions of innovation attributes placing relatively less emphasis on the diverse set of factors hypothesized to influence innovation/IT acceptance behavior.

Too little research in either domain has been situated in a real world organizational environment although substantial research highlights the importance of context as an influence in individual behavior.

There has been substantial research of organizational innovation diffusion. However, most of this research has focused on identifying the characteristics of "innovative" organizations based on cumulative counts of innovations adopted, and/or the earliness/lateness of innovation adoption. Despite broad recognition of the importance of organizational IT innovation implementation, there is a surprising shortage of empirical comparative research of this crucial phenomenon. This may help explain why scholars still consider organizational IT innovation implementation a poorly understood phenomenon.

A fundamental premise of this research is that individual IT innovation adoption in the organizational environment is too complex a phenomenon to be modeled using only individual perceptions of the innovation's usefulness and/or ease of use. Yet that is what the accumulated body of IT acceptance research would seem to suggest.

Venkatesh, et al. (2003) asserted "it is possible that we may be approaching the practical limits of our ability to explain individual acceptance and usage decisions in organizations" (Venkatesh et al., 2003, p. 471). While UTAUT provided excellent explanatory performance in the settings studied – with performance and effort expectancy constructs as its principal predictors – it is interesting to note the theoretical basis of that research ("the basic conceptual framework underlying the class of models explaining individual acceptance of information technology that forms the basis of this research" (Venkatesh et al., 2003 p. 427)) was the conceptual model represented in Figure 1.9.

This conceptual model proposes "Individual Reactions to Using Information Technology" as the only predictors of "Actual Use of Information Technology." Comparison with Agarwal's "Phenomenon of Individual Acceptance of IT" in Figure 1.10 reveals a striking difference in terms of postulated IT usage predictors. Other scholars including Fichman, Gallivan, Rogers, Fulk, and Zmud also postulate richer and more diverse sets of organizational innovation diffusion factors comparable to Agarwal's.

This research strives to develop a broader perspective similar to scholars such as Compeau, et al. who noted "adoption is not just about convincing people of the benefits to be derived from a technology"...."while the TAM and DOI (diffusion of innovation) perspectives focus almost exclusively on beliefs about the technology and the outcomes of using it, SCT and TPB include other beliefs that might influence

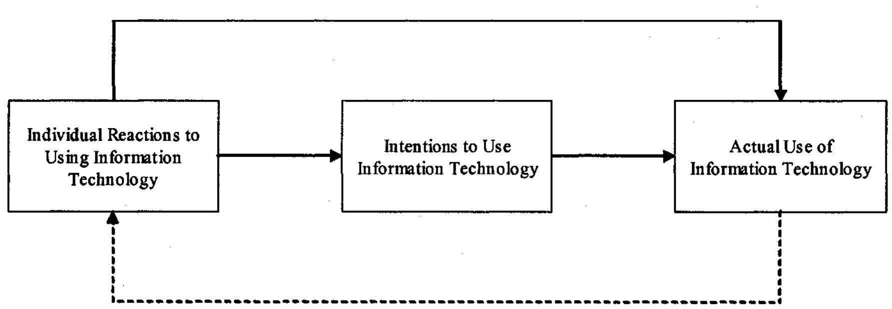


Figure 1.9
"Basic Concept Underlying User Acceptance Models"
(Venkatesh et al., 2003, p. 427)

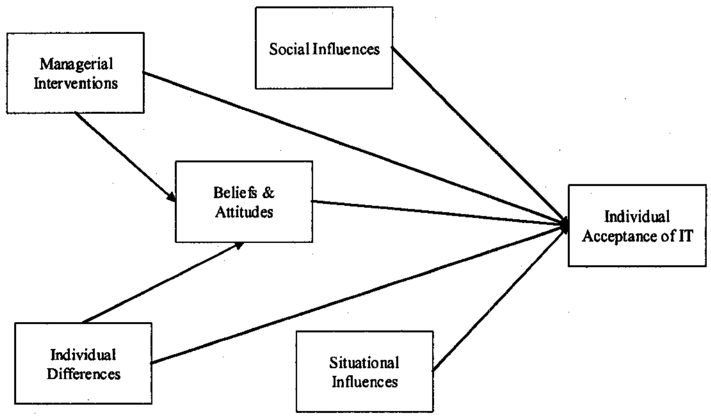


Figure 1.10

"Phenomenon of Individual Acceptance of IT" (Agarwal, 2000, p. 86)

behavior, independent of perceived outcomes" (parentheses added) (Compeau et al.1999 146) and Karahanna, et al. (1999) who noted that "although the Davis, et al. and Thompson, et al. studies have enhanced our understanding of determinants of initial usage and continued usage, they only examined the influence of two innovation attributes, perceived usefulness and perceived ease of use, on technology acceptance outcomes. Other work in technology acceptance, notably innovation diffusion studies, however, argues for a more comprehensive set of beliefs" (Karahanna et al., 1999, p. 184).

The primary objective of the research is to perform theory-based empirical study of a diverse set of factors hypothesized to affect organizational IT innovation diffusion. Recognizing that the innovation diffusion within the organization is an outcome of individual adoption decisions (Gatignon & Robertson, 1985), this research proposes that a model of individual IT innovation adoption/acceptance in the organizational environment comprised of a richer set of factors believed to affect individual innovation acceptance/usage behavior will contribute to a more complete and useful understanding of this critical phenomenon. This should contribute to a better understanding of factors affecting organizational IT implementation. Given the dominant role and potential of modern IT in organizational change/transformation, a better understanding of the factors conducive to successful organizational IT implementation could lead to enormous societal benefit.

2.0 Literature Review

2.1 Introduction

This research investigates empirically factors theorized to influence the organizational diffusion of information technology (IT) innovations. This important, but under-researched phenomenon is conceptualized to encompass three interdependent social science research domains; innovation diffusion, individual IT acceptance, and organizational behavior.

Organizational innovation diffusion is manifested through the individual innovation adoption behavior of an organization's employee user community. Investigation of this diffusion phenomenon requires consideration of factors affecting individual IT innovation adoption behavior in the organizational environment and a model of this necessary antecedent behavior. Innovation diffusion, individual IT acceptance, and organizational behavior research literatures were reviewed to develop a theoretical foundation for the research model.

The literature review summarizes the contributions of innovation diffusion, individual IT acceptance, and organizational behavior research. Theories and previous research findings that contribute to the research model are identified. The literature review also identifies gaps in these research domains this research is intended to help fill.

2.2 Innovation Diffusion

2.2.1 Introduction: Innovation diffusion research investigates how and why new ideas, practices, and or tools spread, come to be adopted by - or diffuse through - a population.

Innovation has played a fundamental role in the improvement of the human condition. Tornatzky and Fleischer identified technological innovation as a "significant part of the *renewal* function of social organizations" and noted that "technological innovation is a topic that stirs passion....is often involved in the historical competition of cultures, ideas, and peoples" and "often defines what we are and what we do" (Tornatzky & Fleischer, 1990 , p. 10). Due to its broad applicability and importance innovation diffusion has received heavy research attention from a broad spectrum of communities.

Downs and Mohr (1976, p. 700) observed that "innovation has emerged over the last decade as possibly the most fashionable of social science areas." They explained the popularity of innovation research in fields as "diverse as anthropology and economics" by pointing out that "innovation research of the salient behavior of individuals, organizations, and polities can have significant social consequences" (Downs & Mohr, 1976, p. 700).

More than a decade later, Meyer and Goes (1988, p. 897) noted "few research questions have spanned so many social science disciplines, elicited such an outpouring of empirical research, and yielded so few unequivocal findings" as the question; "Why and how do organizations evaluate, adopt, and implement innovations?"

Rogers (1995) justified the continued popularity of innovation diffusion research, noting:

> "The diffusion model is a conceptual paradigm with relevance for many disciplines. The multidisciplinary nature of diffusion research cuts across various scientific fields; a diffusion approach provides a common conceptual ground that bridges these divergent disciplines and methodologies. There are few disciplinary limits as to who studies innovation. Most social scientists are interested in social change; diffusion research offers a particularly useful means to gain understandings of change.....Economists are centrally interested in growth; technological innovation is an important variable for increasing the rate of economic growth in a society. Students of organization are concerned with processes of change within formal institutions, and in how an organizational structure is altered by the introduction of a new technology. Social psychologists try to understand the sources and causes of human behavior change; especially as

such individual change is influenced by groups and networks to which the individual belongs. Sociologists and anthropologists share an academic interest in social change but use different methodological tools." (Rogers, 1995 p. 96)

Despite being heavily researched, there is broad agreement that important questions remain about how and why innovations diffuse. According to Meyer and Goes (1988, p. 897) "few research questions have spanned so many social science disciplines, elicited such an outpouring of empirical research, and yielded so few unequivocal findings" and concluded that "from both theoretical and practical perspectives, our cumulative knowledge of why and how organizations adopt and implement innovations is considerably less than the sum of its parts." Acknowledging the complexity and diversity of innovation diffusion, Downs and Mohr note that "even the suggestion that a single theory and set of determinants are applicable to the entire set of newly implemented techniques, programs, rules, and norms that are lumped under the generic heading *innovations* should be considered suspect" (Downs & Mohr, 1976, p. 701). More recently, Fichman noted, "no single theory of innovation exists, nor does it seem likely that one will emerge" (Fichman, 2000, p. 107).

2.2.2 Classical Innovation Diffusion: Everett Rogers is recognized for his pioneering contributions to innovation diffusion research and its current theories. He researched and synthesized more than five hundred studies of the diffusion of a broad range of innovations dating back to the 1940's. These included many agricultural innovations such as hybrid corn (Rogers, 1962).

Rogers defined an innovation as "an idea, practice, or object perceived as new by an individual or other unit of adoption" (Rogers, 1995, p. 35) and innovation diffusion as "the process by which an innovation is communicated through certain channels over time among members of a social system." Rogers' conceptualization of innovations and diffusion are virtually identical to those of other noted scholars including Zaltman, et al. (1973), Fichman (1992), Lucas, et al. (1990), Tornatzky and Fleischer (1990), and Gallivan (2001).

Rogers' research and most subsequent innovation diffusion research based on it have focused on volitional individual adoption of single-user personal innovations (Gallivan, 2001; Fichman, 1992; Swanson, 1994). These individual innovation adoption decisions are thought to reached and implemented through a four-step process that includes learning about the innovation, gathering information about it, making a decision to adopt or not adopt the innovation based on the information collected, and then implementing the decision. Figure 2.1 depicts Rogers' individual innovation adoption process.

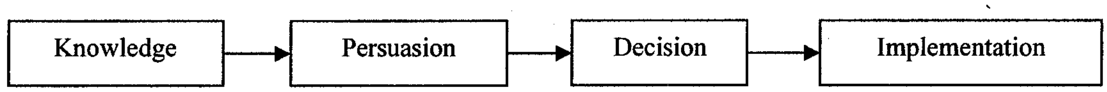


Figure 2.1
Individual Innovation Adoption Decision Process (Rogers, 1995)

According to Rogers (1995, p. 21) "the innovation decision process can lead to either *adoption*, a decision to make full use of an innovation as the best course of action available, or to *rejection*, a decision not to adopt an innovation." He thus defined adoption as "full use of an innovation as the best course of action available" (Rogers, 1995, p. 21). Later scholars interested in the diffusion of complex IT innovations embrace a far more complex conceptualization of adoption.

Rogers conceived of an innovation diffusion framework comprised of an innovation, communication channels for disseminating information about the innovation, a social system of potential adopters, and the diffusion process that occurred over time (Rogers, 1962). His conceptualization of innovation diffusion stressed the important role of interpersonal and/or mass media communications that provide potential adopters information about the innovation, which influences their decision of whether or not to adopt the innovation.

Rogers (1995) identified five types of factors that could influence the rate and extent of innovation adoption. These are depicted in Figure 2.2.

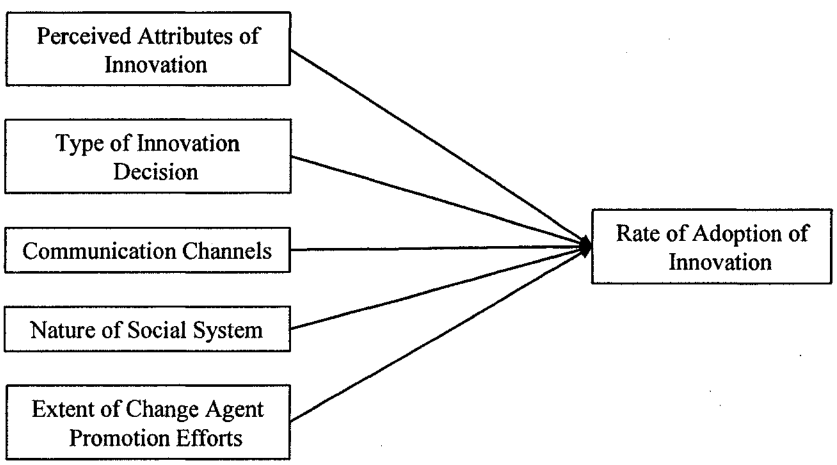


Figure 2.2

Factors Affecting Innovation Adoption (Adapted from Rogers, 1995)

However, he concluded "the characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption" (Rogers, 1995, p. 35) and that "subjective evaluations of an innovation, derived from individuals' personal experiences and perceptions and conveyed by interpersonal networks, drives the diffusion process" (Rogers, 1995, p. 208). While noting "little diffusion research has been carried out to determine the relative contribution of each of the five types of variables", Rogers asserted that "49 to 87 percent of the variance in the rate of adoption is explained by five perceived innovation attributes: relative advantage, compatibility, complexity, trialability, and observability" (Rogers, 1995, p. 206). This may explain why most innovation research has focused on the relationship between an innovation's attributes and its diffusion pattern.

Regarding the other four factors he hypothesized should influence innovation diffusion Rogers noted:

> • Type of Innovation Decision: "Innovations requiring an individual-optional innovation decision are generally adopted more rapidly than when an innovation is adopted by an organization" and "the more persons involved in making an innovation-decision, the slower the rate of adoption" (Rogers, 1995, p. 207-208).
> • Communications Channels: "If interpersonal channels (rather than mass media channels) create awareness-knowledge, as frequently happens for later adopters, their rate of adoption is slowed" but "the relationship between communication channels and the attributes of the innovation often interact to slow down or speed up the rate of adoption" (Rogers, 1995, p. 207-208).
> • Nature of Social System: "The degree to which the communication network structure" of a social system "is highly interconnected, also affects an innovation's rate of adoption" (Rogers, 1995, p. 207-208).
> • Extent of Change Agent Promotion Efforts: "The relationship between rate of adoption and change agents' efforts, however, may not be direct and linear". "The greatest response to change agent effort occurs when opinion leaders adopt, which usually occurs somewhere between 3 and 16 percent adoption in most systems." (Rogers, 1995, p. 207-208)

There is a consensus in the literature regarding the principal findings and contributions of Rogers's research. Often referred to as "classical innovation diffusion theory", these include:

- An innovation's attributes are important determinants of its diffusion pattern.
- Cumulative innovation diffusion typically occurs in a pattern resembling an "S" curve. The shape of this pattern depends on the dissemination of information about the innovation through communications channels in the social system of potential adopters. Innovations initially diffuse slowly because they are relatively unknown.

As more potential adopters learn about the innovation through communication channels, the adoption rate increases. Eventually, the pool of potential adopters is reduced due to adoption/rejection and the adoption rate tails off. Figure 2.3 depicts historic cumulative diffusion patterns that are consistent with this conceptualization.

- Innovation adopters are categorized based on their adoption behaviors. Indicators of high "innovativeness" are early adoption and/or the frequent innovation adoption. According to Rogers (1995, p. 262) adopters can be categorized as "innovators" (~2.5%), "early adopters" (~13.5%), members of the "early majority" (~34%) or the "late majority" (~34%), or "laggards" (~16%). Interestingly perhaps, when plotted as a density distribution, these categories display the shape of a normal distribution or "bell curve."
- Innovation adoption can be accelerated by individuals who act as change agents and/or who are viewed by potential adopters as opinion leaders and who advocate adoption.
- Adoption is a simple, unequivocal, individual act based on a binary decision.

Although "diffusion innovation research began with investigations of individual decision makers such as farmers" (Rogers, 1995, p. 376), scholars found many important innovation decisions situated in more complex settings. This paved the way for substantial organizational innovation research.

In later work, Rogers (1995) briefly addressed organizational innovation. Like Zaltman, et al. (1973), Rogers conceived organizational innovation as a two-step process (initiation and implementation) with five sub-stages. Rogers' organizational innovation process is represented in Figure 2.4.

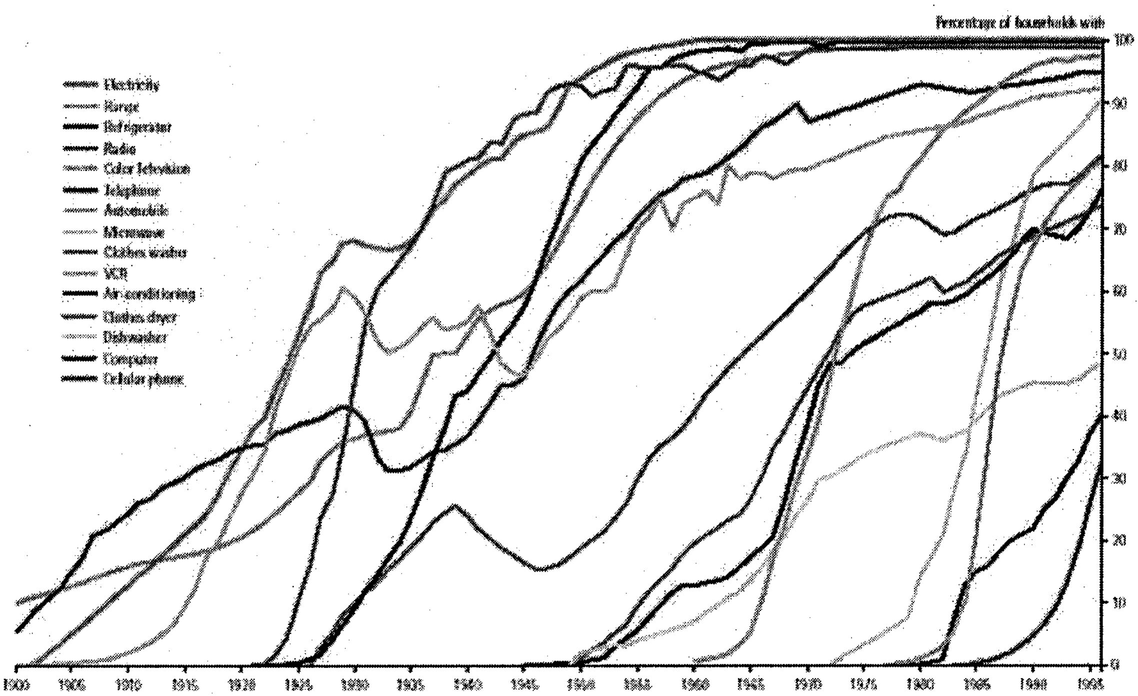


Figure 2.3
Historic Innovation Adoption Diffusion Data
Fortune Magazine, 8 June 1998)

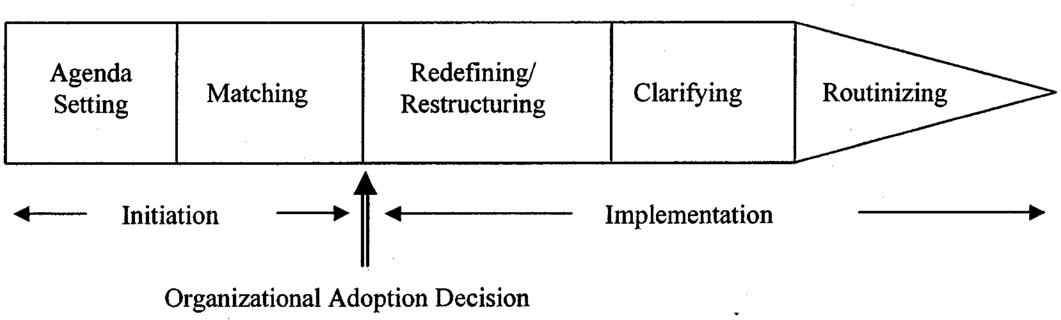


Figure 2.4

Organizational Innovation Process (From Rogers, 1995)

In Rogers' organizational innovation process, agenda setting and matching in the initiation stage paved the way for the organizational adoption decision. Following organizational adoption, innovation implementation included clarification, redefining/restructuring, and routinization occurred. Rogers' organizational innovation process sub-stages are described in Appendix A.

Although Rogers did not research organizational innovation extensively, he acknowledged it to be much more complex than individual innovation. Rogers (1995) recognized that a diverse set of organizational variables including individual leader characteristics, structural characteristics such as centralization, formality, interconnectedness, and complexity, and external environmental factors might affect organizational innovation.

Rogers also perceived the interactive relationship between organizations and innovations, noting "implementation of a technological innovation in an organization amounts to a mutual adaptation of the innovation and the organization. Typically, each one changes during the subprocess of implementation" (Rogers, 1995, p. 395). Social aspects of innovation are manifest in the "social construction of technology" (Rogers, 1995, p. 396), which "occurs over time through a social process of human interaction" (Rogers, 1995, p. 399). Rogers also recognized the potential influence of innovation champions and other management interventions intended to reduce employee innovation adoption uncertainty.

Rogers provided a basis for later research of the complex phenomenon of organizational innovation. He was prescient in observing that an "important reason for the increasing research attention accorded to innovation in organizations is the widespread introduction of computer-related technologies in all kinds of organizations. The implementation of many of these innovations failed, causing a great deal of practical interest in better understanding how to effectively introduce computer-related technologies" (Rogers, 1995, p. 390).

2.2.3 Organizational Innovation Processes: Zaltman, Duncan, and Holbeck (1973) are widely recognized as pioneers of modern organizational innovation research. According to Rogers (1995), "an important turning point in the history of research on innovation in organizations occurred with publication of the book Innovations and Organizations by Gerald Zaltman and others (1973). These authors specified the distinctive aspects of innovation when it took place in an organization" (Rogers, 1995, p. 389). Of particular relevance to this study, Rogers noted that one of the Zaltman, et al.'s most important contributions was to point out "the main dependent variable of study often became implementation, putting an innovation into use, rather than adoption" (Rogers, 1995, p. 389).

Zaltman, et al. (1973) conceptualized organizational innovation as a two-stage process. Their initiation stage was conceptualized as problem solving, and included knowledge awareness, attitude formation, and decision substages. The implementation stage included initial-implementation and continued-sustained implementation substages (Zaltman et al., 1973, p. 62). Of relevance to this study of organizational innovation diffusion, Zaltman, et al. found innovation implementation to be more complex and less well conceptualized. Figure 2.5 is a representation of Zaltman, et al's organizational innovation process.

Also relevant to the purposes and motivation of this research, Zaltman, et al. observed that:

> "most diffusion theorists generally terminate their analysis at the stage of initiation, that is, at the point either where the new idea has become legitimated by power holders of the unit or where the decision has been made to implement the new idea. What must be done, thereafter in terms of

actually implementing the idea – of actually changing the unit, its subsystems, or the behavior of members - is not considered or is important only to the extent it has influence upon the decision to "initiate" the innovation" (Zaltman et al., 1973, p. 58).

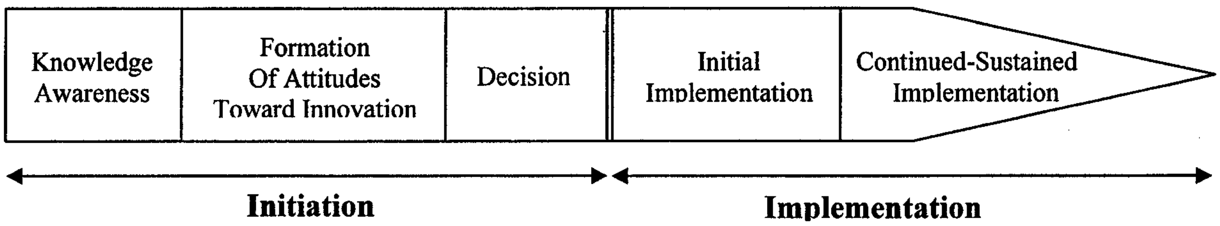


Figure 2.5

Process of Organizational Innovation (Zaltman et al., 1973)

Zaltman, et al. characterized initial implementation as a substage in which the organization first attempts to utilize the innovation and "involving some trial of the potential adoption" (Zaltman et al., 1973, p. 67). If successful, "there is greater likelihood that the innovation will be continued to be implemented" (Zaltman et al., 1973, p. 67).

In more recent research "organizational innovation is most often viewed as a three step process: initiation, adoption, and implementation" (Kwon & Zmud, 1987, p. 232). The three-step organizational innovation process is often attributed to Thompson who defined innovation as "the generation, acceptance, and implementation of new ideas, processes, products or services" (Thompson, 1965, p. 2).

In the three-step process, initiation occurs as a response to a pressure to change that can be a consequence of either "need-pull or technology-push forces" (Kwon & Zmud, 1987, p. 232). That is there is some perception of an organizational problem or shortcoming, or of an organizational opportunity. Adoption represents a formal organizational decision to allocate resources to the innovation. Often there is a formal signal of intention to implement the innovation. Implementation follows adoption and can be viewed as the process through which the innovation is introduced, installed, adopted and used by the organization's target users.

Figure 2.6
Three Stage Organizational Innovation Process

Kwon and Zmud observed that "modern organizational change over the last decade has been technology driven" and "information technology has become a major technological force influencing business success" (Kwon & Zmud, 1987, p. 231). Noting lack of a "consistent definition of IS implementation", the "fragmented" nature of IS implementation literature, and absence of "a dominant paradigm with which to frame IS implementation research" (Kwon & Zmud, 1987, p. 228), they completed a comprehensive assessment of organizational innovation research.

Kwon and Zmud concluded "the functional parallels between IS implementation and diffusion of technological innovation are clear" and "IS implementation is defined as an organizational effort to diffuse an appropriate information technology within a user community" (Kwon & Zmud, 1987, p. 231).

Kwon and Zmud concluded most innovation research seeks to predict adoption but ignores what happens following organizational adoption. Recognizing the critical importance of implementation to organizational innovation success, they recommended a six-stage model of organizational innovation based on Lewin's change model (Cooper &

Zmud, 1990). Kwon and Zmud decomposed the implementation phase into four sub-stages to provide a more detailed conceptualization of this critical and complex stage. Their innovation process is depicted in Figure 2.7.

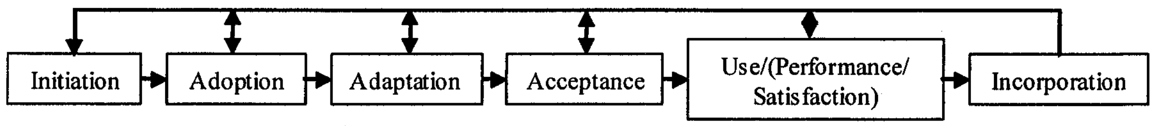


Figure 2.7
"Six Phase View of the IS Implementation Process" (Kwon & Zmud, 1987, p. 233)

Incorporation ("the innovation becomes embedded within an organization's routine and when the innovation is being applied to its full potential" (Kwon & Zmud, 1987, p. 233)) was defined as the goal or end state of the innovation process. Kwon and Zmud warned, "complete diffusion throughout an organization's tasks, people, and structure will not occur unless a variety of other technical, social and political issues are resolved." (Kwon & Zmud, 1987, p. 233)

Cooper and Zmud (1990) refined the work of Kwon and Zmud. Their research of material resource planning adoption led to a refinement of the organizational innovation diffusion model providing increased insight into critical innovation implementation activities that occur only after organizational adoption. Cooper and Zmud's model, also based on Lewin's change model, has received praise from other IT innovation diffusion researchers. Gallivan (2001, p. 59) noted that "in the IS literature, the best-known model describing technology implementation in organizations is the six-stage model proposed by Zmud and colleagues." A representation of their six-stage IT implementation model appears in Figure 2.8.

In addition to drawing needed additional attention to the implementation stage of organizational innovation, Cooper and Zmud (1990, p. 124) also specified "process" and "product" definitions for each of the six stages of their model. These definitions appear in Appendix B.

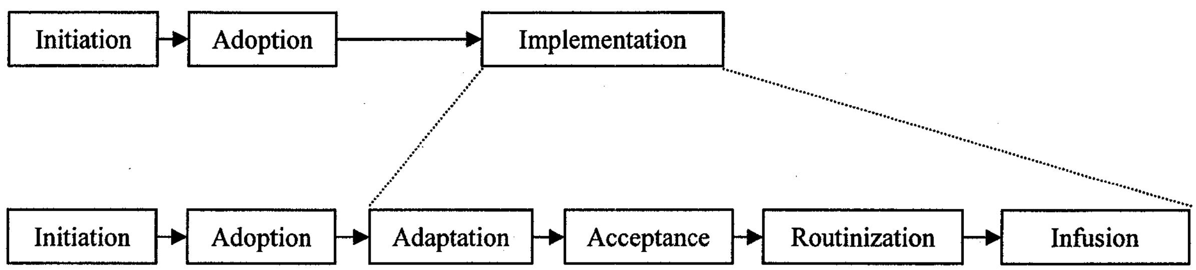


Figure 2.8

Six-Stage IT Implementation Process Model (Cooper & Zmud, 1990)
(Three-Stage Model Added for Emphasis)

Cooper and Zmud defined their four organizational IT innovation implementation substages as follows:

- Adaptation: "The IT application is developed, installed, and maintained. Organizational procedures are revised and developed. Organizational members are trained both in new procedures and the IT application." (Cooper & Zmud, 1990, p. 124)
- Acceptance: "Organization members are induced to commit to IT application usage." (Cooper & Zmud, 1990, p. 124)
- Routinization: "Usage of the IT application is encouraged as normal activity." (Cooper & Zmud, 1990, p. 124)
- Infusion: "Increased organizational effectiveness is obtained through use of the IT application in a more comprehensive and integrated manner to support higher level aspects of organizational work." (Cooper & Zmud, 1990, p. 124)

Recognizing that "to fully leverage an organization's IT investment, core processes must be reengineered" (Saga & Zmud, 1994, p. 79), Saga and Zmud focused on Cooper and Zmud's final implementation substage, infusion. They found "over time, all successful IT applications are enhanced or reconfigured, reflecting an increasing organizational understanding of both a work system and the potential of IT to support the work system" (Saga & Zmud, 1994, p. 79) and this usually leads to higher "levels of use." They identified three qualitatively enhanced IT usage behaviors that can lead to "using a technology to its full potential in improving organizational performance":

- Extended Use: "using more of the technology's features in order to accommodate a more comprehensive set of work tasks" (Saga & Zmud, 1994, p. 80)
- Integrative Use: "using the technology in order to establish or enhance work flow linkages among a set of work tasks" (Saga & Zmud, 1994, p. 80)
- Emergent Use: "using the technology in order to accomplish work tasks that were not feasible or recognized prior to the application of the technology to the work system" (Saga & Zmud, 1994, p. 80)

Gallivan (2001) was an important source of inspiration for this research, and contributed significantly to the individual innovation adoption model it will use. He focused his qualitative research of the organizational diffusion of client-server technology on innovation stages following organizational adoption. He extended the research of Kwon and Zmud (1987) and Cooper and Zmud (1990) and made an explicit conceptual linkage between innovation diffusion research and individual IT acceptance research.

Gallivan proposed a three-stage organizational innovation diffusion framework comprised of the stages of primary adoption, secondary adoption/assimilation, and organizational consequences. His research focused exclusively on the secondary adoption/assimilation stage, defining secondary adoption as individual adoption after organizational adoption. He found "this part of the framework is the most complex and has been neglected by researchers who have studied primary adoption of technologies while neglecting issues of secondary adoption and assimilation" (Gallivan, 2001, p. 61).

Gallivan's conceptualization of secondary individual adoption included constructs from innovation diffusion and individual IT acceptance research. He identified three factors influencing secondary adoption; management interventions ("actions taken and resources made available by managers to expedite secondary adoption, including mandating usage" (Gallivan, 2001, p. 61)), subjective norms ("individuals' beliefs about the expectations of relevant others regarding their own secondary adoption behavior" (Gallivan, 2001, p. 61)) and facilitating conditions ("a broad category that captures other factors that can make implementation more or less-likely to occur" (Gallivan, 2001, p. 61)). A representation of Gallivan's individual innovation adoption framework appears in Figure 2.9.

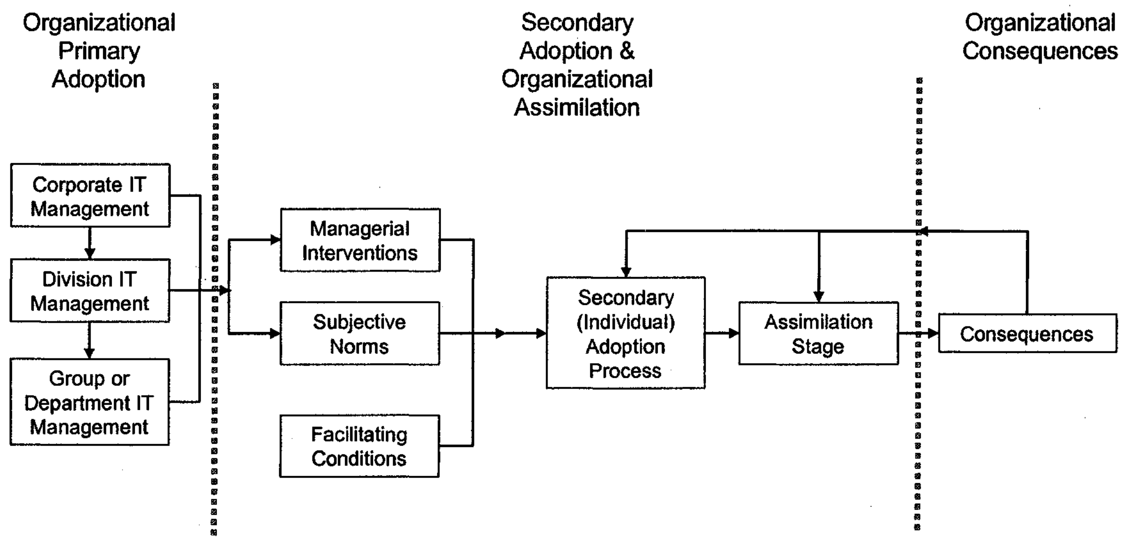


Figure 2.9

Organizational Innovation Diffusion Theoretical Framework (Gallivan, 2001)

2.2.3.1 Summary of Organizational Innovation Process Research: Review of organizational innovation process research highlights a steady growth of scholarly interest in innovation implementation. Early pioneering work of Zaltman, et al. led to a conceptualization of organizational innovation as a two-stage process (initiation and implementation) with recognition of the importance of implementation, but little illumination of its details. Subsequent researchers including Zmud and his colleagues, Wynekoop, Fichman, and Leonard-Barton recognized the vital role of implementation to the realization of organizational benefit and contributed to its more detailed conceptualization.

Kwon and Zmud and Cooper and Zmud focused on the innovation implementation stage and decomposed it into four sequential substages; each describing consecutively more complex levels of innovation adoption. Saga and Zmud (1994) described the implementation infusion substage as including three distinct and qualitatively different innovation usage behaviors.

Gallivan (2001) operationalized the work of Cooper and Zmud in his organizational IT innovation framework, which focused on secondary individual adoption of IT innovations. His research identified factors from both IT acceptance and innovation diffusion research hypothesized to influence this critical innovation adoption decision.

The trajectory of this organizational innovation process research reflects a steady migration of scholarly interest from the adoption stage to the implementation stage. This shift of emphasis can most likely be attributed to scholars' gradually increased awareness of both the complexity and the critical importance of organizational innovation implementation. Zmud and Apple (1992, p. 149) predicted such a trend, noting that "the relative importance of attending to incorporation concerns is likely to increase with more complex innovations." Tornatzky and Fleischer offered a similarly perceptive explanation noting "it is extremely difficult to determine just what the act of adoption in the incorporation of a complex new technology might be", adding that "like the elephant and the blind men, a complex technology means different things to different participants" (Tornatzky & Fleischer, 1990, p. 123). Yet, in spite of growing theoretical interest, there has been precious little empirical research of this critically important phenomenon.

2.2.4 Organizational Factors Affecting Innovation Diffusion: In pioneering organizational research of Scottish firms of the 1950's, Burns and Stalker (1961) found alternative organizational forms fared differently under varying conditions of business environment and technology stability. According to Burns and Stalker:

> "There seemed to be two divergent systems of management practice. Neither was fully and consistently applied in any firm, although there was a clear division between those managements which adhered generally to the one, and those which followed the other. Neither system was openly and consciously employed as an instrument of policy, although many beliefs and empirical methods associated with one or the other were expressed. One system, to which we gave the name 'mechanistic', appeared to be appropriate to an enterprise operating under relatively stable conditions. The other, 'organic' appeared to be required for conditions of change. In terms of 'ideal types' their principal characteristics are these:
>
> In mechanistic systems the problems and tasks facing the concern as a whole are broken down into specialisms. Each individual pursues his ask as something distinct from the real tasks of the concern as a whole, as if it were the subject of a sub-contract. 'Somebody at the top' is responsible for seeing to its relevance. The technical methods, duties, and powers attached to each functional role are precisely defined. Interaction within management tends to be vertical, i.e., between superior and subordinate. Operations and working behaviour are governed by instructions and decisions issued by superiors. This command hierarchy is maintained by the implicit assumption that all knowledge about the situation of the firm and its tasks is, or should be, available only to the head of the firm."
>
> "Organic systems are adapted to unstable conditions, when problems and requirements for action arise which cannot be broken down and distributed among specialist roles within a clearly defined hierarchy. Individuals have to perform their special tasks in the light of their knowledge of the tasks of the firm as a whole. Jobs lose much of their formal definition in terms of methods, duties, and powers, which have to be redefined continually by interaction with others participating in a task. Interaction runs laterally as much as vertically. Communication between people of different ranks tends to resemble lateral consultation rather than vertical command. Omniscience can no longer be imputed to the head of the concern." (Burns & Stalker, 1995, p. 5-6)

Zaltman, et al. (1973, p. 130) credit Burns and Stalker as being "the first researchers to indicate that different types of organizational structures might be effective in different situations." "The organic model was more suited for change and thus most conducive to innovation." (Aiken & Hage, 1971, p. 63) They "comprehend more eventualities than that necessary in concerns under stable conditions, more information and considerations enter into decisions; the limits of feasible action are set more widely" (Burns & Stalker, 1961, p. 11). Mechanistic organizations were less able to enter new fields due largely to "political or status preoccupations" of key individuals, which resulted in an organization "adjusted to serving the ends of the political and status system of the concern rather than its own" (Burns & Stalker, 1961, p. 6).

Viewed as "a social system created for attaining some specific goals through the collective efforts of its members", an organization's "most salient characteristic is its structure" (Zaltman et al., 1973, p. 106). Zaltman, et al. studied "what type of organizational structure facilitates the process of innovation" and found that "an important characteristic of the innovative organization is its ability to deal with uncertainty and exhibit instrumental innovation in its decision-making processes" (Zaltman et al., 1973, p. 126). Bureaucratic organizations performed well in stable environments but did not fare well in a dynamic environment. Zaltman, et al. attributed this performance difference to these organizations' monocratic[1] conceptualization, their "lack of mechanisms for dealing with conflict" (Zaltman et al., 1973, p. 124), and "rational-optimizing" decision making based on a "presumption of certainty in the decision environment" (Zaltman et al., 1973, p. 124). Zaltman, et al. also found "mechanistic" organizations less innovative than "organic" organizations. Their

[1] The monocratic organizational concept "holds that (1) there is great inequality among organizational participants in their status, abilities, contributions to the organization, and rewards, (2) the organization's technology is simple and within the grasp of a few people, (3) the person at the top of the organization is assumed to be omniscient and issues all orders in the organization, (4) these orders are clarified downward by successive levels of subordinates, so that the delegation process is complete, (5) because there is only one source of legitimate authority in the organization, conflict is not seen as legitimate, and thus bargaining coalitions and other conflict-settling activities are illegitimate" (Zaltman et al., 1973, p. 123) .

summarization of characteristics typical of these two classes of organizations appears in Appendix C.

Zaltman, et al. (1973, p. 132) identified "hierarchy of authority, degree of impersonality in decision making, degree of participation in decision making, degree of specific rules and procedures, and degree of division of labor" (Zaltman et al., 1973, p. 132) as attributes that can be used to describe an organization's structure. Pugh et al. (1968, p. 65) identified "six primary dimensions of organization structure": specialization, standardization, formalization, centralization, configuration, and flexibility. When highly structured, these attributes adversely affect organizational communications, the free flow of information, and ultimately organizational innovativeness (Zaltman et al., 1973).

Three attributes were found most directly related to innovativeness: complexity ("number of occupational specialties in the organization and their professionalism" (Zaltman et al., 1973, p. 134)), formalization ("emphasis placed....on following specific rules and procedures in performing one's job" (Zaltman et al., 1973, p. 138; Cohn & Turyn, 1984, p. 154)), and centralization ("locus of the authority and decision making in the organization"..."the higher in the organization decision making takes place, and less participation in decision making that exists in an organization, the greater the centralization and vice versa" (Zaltman et al., 1973, p. 143)).

Zaltman, et al. (1973) theorized that organizational structural characteristics could affect innovation process phases differently. More complex, less formal, and less centralized structures were more conducive to innovation initiation. Higher formality and centralization and lower complexity facilitate innovation implementation (Zaltman et al., 1973). A summary of hypothesized organizational structure effects on innovation process phases appears in Appendix D.

An organization committed to innovation "must shift its structure as it moves through the various stages of innovation" (Zaltman et al., 1973, p. 155). Alternatively, it might employ a "highly complex group of individuals of diverse background" (Zaltman et al., 1973, p. 138) using "a broad set of operating guidelines" (Zaltman et al., 1973, p. 142) and a participatory decision making process during the initiation phase. For implementation, the organization might rely on a "less complex unit that would select a given proposal for innovation" (Zaltman et al., 1973, p. 138) and "focus on specifying operating rules and procedures on how the innovation would be implemented" (Zaltman et al., 1973, p. 142) using a highly centralized decision process.

To mitigate innovation resistance Zaltman, et al. (1973) urged consideration of factors including innovation source, nature of the innovation, innovation implementation process, and the organizational climate regarding change/innovation. These appear in Appendix E and reinforce the notion that a diverse set of factors influence innovation implementation.

Limited research findings regarding the effects of organization structural attributes on innovation implementation are mixed. Damanpour's (1991) meta-analysis of research of the effects of organizational structural attributes on innovation found "adoption of innovation is easier when organizations have organic rather than mechanistic characteristics" (Damanpour, 991, p. 579) and that "results for all variables except vertical differentiation are in the direction consistent with Burns and Stalkers theory" (Damanpour, 1991, p. 579). Cohn and Turyn (1984) found interaction among structural attribute influences such that the effects of centralization and formalization on innovation were suppressed by organizational decision-making complexity.

Damanpour researched the "ambidextrous model"; i.e., that structural attributes could have opposite effects on different innovation process stages but concluded "the current findings are not in the direction of the model's proposition" (Damanpour, 1991, p. 580). He explained the inconsistency by distinguishing technical and administrative innovations, noting "propositions advanced by these two model (ambidextrous and dual-core) agree that organic characteristics enhance the initiation of technical innovations, whereas mechanistic characteristics help the implementation of administrative innovations; however, they are not united concerning the influence of organizational factors on the initiation of administrative innovations or the implementation of technical innovations" (Damanpour, 1991, p. 580).

Damanpour also researched the effect of innovation types thought to affect organizational innovation (product-process, radical-incremental, administrative-technical). He found "type of innovation might not be a primary contingency variable" (Damanpour, 1991, p. 583) but that "distinguishing (organizational) types is crucial" and asserted that "type of organization should be a primary contingency variable" (Damanpour, 1991, p. 583) in organizational innovation study. Innovation type and process stage were found to be "secondary contingencies or intermediate variables" (Damanpour, 1991, p. 583). Damanpour concluded that the applicability of innovation models such as the dual-core and ambidextrous would likely be contingent upon organizational type and structure, noting:

> "the dual-core and ambidextrous model apply better to "machine bureaucratic" organizations, in which the initiation and implementation of administrative or technical innovations is achieved in different parts of the organization (Damanpour, 1988). In another type of organization, such as a

"simple structure" or an "adhocracy", the initiation-implementation dichotomy may not be applicable because initiators and implementers may be the same individuals or units. Also, in an adhocracy implementers may be the same individuals or units. Also, in an adhocracy the determinants of administrative and technical innovations might not be discernible because the technical and administrative cores are mixed and the process of both types of innovation is both bottom-up and top-down. Multidimensional innovation studies are needed to generate data for a better understanding of the combined effects of different contingencies on organizational innovativeness" (Damanpour, 1991, p. 583)

Damanpour compiled a comprehensive and well-referenced compendium of innovation-related organizational structural attributes. These appear with his findings in Appendix F.

Finding IS implementation understanding "surprisingly incomplete", Kwon and Zmud (1987) reviewed all existing IS implementation research. They observed that "four rather narrow research streams account for a majority of the research undertaken to date" (Kwon & Zmud, 1987, p. 228) (factors, mutual understanding, process, and political (Kwon & Zmud, 1987)). They concluded the literature "has not developed a better understanding of implementation" (Kwon & Zmud, 1987, p. 230), and attributed this to "the lack of a common perspective among IS implementation researchers" and their finding that "no core set of constructs exists" (Kwon & Zmud, 1987, p. 231).

Attempting to place IS implementation research in context, Kwon & Zmud observed;

"Information technology has become a major technological force influencing business success... rapid and rampant movement of information technologies into business organizations has raised managerial concern regarding the capability of today's organizations to manage the organizational introduction of information technology. IS implementation, therefore, has become an important managerial concern focusing on the effective diffusion of information technologies into organizations, business units, and work groups" (Kwon & Zmud, 1987, p. 231).

Their research led them to conclude that "the functional parallels between IS implementation and diffusion of technological innovation are clear" (Kwon & Zmud, 1987, p. 231) and predicted "recognizing and assessing information technology innovations" and "facilitating the diffusion of appropriate technologies into an organization's work units" would become the "dominant" "information system activities" "throughout the 1980's and 1990's" (Kwon & Zmud, 1987, p. 231).

Kwon and Zmud synthesized "empirical and non-empirical studies regarding organizational innovation and IS implementation to identify the forces contributing to successful efforts to introduce technological innovations into organizations" (Kwon & Zmud, 1987, p. 233). They identified five sets of forces: individual, structural, technological, task-related, and environmental factors. Figure 2.10 is depiction of "key forces" "contributing to successful efforts to introduce technological innovations into

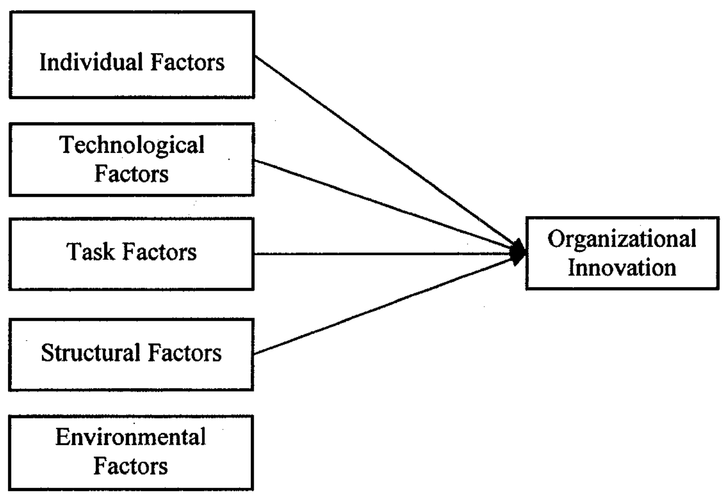


Figure 2.10

"Key Forces Contributing To Successful Efforts to Introduce Technological Innovations into Organizations" (Kwon & Zmud, 1987, 233)

organizations" (Kwon & Zmud, 1987, p. 233). A complete summary of Kwon and Zmud's innovation forces including definitions and research findings relative to each appears in Appendix G.

In a more recent synthesis of organizational innovation research, Fichman (2000) identifies three categories of factors that influence organizational innovation: technology-diffusion environment factors, organization-adoption environment factors, and organization-innovation interaction factors.

Technology-diffusion factors have the "most direct impact on the rate and pattern of diffusion of a technology" (Fichman, 2000, p. 110), organization-adoption environment factors relate most to the "question of what determines the organizational propensity to adopt multiple innovations over time" (Fichman, 2000, p. 110), while factors associated with the interaction of a technology and an organization are most influential in determining "the propensity of an organizational to adopt and assimilate a particular innovation" (Fichman, 2000, p. 111). Fichman's categorization of organizational IT innovation diffusion factors is depicted in Figure 2.11.

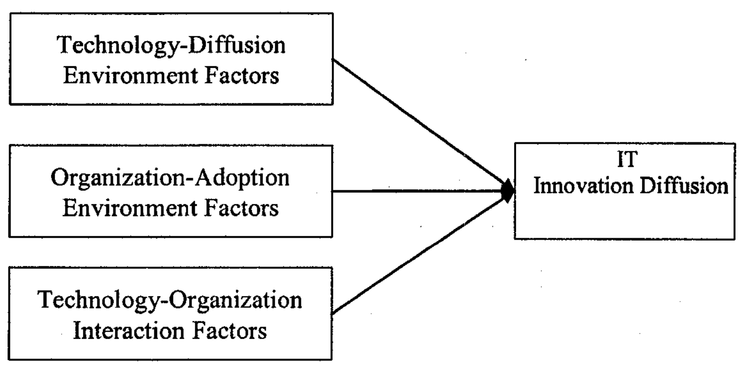


Figure 2.11

Organizational Innovation Implementation Factors (Fichman, 2000)

Fichman's organization-adoption environment factors pertain to organizational innovation adoption, and will not be discussed further in this study of secondary innovation adoption.

Fichman's technology-diffusion environment factors include innovation characteristics and propagating institutions. Attributes identified by Fichman and his assessment of their influence will be mentioned in the following section of the literature review. Fichman's technology-diffusion environment factors and his hypotheses regarding their influence on organizational innovation diffusion appear in Figure H.1 of Appendix H.

The diffusion of an innovation – even one initially perceived by many potential adopters as having undesirable qualities – can be affected positively by "the actions of institutions seeking to propagate those innovations" (Fichman, 2000, p. 113). Propagating institutions allow mitigation of potential barriers to innovation adoption such as high cost, or high knowledge requirements. Fichman finds that "although some technologies initially emerge as more complex, expensive, and incompatible than others, these initial characteristics can be moderated by the actions of institutions seeking to propagate those innovations" (Fichman, 2000, p. 113). Propagating institutions include advertising and/or promoting an innovation, favorable pricing strategies, the standardization and, or simplification of technology, innovation sponsorship, financial subsidies for an innovation or technology, and the reputation of the supplier and, or advocate of the technology or innovation (Fichman, 2000, p. 113). These can be initiated or invoked by technology vendors, consulting firms, government agencies, user groups, or any person or group interested in the diffusion of an innovation. Effects of Fichman's propagating institutions resemble those of Rogers' change agents and opinion leaders.

Fichman's organization-adoption environment factors include organizational and leader characteristics and the characteristics of the innovation adoption environment. Some factors in this category, such as size and slack resources influence organizational innovativeness. Although of secondary interest here, these factors appear in Figure H.2 of Appendix H. Others of interest to this research will be reviewed below.

"Other structural characteristics" addressed by Fichman include organizational structural attributes such as formalization, centralization, and vertical differentiation (Fichman, 2000). He associates these attributes with the relative adaptability and innovativeness of organic and mechanistic organization archetypes. Citing the research of Damanpour (1991) and others, Fichman observes the often postulated bi-directional influence of these factors on different innovation phases is not well-supported by existing research (Fichman 2000).

Addressing the influence of "personal characteristics of leaders and the workforce", Fichman postulates an important link between individual and organizational innovativeness, noting that "characteristics that predispose individuals to adopt innovations for personal use outside of the organizational context"…"when associated with key decision makers or aggregated across the entire organization, also affect organizational innovation" (Fichman, 2000, p. 114).

Fichman addresses "characteristics of the communication environment" in the context of organizational primary adoption, noting that "organizations that make larger investments in a wide array of information sources and communication channels (e.g., professional society memberships, periodical subscriptions, external seminars, internal advanced technology groups) should be more likely to lead in innovating" (Fichman, 2000, p. 115). Other organizational innovation researchers (e.g. Brancheau & Wetherbe, 1990; Thompson, 1965) recognize the relationship between organizational "connectedness" and innovation diffusion.

Like an increasing number of scholars (e.g., Downs & Mohr, 1976; Meyer & Goes, 1988) Fichman asserts that "many of the factors that affect innovation diffusion and assimilation are not characteristics of either innovations or organizations per se, but describe a particular innovation-organization combination" (Fichman, 2000, p. 116). These technology-organization combination factors include organization-innovation fit, innovation perceptions, and social influence, and what Fichman terms the innovation delivery system.

The receptiveness of an organization to an IT innovation, and the ultimate success of the innovation depend heavily upon the organization-innovation fit. Organizations are more inclined to adopt and utilize IT innovations compatible with their business objectives and processes. An example is found in the research of material resource planning (MRP) tool adoption and assimilation performed by Cooper and Zmud (1990). They concluded "there are manufacturing environments for which MRP is systematically not adopted", noting that "MRP adoption is more likely to occur when a firm's manufacturing environment is characterized by "continuous manufacturing methods" and "make to stock [vice make to order] strategies" (Cooper & Zmud, 1990, p. 134).

Fichman finds absorptive capacity ("the ability of a firm to recognize the value of new, external information, assimilate it, and apply it to commercial ends" (Cohen & Levinthal, 1990, p. 128)) an important organization-innovation fit factor. Absorptive capacity is an important innovation determinant because "outside sources of knowledge are often critical to the innovation process, whatever the organizational level at which the innovating unit is defined" (Cohen & Levinthal, 1990, p. 128), and "prior knowledge permits the assimilation and exploitation of new knowledge" (Cohen & Levinthal, 1990,

p. 135-136). High absorptive capacity relative to new knowledge (or an innovation) reflects a mixture of knowledge "very closely related to the new knowledge to facilitate assimilation" and knowledge that is "fairly diverse, although still related, to permit effective, creative utilization of the new knowledge" (Cohen & Levinthal, 1990, p. 136). Cohen and Levinthal (1990, p. 148) note that "technology adoption, is affected by the degree to which an innovation is related to the pre-existing knowledge base of prospective users."

Thus an organization's knowledge - related and diverse – is an important determinant of its propensity and/or ability to adopt and successfully implement an innovation. In this sense, innovativeness may be viewed as path dependent. Organizations lacking absorptive capacity may become "locked out" of an innovation due to knowledge barriers attendant to its adoption and implementation. Cohen and Levinthal extend the concept of absorptive capacity to the individual level although their research pertained primarily to organizations.

Attewell (1992) advances a similar argument in reframing the role of communications in innovation. Contrary to Rogers, he asserts the importance of communication channels lies in their dissemination of innovation-related know-how, not simply signaling or awareness information. Attewell would reconceptualize innovation in terms of "organizational learning, skill development, and knowledge barriers" (Attewell, 1992, p. 1). His logic is consistent with that of Cohen and Levinthal (1990), Fichman (1992), and (Fichman & Kemmerer, 1997a) regarding the important role of knowledge in organizational innovation.

Fichman identifies an important linkage between IT innovation perceptions and social influence. "Even after formal adoption, individuals within the organization often have broad discretion about whether and how to use an innovation." (Fichman, 2000, p. 117) "A key element of the post formal adoption process for many innovations is the extent to which the technology is accepted among intended users, and this intra-organizational adoption process is largely driven by individual perceptions of an innovation." (Fichman, 2000, p. 117)

Acknowledging the importance of individual perceptions of innovation attributes, Fichman questions how these perceptions are formed. He identifies two competing schools; the "rational/contingent school" and the "social learning school" (Fichman, 2000, p. 117). Rational contingent advocates "argue that potential adopters form perceptions primarily based on an assessment of the objective features of the technology as conditioned by their own particular needs and capabilities", whereas social learning advocates "argue that technology perceptions are primarily socially constructed" "(i.e., they are driven by an individual's observation of group norms and co-worker attitudes and behaviors toward an innovation)" (Fichman, 2000, p. 117). Fichman notes scholars have largely abandoned "either or" arguments asserting the dominance of one school over the other. A new integrative approach advocated by Kraut, et al. (1998), Webster and Trevino (1995), Agarwal and Prasad (1997), and Karahanna and Straub (1999) recognizes rational and social influences in the formation of individual innovation perceptions. This is consistent with Rogers' finding that opinion leaders and change agents can influence individual perceptions of innovation attributes.

Fichman highlights innovation implementation in the organization-technology innovation delivery system. He includes some factors classified by others as managerial interventions (e.g., technology champion, top management support). Fichman's implementation process factors include the degree to which an organization employs "the facilitating mechanisms developed by propagating institutions" (Fichman, 2000, p. 118) including technology standardization, adopter subsidies, and, or knowledge acquisition through consulting).Fichman, 2000)

Fichman finds successful implementation requires an appropriate process model that exhibits a good fit with the technology-organization combination. Implementation process models can address "challenges related to organizational learning, the need to coordinate a large number of interdependent implementation elements, the need to deal with indeterminacy about what an organization can or should accomplish with the technology" (Fichman, 2000, p. 118).

2.2.4.1 Summary of Research of Factors Affecting Organizational Innovation Diffusion: There is a consensus among scholars that a variety of complex, diverse, and often interdependent factors can influence the rate and extent of organizational innovation diffusion. These certainly include individual perceptions of the innovation, but also others such as social influence, organizational structure attributes that mark an organization as fundamentally "organic" or "mechanical" in its nature, and the actions of management or salient others to advance or stymie innovation diffusion.

While perhaps intuitive in retrospect, another important finding is that scholars recognize organizational IT implementation as a process of innovation diffusion within the organization. This provides a basis for integration of appropriate innovation diffusion research findings to the phenomenon of organizational IT diffusion or implementation; the objective of this research.

However, since most classical innovation diffusion research has not studied the adoption phenomenon of interest here, care must be exercised in the application of existing innovation diffusion theories. As Fichman (1992) cautioned; "when borrowing theory, researchers must take care to ensure that the context to which the theory is being applied matches well with the context in which the theory was developed, or alternatively, to tailor the theory to account for contextual differences" (Fichman, 1992, p. 1). Referring to organizational IT implementation directly, he noted "complicating factors" such as usage mandates, varying levels of IT use, network externalities, "are quite common in the context of IT adoption; hence the opportunities to apply classical diffusion theory "as is" may be rare indeed" (Fichman, 1992, p. 1).

The purpose of this research is to synthesize existing innovation diffusion, individual IT acceptance, and organizational behavior theories to create a model incorporating factors present in the social environment of the modern organization. As the above discussion suggests, this involves a more diverse set of factors than has been researched to date.

2.2.5 Research of Innovation Attribute Effects on Innovation Diffusion: A substantial body of literature suggests that organizational innovation diffusion is a complex process affected by numerous diverse factors. Rogers' research led him to conclude five categories of factors influence innovation diffusion; perceptions of an innovation's attributes, the type of innovation decision, communication channels, the nature of the social system of potential adopters, and the efforts of change agents

(Rogers, 1995). Nevertheless, he added "the characteristics of an innovation, as perceived by the members of a social system, determine its rate of adoption" (Rogers, 1995, p. 36) and that "from 49 to 87 percent of the variance in the rate of adoption is explained by five attributes" (Rogers, 1995, p. 206).

The innovation attributes first identified by Rogers as important determinants of an innovation's diffusion were relative advantage ("degree to which an innovation is superior to ideas it supersedes"), compatibility ("degree to which an innovation is consistent with existing values and past experiences of the adopters"), complexity ("degree to which an innovation is relatively difficult to understand and use"), divisibility ("degree to which an innovation may be tried on a limited basis"), and communicability ("degree to which the results of an innovation may be diffused to others"). (Rogers, 1962, p. 124-132)

More than thirty years of subsequent research resulted in only minor refinements to these attributes. Rogers (1995) replaced – perhaps more accurately, renamed – divisibility by trialability ("degree to which an innovation may be experimented with on a limited basis" (Rogers, 1995, p. 243)) and communicability by observability ("degree to which the results of an innovation are visible to others" (Rogers, 1995, p. 244)). The other three innovation attributes remained unchanged.

Zaltman, et al. found nineteen "attributes that have been found to be relevant for describing, explaining, and predicting responses to innovations" (Zaltman et al., 1973, p. 33). Some resemble, or are identical to those of Rogers; e.g., complexity, compatibility, perceived relative advantage, commitment (i.e., Rogers' trialability). One that does not is Zaltman, et al.'s gateway attribute; innovations that help prepare organizations for easier adoption of related or subsequent innovations. Organizations that fail to adopt "gateway" innovations may be less able to adopt subsequent innovations. This seems linked to Cohen and Levinthal's (1990) observation that organizations that consistently refrain from adopting relevant new innovations can ultimately reach a point of technological "lockout." Conversely, innovative organizations can achieve a competitive advantage due to their superior technology and their ability to easily adopt and implement new innovations.

The extensive list of attributes identified by Zaltman, et al., their definitions, and comments concerning their effect on innovation appear in Appendix I.

Asserting "innovation characteristics research" "represents one of the classic issues in the innovation literature, albeit one that has been little studied in the past" (Tornatzky & Klein, 1982, p. 28), Tornatzky and Klein completed a still widely cited meta-survey of innovation attribute research. Reviewing seventy-five studies they identified thirty innovation characteristics and highlighted the ten most frequently addressed in the literature; compatibility, relative advantage, complexity, cost, communicability, divisibility, profitability, social approval, trialability, and observability. (A complete list of these attributes and their definitions appear in Appendix J.) An important result of this research was the finding that only three innovation characteristics - compatibility, relative advantage, and complexity – were found to exhibit "consistent significant relationships to innovation adoption" (Tornatzky & Klein, 1982, p. 28).

However, Tornatzky and Klein's research resulted in other important contributions. Responding to Downs and Mohr's criticism that researchers' failure to "pay sufficient attention to the distinction" between primary [attributes inherent to an innovation and seen as being perceived uniformly among potential adopters] and secondary [an attribute that can be perceived differently in different adoption contexts and by different potential adopters] innovation characteristics" contributed to innovation research finding inconsistency, Tornatzky and Klein argued "if anything, Downs and Mohr (1976) probably underplay the importance of "subjective" factors" (Tornatzky & Klein, 1982, p. 28). They noted "the perceptual literature in social psychology and related fields" "has for many years noted that even what is assumed to be invariant physical reality (e.g., a primary attribute) is always subject to social influences" (Tornatzky & Klein, 1982, p. 28). They cited evidence in the findings of "group conformity studies" that "respondents make startling alterations in perceptions of physical dimensions (Asch, 1956) when confronted with a synthetic majority opinion to the contrary "(Tornatzky & Klein, 1982, p. 28). They asserted that while certain innovation attributes such as cost are amenable to objective measurement, "the meaning of the objective measure of the characteristic is subjective, that is, in the mind of the perceiver" (Tornatzky & Klein, 1982, p. 28). The importance of this argument is that "in this sense, there can be no primary attribute of an innovation" (Tornatzky & Klein, 1982, p. 28). Every potential adopter will perceive these seemingly objective characteristics "in reference to some internalized system of values or cognitive framework" and "the result is a subjective rating of the significance of the "fact" (e.g., size, cost, etc.)" (Tornatzky & Klein, 1982, p. 28).

Moore and Benbasat found that "in spite of the importance of perceived characteristics in diffusion research, most existing instruments designed to tap these characteristics lacked reliability and validity" and that "no comprehensive instrument to measure the variety of perceptions of innovations existed" (Moore & Benbasat, 1991, p.

194). They observed "researchers in IS have begun to rely on the theories of innovation diffusion to study implementation problems", that a "major focus in these studies has been how potential users' perceptions of the information technology innovation influence its adoption", and that an instrument to measure these perceptions "should be vital to diffusion researchers" (Moore & Benbasat, 1991, p. 191). They also noted "lack of a cumulative tradition in IS is one of the serious issues facing the field" and attributed this problem at least in part to the absence of "well defined constructs" "based on theory" "and the operationalization of these constructs through measures with high degrees of validity and reliability" (Tornatzky & Klein,1991, p. 193).

To mitigate this important deficiency and to facilitate their research Moore and Benbasat completed an exhaustive IT innovation construct measurement instrument development. Considering all existing measures, they developed a thirty-eight item instrument applicable to any IT type and equally valid in studies of IT innovation adoption and, or implementation (Moore & Benbasat, 1991). Their attributes were relative advantage, compatibility, ease of use, result demonstrability, image, visibility, trialability, and voluntariness (Moore & Benbasat, 1991).

Moore and Benbasat clarified and refined construct definitions to enhance validity. They found Rogers' observability attribute "quite complex" (Moore & Benbasat, 1991, p. 203) and more accurately represented by a combination of result demonstrability ("the more amenable to demonstration the innovation is, [and] the more visible its advantages are. . . the more likely it is to be adopted" (Moore & Benbasat, 1991, p. 195)) and visibility ("the more a potential adopter can see an innovation, the more likely he is to adopt it" (Moore & Benbasat, 1991, p. 203)).

Moore and Benbasat also developed two new measures. "image" ("the degree to which use of an innovation is perceived to enhance one's image or status in one's social system") (Moore & Benbasat, 1991, p. 195)) was added to capture Rogers' notion that "undoubtedly one of the most important motivations for almost any individual to adopt an innovation is the desire to gain social status" (Moore & Benbasat, 1991, p. 195). A voluntariness ('the degree to which use of the innovation is perceived as being voluntary, or of free will" (Moore & Benbasat, 1991, p. 195)) construct was added to distinguish between volitional and non-volitional innovation adoption decisions. While not an innovation characteristic, voluntariness acknowledges the important reality that potential adopters may feel pressure to adopt an innovation even if the organization's official policy is voluntary usage.

Moore and Benbasat also articulated an important distinction between potential users' perception of a technology and their perceptions of using the technology. Citing Ajzen and Fishbein (1980), they argued an individual's attitude towards an object can be much different from his or her attitude toward a behavior concerning that object.

As an example of this effect, they noted for that:

> "A difference may exist between any employer's attitude towards a particular individual (the object) and his attitude towards hiring that individual (the behavior). An employer may dislike the individual but may nevertheless believe that hiring him will bring positive results. Thus, his attitude toward hiring that individual will be positive." (Moore & Benbasat, 1991, p. 196)

In concluding they highlighted the effect on innovation diffusion by noting:

> "The relevance of the above argument to the study of the diffusion of innovations is clear. Innovations diffuse because of the cumulative decisions of individuals to adopt them. Thus, it is not the potential adopters' perceptions of the innovation itself, but rather their perceptions of using the innovation that are key to whether the innovation diffuses". (Moore & Benbasat, 1991, p. 196)

Their instrument embodies the logic of this distinction. Each item is characterized as a perceived characteristic of innovating, vice a perceived characteristic of the innovation

(Moore & Benbasat, 1991). For example, Moore and Benbasat queried respondents' perceptions of "the relative advantage of using a personal work station" rather than their perceptions of "the relative advantage of the personal work station." Moore and Benbasat's attribute measures appear in Appendix K.

Despite great interest in the influence of innovation attributes and their interactions with important adopter characteristics, some scholars refute the importance of their role in innovation diffusion. Tornatzky and Fleischer, discussing Rogers' innovation attributes observe:

> "There are the attributes of innovations (mentioned in chapter 2) that are ostensibly related to their adoption: relative advantage, compatibility, complexity, trialability, and observability. The rate of adoption presumably depends on some interaction of these features of the innovation with relevant features of the user population in question (Eveland, et a1. 1977). Only a few of these attributes - particularly complexity and compatibility - have a relatively consistent relationship to adoption behavior" (Tornatzky & Fleischer, 1990, p. 122).

Tornatzky and Klein assert that innovation entails a "complex sequence of decisions made by many people in different situations, against largely situational criteria" that cannot be well understood without "careful attention to the concept of choices within contexts" (Tornatzky & Fleischer, 1990, p. 124). Refusing to focus on innovation attributes, they regard organizational innovation deployment a complex phenomenon requiring "balancing" five contingencies; the nature of the technology, the characteristics of users, the characteristics of deployers, the boundaries within and between deployers and users, and the characteristics of communications and transaction mechanisms (Tornatzky & Fleischer, 1990, p. 124-125). Their conceptualization parallels that of Downs and Mohr (1976) who note innovation adoptability and organizational innovativeness cannot be considered independently. Rather, they must be considered pairs; in which innovation adoptability and organizational innovativeness combine as in a "mirror image symmetry." (Downs & Mohr, 1976, p. 711)

Fichman (2000) acknowledges the important role of innovation attributes in diffusion. He raises an important issue with regard to primary (invariant, objective) and secondary (subjective, adopter/scenario dependent) innovation attributes. Fichman asserts primary attributes are "assessed on logical inferences about the innovation in question or by relying on expert judgments" (Fichman, 2000, p. 112) while "values for secondary attributes can be inferred from objective features of the organization" (Fichman, 2000, p. 112). He concludes that attributes are difficult to conceptualize as truly intrinsic to an innovation. That an IT innovation may be perceived as very complex for some potential adopters and not nearly as complex for others is not surprising. However, this can bring into question the importance and/or role of innovation attributes to diffusion. Much research has shown that the effect of - or, perhaps more importantly the perception of - innovation attributes can be influenced by implementation activities. Thus it may be that individual perceptions of innovation attributes - critical determinants of adoption/diffusion - are to a certain degree socially constructed. Fichman noted; "it appears that Rogers implicitly embraces this soft-primary view by arguing that it is how the members of a population collectively perceive the characteristics of an innovation that determine its rate of adoption in that population" (Fichman, 2000, p. 112).

2.2.6 Secondary Individual Adoption: A distinguishing characteristic of this research is its focus on individual IT innovation adoption decisions that occur in the organizational environment only after the organization has adopted and deployed an IT innovation. Individual innovation adoption decisions such as this are referred to in the literature as secondary adoption (Gallivan, 2001), contingency adoption (Rogers, 1995), and/or authority adoption (Zaltman et al., 1973). Rogers underscores the importance of this phenomenon by noting that "many innovations, however, are adopted by *organizations*. And in many cases, an individual cannot adopt a new idea until an organization has previously adopted" (Rogers, 1995, p. 371).

This important phenomenon, regardless of the term used to describe it, has received little research attention. "Much of diffusion theory was developed in the context of adopters making voluntary decisions to accept or reject an innovation based on the benefits they expect to accrue from their own independent use of the technology" (Fichman, 1992, p. 1). Other scholars such as Tornatzky & Fleischer (1990) and Gallivan (2001) express equivalent positions.

"Diffusion of innovations within an organization (after the original organizational adoption decision) differs significantly from the spread of individually adopted innovations such as residential solar panels (Rogers, 1982) due to the possibility of management behavior to intervene in individual decisions to adopt (or continue using) the innovation, with forms of control and influence ranging from clear directives to subtle indications of support" (Leonard-Barton & Deschamps, 1988, p. 1253).

Limitations of classical innovation diffusion research in these more complex scenarios are also recognized; "problems arise when the diffusion model is applied in situations where its basic assumptions are not met-that is to say, virtually every case involving complex, advanced technology…..a complex technology means different things to different participants." (Tornatzky & Fleischer, 1990, p. 123)

Fichman noted (1992, p. 1), "the adoption decision of individuals or organizations may depend on the dynamics of community-wide levels of adoption (i.e., whether "critical mass" has been established) because of network externalities" and that "these sorts of complicating factors are quite common in the context of IT adoption; hence, the opportunities to apply classical diffusion "as is" may be rare indeed."

There is a substantial literature addressing organizational innovation. However, most focuses on organizational primary adoption. Numerous scholars (e.g., Downs & Mohr, 1976; Wynekoop & Senn, 1992; Gallivan, 2001; Zmud & Apple, 1992; Rogers & Adhikarya, 1979) note the prevalent tendency of innovation diffusion researchers to focus on organizational adoption at the expense of what is increasingly recognized to be the more important issue of how the innovation is used following organizational adoption; i.e., secondary individual adoption. Others also note a paucity of research of internal IT innovation diffusion after organizational adoption.

Zmud and Apple (1992, p. 149) found "while much research has been directed towards understanding how to achieve broad [organizational] adoption, little has been directed towards a, similar understanding of how best to achieve broad incorporation" [incorporation defined as "implementation activities directed towards embedding an adopted innovation within an organization" (Zmud & Apple, 1992, p. 148)]. Zmud and Apple predicted "the relative importance of attending to incorporation concerns is likely to increase with more complex innovations" and that "designing innovations and associated implementation processes to increase the likelihood of broad incorporation may have much greater impact than efforts to design innovations and implementation processes to increase the likelihood of broad adoption" (Zmud & Apple, 1992, p. 149).

Wynekoop and Senn (1992, p. 63) found that "organizational diffusion research has traditionally focused on the adoption or rejection of an innovation by organizations, not the process of implementing an innovation in an organization after it has been adopted."

In widely cited research of medical innovation assimilation, Meyer and Goes noted "few studies however, have....assessed the utilization of innovations after their adoption" adding that "although there are some notable exceptions...much of the implementation literature is impressionistic. The few studies systematically measuring implementation over time...investigated only one or two innovations. Consequently, their findings can be challenged on the grounds they are idiosyncratic to the particular innovations studied." (Meyer & Goes, 1988, p. 899)

Downs and Mohr (1976) question the dominant tendency of organizational innovation researchers to operationalize innovation in terms of time of adoption and, or the number of innovations adopted within some time period, when what is really of interest is the existence – and explanation – of significant variations in adoption behavior across potential adopter populations (Downs & Mohr, 1976, p. 710).

Fichman (2000, p. 109) reduces this to the question of how one defines organizational innovativeness, noting "if organizations always rapidly implement the innovations they adopt, then adoption timing would serve well as the universal definition of innovativeness. However, post-adoption behaviors can vary considerably across organizations. In fact, some research suggests that thorough and rapid implementation is the exception rather than the rule for many technologies." In their research of assimilation gaps (the difference between organizational acquisition of a technology and its actual deployment and use among employees), Fichman and Kemmerer (1999) discovered a "basic insight" that "widespread acquisition of an innovation need not be followed by widespread deployment and use by acquiring organizations" (Fichman & Kemmerer, 1999, p. 256). They cite numerous research findings revealing innovation assimilation gaps and note that, unrecognized, the phenomenon can be expected to "present an illusory picture of the diffusion process-leading to potentially erroneous judgments about the robustness of the diffusion process already observed, and of the technology's future prospects" (Fichman & Kemmerer, 1999, p. 255).

There is substantial confirmation in the literature that the individual adoption addressed in this study is an important and under-research phenomenon.

2.3 Individual Information Technology Acceptance

2.3.1 Introduction: Individual information technology acceptance research is motivated by the desire to "assess the value of information technology to an organization and to understand the determinants of that value" (Taylor & Todd, 1995a, p. 144). Initial efforts to capture a relationship between IT investment and organizational success at the macroeconomic, industry, and firm levels produced mixed – and often conflicting, or contradictory – results. Researchers then focused on lower level IT organizational success factors and indicators.

Delone and McLean (1992) identified six measures of information system success (system quality, information quality, user satisfaction, individual impacts, organizational impacts, and usage) spanning disparate dimensions of quality, attitude, performance, and behavior respectively. Usage is necessary to attainment of organizational benefits and – at least conceptually - more easily measured; thus, it has gained favor as an IT success factor.

While usage is the preferred IT success factor (Agarwal & Prasad, 1997), most research has actually studied "acceptance", a more abstract concept. Grounded in the behavioral theories of social psychology, much IT acceptance research has sought to identify factors contributing to potential users developing positive intentions to use an IT, forming a positive attitude toward use of the IT, or actually using the IT. Thus, while referred to as "IT acceptance" the literature embraces several IT acceptance indicators.

As Agarwal (2000, p. 90) observed, "while individual acceptance is the broad outcome that technology acceptance models and theories attempt to explain, this criterion construct has been operationalized in a variety of ways." Saga and Zmud (1994, p. 69) found acceptance to be "multifaceted, and comprised of actions, intentions, and attitudes"; a finding consistent with Agarwal's (2000) assertion that suitable measures of IT acceptance depend on the stage of implementation, the nature of the IT innovation, and/or managerial and pragmatic considerations.

2.3.2 Principal IT Acceptance Theory Research Streams: Most IT acceptance research completed in the past two-plus decades derives from three underlying theoretical sources; behavioral theories of social psychology (e.g., Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), the Technology Acceptance Model (TAM) (Davis, 1989) (a direct descendant of TRA), and the Theory of Planned Behavior (TPB) (Ajzen, 1991)), Social Cognitive Theory (SCT) (Bandura, 1986), and the theories of innovation diffusion largely attributable to Rogers. Task-technology fit (TTF) (Goodhue & Thompson, 1995; Goodhue, 1995; Goodhue, 1998) is a less widely accepted and researched IT acceptance paradigm.

Most prominent IT acceptance research paradigms routinely refer to one another in theory and model development and rationalization. Thus, Ajzen (1991) refers generously to Bandura's SCT in defining the perceived behavioral control construct which distinguishes TPB from TRA, and Davis (1989) and Davis, et al. (1989) refer to innovation diffusion research and SCT in the development of his TAM and its belief constructs, which are descendants of the TRA. Significant linkages exist between these foundational theories and the research findings derived from them.

2.3.2.1 Social Psychology/Technology Acceptance Model: Social psychology behavioral models and their derivatives have dominated IT acceptance research. Three related models with strong ties to social psychology; TRA (Fishbein & Ajzen, 1975), TAM (Davis et al., 1989), and TPB (Ajzen, 1991) provide foundational theories that undergird most IT acceptance research completed in the past twenty years. Bandura's Social Cognitive Theory (SCT) and Rogers' Innovation Diffusion Theory (IDT) have played significant contributing roles, but social psychology behavioral models have been instrumental to the accumulation of IT acceptance knowledge.

TAM, developed by Davis in his 1986 doctoral research has emerged as the dominant individual IT acceptance model. TAM's prominence in this research stream is indicated by the fact that as of January 2006, the Social Science Citation Index (SSCI) credited Davis's two original published TAM articles Davis (1989) and Davis et al. (1989)) with a total of 1159 citations (Davis (1989) 628 citations, and Davis, et al. (1989) 531 citations). Virtually every IT acceptance research overview or meta-analysis (e.g., Agarwal, 2000) and/or IT acceptance research paper cites TAM in some way.

TAM was derived from TRA (Fishbein & Ajzen, 1975) which is "an especially well-researched intention model that has proven successful in predicting and explaining behavior across a wide variety of domains" (Davis et al., 1989, 983). TRA is depicted in Figure 2.12. TRA postulates that an individual's attitude ("an individual's positive or negative feelings (evaluative affect) about performing the target behavior" (Fishbein & Ajzen, 1975, p. 216))

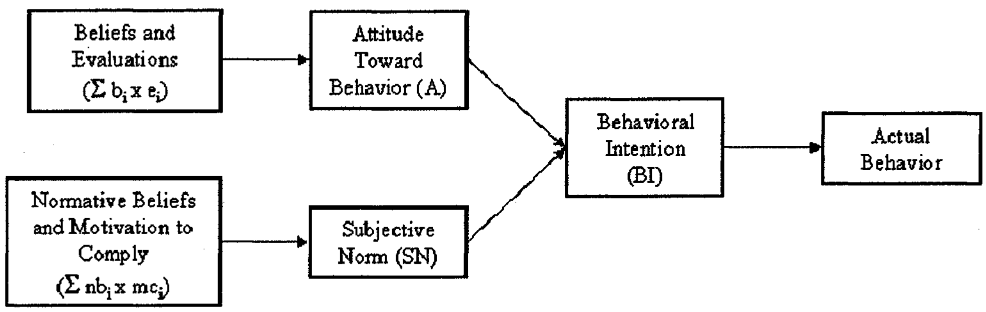


Figure 2.12
Theory of Reasoned Action (Fishbein & Ajzen, 1980)

and subjective norm ("the person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein & Ajzen, 1975, p. 302)) are direct determinants of his/her behavioral intention ("a measure of one's intention to perform a specified behavior (Fishbein & Ajzen, 1975, p. 288)) to perform a target behavior. Behavioral intentions are "indications of how much of an effort they are planning to exert, in order to perform the behavior" and "generally, the stronger the intention to engage in a behavior the more likely should be its performance" (Ajzen, 1991, p. 181). Research has verified a strong and consistent relationship between intentions and behavior when intentions and behavior are consistent in terms of action, target, context, and time-frame and/or specificity (Sheppard, Hartwick & Warshaw, 1988, p. 325).

A person's attitude toward a behavior is determined by his/her beliefs toward the behavior ("the individual's subjective probability that performing the target behavior will result in a consequence" (Davis et al., 1989, p. 984)) and the evaluative weights ("implicit evaluative response to the consequence" (Davis et al., 1989, p. 984)) he/she assigns to those beliefs. Similarly, an individual's subjective norm towards a behavior is determined by his/her normative beliefs toward the behavior (beliefs regarding the expectations of important referents) and his/her motivation to comply with those beliefs. As indicated in the graphic, individuals' attitude and subjective norm are both expressed in terms of an expectancy-value summation.

TRA requires situation-specific elicitation of "five to nine salient beliefs using free response interviews with representative members of the subject population" (Davis et al., 1989, p. 984) and evaluative weights as well as normative beliefs and motivations to comply relative to the specific target behavior. Taylor and Todd (1995) observe that eliciting stable relevant belief dimensions for attitude determination can be problematic in applying TRA. They also speculate that TRA's idiosyncratic setting-specific beliefs, as compared with TAM's generalized beliefs may result in "less than ideal" (Taylor & Todd, 1995a, p. 151) belief measurement and help explain TRA's lower predictive power in most comparisons with TAM (e.g., Mathieson, 1991). Shephard, et al. (1988) completed an extensive meta-analysis of TRA research, concluding "the Fishbein and Ajzen model has strong predictive utility, even when utilized to investigate situations and activities that do not fall within the boundary conditions originally specified for the model" (Shephard, Hartwick & Warshaw, 1988, p. 338).

The TAM first appearing in published research (Davis et al., 1989, p. 985) is depicted in Figure 2.13. While derived directly from TRA, TAM embodies several modifications intended to provide a model "specifically meant to explain computer usage behavior" (Davis et al. 1989 983). Perhaps most fundamental is replacement of behavior-specific salient beliefs used in TRA with two pre-specified beliefs in TAM; perceived usefulness ("prospective user's subjective probability that using a specific application system will increase his or her job performance within an organizational context" (Davis et al. 1989 985)) and perceived ease of use ("the degree to which the prospective user expects the target system to be free of effort" (Davis et al., 1989, p. 985)).

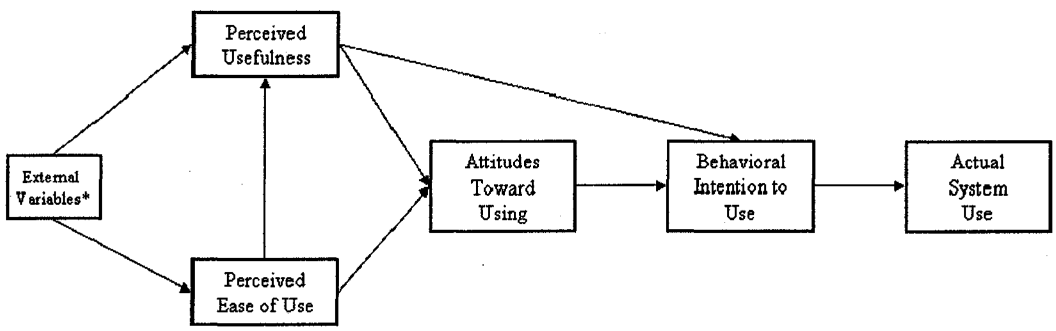


Figure 2.13

Technology Acceptance Model (Davis et al., 1989, p. 985)

Noting "several studies have found variables similar to these linked to attitudes and usage", Davis, et al. asserted that "perceived usefulness and perceived ease of use, are of primary relevance for computer acceptance behavior" (Davis et al., 1989,

p. 985). Perceived usefulness and perceived ease of use are "meant to be fairly general determinants of user acceptance" (Davis et al., 1989, p. 988). This alteration of TRA was also rationalized as "an attempt to arrive at a belief set that more readily generalizes to different computer systems and user populations" (Davis et al., 1989, p. 988). Davis (1989, p. 321) reported "a striking convergence among the wide range of theoretical perspectives and research studies" including "self-efficacy theories", "cost-benefit paradigm", "adoption of innovations", and "channel disposition model" (Davis, 1989, p. 321-322) which led him to conclude "the accumulated body of knowledge regarding self-efficacy, contingent decision behavior and adoption of innovations provides theoretical support for perceived usefulness and ease of use as key determinants of behavior" (Davis, 1989, p. 323).

A second important difference is that TAM does not include subjective norm (SN). Elimination of SN from TAM was rationalized primarily in terms of "its uncertain theoretical and psychometric status" (Davis et al., 1989, p. 986). Davis, et al. observed SN "is one of the least understood aspects of TRA" and cited further difficulties distinguishing direct and indirect SN effects on intention arising from the construct's three constituent dimensions; internalization, identification, and compliance. Despite omitting SN from TAM and failure in this research (comparing TAM and TRA) to find a significant relationship between SN and behavioral intention, Davis, et al. observed that due to the individual nature of the application studied (word processing) and the weak psychometric properties of the SN instrument, "further research is needed to address the generalizability of our SN findings, to better understand the impact of social influences on usage behavior, and to investigate conditions and mechanisms governing the impact of social influence on usage behavior" (Davis et al., 1989, p. 999).

TAM's incorporation of a direct relationship between perceived usefulness and behavioral intention is another important departure from TRA. TRA holds all salient beliefs influence an individual's intention to perform a behavior indirectly through attitude. Thus, attitude is hypothesized to mediate the effects of individual beliefs. Davis rationalizes the direct effect of perceived usefulness on behavioral intention by noting that "within organizational settings, people form intentions toward behaviors they believe will increase their job performance, over and above whatever positive or negative feelings may be evoked toward the behavior per se" (Davis et al., 1989, p. 986). People can and will form positive intentions toward using a system they dislike if they believe it will improve their job performance.

TAM's "external variables" construct is meant to "underscore the fact that one of its purposes is to provide a foundation for studying the impact of external variables on user behavior" (Davis et al., 1989, p. 989). System features such as "menus, mice, and touch screens" (Davis et al., 1989, p. 987) and other factors likely to influence usefulness and, or ease of use perceptions such as "training, documentation, and user support consultants" were categorized as "external factors" (Davis et al., 1989, p. 988). Davis (1993) supported the notion that system design feature effects on usage were mediated fully by TAM's parsimonious set of belief and attitude constructs.

A large and growing body of IT acceptance research has confirmed the effectiveness and validity of TAM, and several extensions for investigating and predicting user IT acceptance (e.g., Mathieson, 1991; Taylor & Todd, 1995; Straub et al., 1995; Szajna, 1996; Chau, 1996; Gefen & Straub, 1997; Doll et al., 1998; Dasgupta et al., 2002; Venkatesh et al., 2003).

TAM's parsimonious structure has proven both an asset and a liability. While making it easy to apply, TAM's simple but very general nature has limited its ability to provide specific information designers need to develop more acceptable systems (Venkatesh & Davis, 2000; Mathieson, 1991; Taylor & Todd, 1995a). It is valuable to know users are more likely to adopt systems perceived to be useful and easy to use and that usefulness is more important. It is more valuable for system designers and implementers to know what system attributes contribute to usefulness and ease of use. That is, what are the constituents of usefulness and ease of use? How do designers make a system useful and/or easy to use?

It would also be valuable to know potential users' priorities for attributes lumped together as "external variables" – and perhaps important threshold values or levels for each of them. Subsequent research has focused on antecedents of the two primary TAM beliefs constructs perceived usefulness and perceived ease of use in an effort to gain more specific/actionable IT acceptance information (e.g., Venkatesh & Davis, 1996; Venkatesh & Davis, 2000; Venkatesh, 2000).

An exhaustive review of TAM related IT acceptance research is beyond the scope of this study. The most salient linkages between this research and TAM center on the role of its two individual perception constructs, their relationship to IT acceptance behavior, and to similar innovation attributes that have played a dominant role in that research domain. Of secondary importance are findings relative to the influence of social factors on IT innovation acceptance.

Perceived usefulness is a belief or perception an individual forms regarding the usefulness of an information system in the performance of his or her job. Perceived usefulness is conceptually similar to the “relative advantage” construct prominently associated with innovation diffusion theories and research (Rogers, 1995; Moore & Benbasat, 1991).

Virtually all TAM individual IT acceptance research has found perceived usefulness the most powerful determinant of individual intention to accept an IT. Individuals are consistently most accepting of IT innovations they perceive will help improve their job performance. Davis (1993) found perceived usefulness 50% more influential than perceived ease of use in explaining an individual’s intention to use an IT.

Venkatesh et al. (2003) examined the predictive power of eight popular IT acceptance models containing five separate instrumentality, or “performance expectancy” constructs similar to perceived usefulness. Their longitudinal research encompassing four ITs and three data collections revealed instrumentality constructs such as “perceived usefulness”, “relative advantage”, “job-fit”, “outcome expectations”, and “extrinsic motivation” (Venkatesh et al., 2003, p. 448-449) were “the strongest predictor of intention” and “significant at all points of measurement in both voluntary and mandatory settings” (Venkatesh et al., 2003, p. 447). These findings are also “consistent with previous model tests” (Venkatesh et al., 2003, p. 447).

Consistent with TRA, Davis’ original TAM theorized IT usefulness perceptions would influence behavioral intentions through attitude. Subsequent research suggests the mediating role of attitude is less clear. Davis, et al. (1989) found attitude a partial mediator at best of usefulness perception effects on behavioral intention and that the construct added little explanatory power. They suggested attitude be eliminated from TAM to create a more parsimonious model reflecting a direct influence of usefulness and ease of use perceptions on behavioral intention. The role of attitude in TAM remains ambiguous. Some TAM-based acceptance research subsequent to Davis, et al. (1989) incorporates an attitude construct (e.g., Davis, 1993; Taylor & Todd, 1995). Other scholars exclude attitude (e.g. Davis et al. 1992; Agarwal & Prasad, 1997; Dasgupta et al., 2002; Venkatesh et al., 2003) from their TAM models.

The role of attitude is relevant because an important distinction between IT acceptance research and innovation diffusion research is the widespread, albeit not pervasive, presence of attitude in IT acceptance models based largely on TRA and TAM (Agarwal & Prasad, 1997). Research and theory supporting the direct influence of beliefs on intentions and, or behavior (i.e., the elimination of the attitude construct) reflect a closer relationship between the two research streams. This research, being somewhat more aligned with innovation diffusion, does not include attitude as a mediator of the effects of beliefs on IT innovation adoption/acceptance.

The relationship between perceived usefulness and perceived ease of use remains ambiguous. While shown statistically to be separate constructs (Davis 1989), some research suggests ease of use influences attitude both directly and indirectly through perceived usefulness (e.g., Davis et al., 1992). When acting indirectly through perceived usefulness, ease of use is conceptualized as a constituent or component of usefulness. This is rationalized intuitively by noting the beneficial effect an easy to use IT can have in reducing the time and/or effort required to complete job tasks; an effect that would enhance job performance and perceptions of system usefulness. Further clouding the relationship between the two perception constructs, Venkatesh and Davis (2000) found that over time the effect of perceived ease of use on perceived usefulness increases while its direct effect on intentions diminishes.

Due to the importance of perceived usefulness, subsequent research has sought to identify its antecedents. Venkatesh and Davis (2000) found job relevance ("an individual's perception regarding the degree to which the target system is applicable to his or her job" (Venkatesh & Davis, 2000, p. 191)), output quality ("how well the system performs those tasks [performed by the IT and related to job accomplishment] (Venkatesh & Davis, 2000, p. 191)), and result demonstrability ("the tangibility of the results of using the innovation" (Venkatesh & Davis, 2000, p. 192)) all positively related to perceptions of IT usefulness.

Perceived ease of use is "the degree to which a person believes that using a particular system would be free of effort" (Venkatesh & Davis, 1996, p. 452); an assessment of the effort required to learn and use an IT. Illustrating the linkage of IT acceptance theories, Davis (1989) and Davis, et al. (1989) argued for perceived ease of use as a separate belief construct by noting "the importance of perceived ease of use is supported by Bandura's (1982) extensive research on self-efficacy, defined as "judgments of how well one can execute courses of action required to deal with prospective situations. Self-efficacy is similar to perceived ease of use as defined above." (Davis, 1989, p. 321) Venkatesh (2000, p. 344) noted a "vast body of research in behavioral decision making and IS demonstrate that individuals attempt to minimize efforts in their behaviors, thus supporting a relationship between perceived ease of use and usage behavior", and that "other theoretical perspectives studying user acceptance have also employed similar constructs."

In contrast to consistent findings regarding the role and influence of perceived usefulness, there is a less clear understanding how perceived ease of use affects attitudes and/or intentions to use IT. Perceived ease of use was originally postulated to affect both attitude and usefulness directly. Davis, et al. (1989) recommended removal of attitude from TAM, leaving ease of use with a direct effect on intention. Davis (1989) speculated ease of use might be an antecedent to usefulness rather than a direct determinant of intention, finding when usefulness effects were removed, the effect of ease of use on intentions all but vanishes.

Szajna (1996) postulated dual, scenario-dependent perceived ease of use roles. In IT introduction scenarios, perceived ease of use was hypothesized to effect behavioral intentions directly while anchored by individual computer self-efficacy beliefs. In scenarios where users accumulated hands on experience, ease of use was hypothesized to affect intentions and usage indirectly via perceived usefulness. Such a formulation suggests that with hands on experience, users form a perception of an IT's ease of use and consider it an aspect of usefulness. It also suggests that only after hands-on experience does an IT's objective ease of use (measured by comparing expert/novice task achievement times) affect perceptions ease of use (Davis & Venkatesh, 1996). Szajna concluded ease of use perceptions influence behavioral intentions only through usefulness. Like others, including Davis, she interpreted these findings to imply that unless people perceive an IT as useful, its ease of use is not salient. Further, once an individual perceives an IT to be useful, increased ease of use enhances its usefulness.

Gefen and Straub (2000) hypothesized that the role of perceived ease of use might depend on the relationship between the task being performed and the IT. They observed most relevant research had not accounted for the nature of the task, focusing only on use or intention to use. They explored the hypothesis that when a task was "extrinsic" to the IT (e.g., buying from an e-commerce site) ease of use was not a determinant of acceptance. However, when the task performed was "intrinsic" to the IT (e.g., gathering information) they hypothesized ease of use perceptions would affect acceptance. Their research provided tentative support for their hypotheses.

Venkatesh, et al. (2003) examined perceived ease of use and four other very similar "effort expectancy" ("degree of ease associated with the use of the system" (Venkatesh et al., 2003, p. 450)) constructs. The findings of their longitudinal research were consistent with those of earlier studies; perceptions of effort required to learn and use an IT innovation were important only in the initial or introductory stages. As users gained experience with an IT, effort expectancy constructs became non-significant. Venkatesh, et al. (2003) also found effort related constructs more salient for women and older workers. All the models and constructs used in this extensive and important research appear in Appendix L.

Most TAM research has substantiated early findings of Davis, et al. (1989) that perceived usefulness is a "major determinant" of individuals' intention to use an IT and perceived ease of use a "significant secondary determinant." This finding is rationalized with the logic that users will cope with ease of use shortfalls if they believe an IT will contribute to their job performance. However, they will not accept an IT that is not useful regardless of how easy it is to use.

While TAM has dominated IT acceptance research, it has received some criticism. Some scholars consider TAM's parsimony strength, but others consider it a weakness. Regarding parsimony, some subscribe to the idea that "a model that provides good prediction while using the fewest predictors is preferable" (Taylor & Todd, 1995, p. 169). Others argue that parsimony is desirable but "only to the extent that it facilitates understanding" (Taylor & Todd, 1995, p. 169). Venkatesh and Davis (1996, p. 472) noted that "one of the limitations of TAM is that it does not help understand and explain acceptance in ways that guide development beyond suggesting that system characteristics impact ease of use and usefulness perceptions." Venkatesh (2000) observed "The parsimony of TAM combined with its predictive power make it easy to apply to different situations; however, while parsimony is TAM's strength, it is also the model's key limitation. TAM is predictive but its generality does not provide sufficient understanding from the standpoint of providing system designers with the information necessary to create user acceptance for new systems" (Venkatesh, 2000, p. 344).

Mathieson (1991) compared TAM and TPB in an educational setting using student subjects. She proposed three model comparison criteria; relative ability to predict user's intentions to use an IT, relative value/worth of the information they provided, and the relative difficulty or expense of applying the model. In this research, TAM explained more slightly more variance in behavioral intention than TPB, (TAM 69.3%/TPB 62.1%). However, Mathieson considered this difference insignificant, concluding that more specific information provided by TPB would be more useful to a system developer than TAM's general information. TAM was far easier to use than TPB which required a pilot study to elicit salient beliefs. Mathieson concluded the relative worth or applicability of the models was situational. TAM is easy to use but provides only general, high level information. It could be used effectively "to measure general levels of satisfaction across a range of users with diverse interests" (Mathieson, 1991, p. 187). TPB "delivers more specific information, giving more insight into why an individual or group might be dissatisfied" but "is more costly to apply" (Mathieson, 1991, p. 187). She noted the models could be used serially; TAM providing an initial high level screening to identify dissatisfied users who would then be surveyed with TPB to find specific sources of dissatisfaction.

Taylor and Todd (1995a) also compared TAM with TPB and a version of TPB featuring decomposed belief structures for its attitude, subjective norm, and perceived behavioral control constructs (DTPB). Their DTPB model also included perceived characteristics of innovating constructs from the innovation diffusion literature (Moore & Benbasat, 1991) and is shown in Figure 2.14.

The models were used to predict student behavioral intention to use and actual usage of a university computing resource center (CRC). TPB and DTPB exhibited better behavioral intention predictive power than the TAM and comparable usage predictive power (behavioral intention/usage: TAM 52%/34%; TPB 57%34%; DTPB 60%/36%).

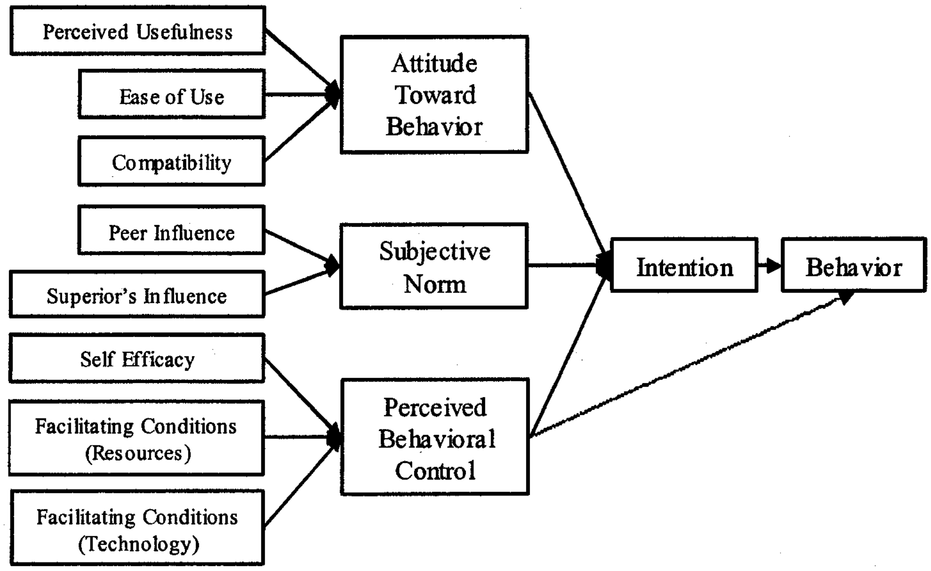


Figure 2.14

Decomposed Theory of Planned Behavior (Taylor & Todd, 1995a)

Improved performance of TPB and DTPB relative to TAM was found to be the result of positive contributions of the subjective norm and perceived behavioral control constructs (Taylor & Todd, 1995a, p. 167). These contributions were attributed to the "naturalistic setting where actual behavior was monitored" (Taylor & Todd, 1995a, p. 168) which "made the subjective norm and perceived behavioral components more salient" and to DTPB's use of decomposed beliefs based on theoretically based belief constructs. Explaining the significant effect of subjective norm on behavioral intention, a departure from earlier research, Taylor and Todd referred to the competitive, evaluation-oriented nature of the real world study setting. They also cited Davis (1993) and Davis, et al. (1992), which both "suggest that subjective norm may be influential in more realistic organizational settings" (Taylor & Todd, 1995, p. 168).

In comparing the models, Taylor and Todd ultimately focused on the "relative tradeoff of the moderate increases in explanatory power…against the increased complexity of the decomposed TPB" (Taylor & Todd, 1995, p. 169). Like Mathieson, their conclusions regarding the relative value/applicability of the models were contingent upon the research setting and purpose.

If research is intended only to provide an estimate of likely acceptance, then the parsimonious TAM may be preferable. It yields reliable results (explaining over 50% of the variance with just two constructs in this research (Taylor & Todd 1995)) and is the easiest and most cost-effective to use. However, if the researcher is "trying to obtain the most complete understanding of a phenomenon, a degree of parsimony may be sacrificed." (Taylor & Todd, 1995a, p. 169) "The decomposed TPB model provides a more complete understanding of the determinants of intention" (Taylor & Todd, 1995a, p. 169) by illuminating "normative beliefs, self-efficacy, and facilitating conditions" which "provide managers with leverage points from which to manage the successful deployment of IT" (Taylor & Todd, 1995a, p. 170).

Compared with the simpler TAM, they find a more detailed model like DTPB "may be particularly relevant to providing guidance during implementation efforts", appealing to those "who study systems implementation and recognize that technical and design features are a necessary, but not sufficient, condition for successful implementation" (Taylor & Todd, 1995a, p. 170).

2.3.2.2 Social Cognitive Theory: Bandura's SCT is a heavily researched behavioral model that some noted scholars view as "one of the most powerful theories of human behavior" (Venkatesh et al., 2003, p. 432).

SCT postulates triadic interactive/bidirectional relationships among individual attributes, environmental characteristics, and human behavior. Bandura attributes the social dimension of the SCT to "the social origins of much human thought and action." The cognitive aspect of SCT "recognizes the influential causal contribution of thought processes to human motivation, affect, and action." (Bandura, 1986, p. xii) SCT holds that individuals both produce and are products of their environment.

SCT's concept of self-efficacy has drawn the greatest interest from IT acceptance researchers. Self-efficacy is defined as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances. It is concerned not with the skills one has but with judgments of what one can do with whatever skills one possesses" Bandura (1986, p. 391).

SCT holds that self efficacy is an important determinant of an individual's willingness to accept difficult challenges and of the effort and, or resilience he/she will exert to achieve their goals. Individuals with high self-efficacy are typically more willing to accept difficult challenges, and because they are confident of ultimately overcoming their challenges, they are likely to exert the extra effort that may be required to achieve them. Self-efficacy should be considered as applying to specific vice general domains of behavior. Self-efficacy, like individual attitudes, must be assessed relative to a specific behavior, time, context, and object to derive maximum explanatory value. Like general attitudes, general measures of self efficacy are less predictive than specific measures focused carefully on a behavior of interest. Thus, a broad measure of an individual's computer self-efficacy would likely provide less explanatory power relative to a specific computer behavior than a self-efficacy measure tailored to the specific behavior of interest.

Compeau and Higgins (1995) developed and tested a ten item measure of individual computer self-efficacy. They defined computer self-efficacy as an individual's judgment of his/her capability to perform tasks using a computer (Compeau & Higgins, 1995). Compeau, Higgins, and Huff (1999) found a positive relationship between individuals' computer self-efficacy and their affective and behavioral reactions to IT. Utilizing self-efficacy as an internal dimension of perceived behavioral control in a decomposed TPB model, Taylor and Todd (1995) also found self-efficacy a significant determinant of IT usage. Venkatesh & Davis (1996) concluded that computer self-efficacy acted as an "anchor" for individual's perceptions of an IT's ease of use. However, Venkatesh, et al. (2003) concluded the effect of the computer self-efficacy construct on an individual's intention to use an IT was fully mediated by an effort expectancy (i.e., ease of use, complexity) construct. This suggests that IT acceptance models incorporating an effort-expectancy construct (e.g., ease of use, complexity) gain no explanatory power by also including a computer self-efficacy construct.

2.3.2.3 IT Acceptance Research Based on Innovation Diffusion Theories: Some scholars (e.g., Kwon & Zmud, Fichman) have acknowledged the linkage between IT acceptance and organizational IT diffusion, or IT implementation. However, little IT acceptance research has been grounded primarily on innovation diffusion theories.

Karahanna, et al. (1999) investigated determinants of intentions to adopt and/or continue use of Windows technology. Their research model was derived from the theory of reasoned action, but included salient features from both IT acceptance and innovation diffusion research. It incorporated potential adopter/user beliefs regarding perceived characteristics of adopting/continuing to use Windows from Moore and Benbasat's (1991) innovation diffusion research. Findings of Karahanna, et al. suggested Windows adoption behavior was more influenced by subjective/social influence factors while continued use decisions were driven by instrumentality considerations (e.g. relative advantage and result demonstrability). Karahanna, et al. also highlighted two conceptual distinctions between IT acceptance and innovation diffusion research; the practice in IT acceptance research to utilize the behavioral intention construct derived from social psychology, and the increasing tendency of innovation researchers to distinguish stages or levels of innovation adoption (e.g., Cooper & Zmud, 1990) whereas IT acceptance researchers typically focus on simpler and less nuanced acceptance measures.

Also, as discussed earlier, Taylor and Todd (1995a) utilized perceived characteristics of innovating drawn from innovation diffusion research in their investigation of the relative predictive power of TAM and two configurations of TPB.

The strongest evident linkage between the two research streams is their common focus on important IT/innovation attributes and their effect on acceptance and/or diffusion. Davis (1989) cited Tornatzky and Klein (1982) in development of TAM's perceived ease of use and perceived usefulness constructs. He noted "research on the adoption of innovations also suggests a prominent role for perceived ease of use" (Davis, 1989, p. 322) and "the accumulated body of knowledge regarding self-efficacy, contingent decision behavior, and adoption of innovations provides theoretical support for perceived usefulness and ease of use as key determinants of behavior" (Davis, 1989, p. 323).

Tornatzky and Klein's 1982 research of the consistency of innovation attribute effects on diffusion represents a strong tie between the two research domains. Of more than thirty attributes appearing in innovation diffusion research, only three (relative advantage, compatibility, and complexity) were consistently related to innovation diffusion. Two - relative advantage and complexity - are virtually equivalent to Davis' TAM belief constructs; perceived ease of use and perceived usefulness (Moore & Benbasat, 1991; Fichman, 1992). Two attributes that have been consistently identified as important determinants of individual IT acceptance.

Fichman (1992) surveyed eighteen empirical IT implementation studies based on innovation diffusion theory. He observed "diffusion theory provides tools....for assessing the likely rate of diffusion of a technology, and additionally, identifies numerous factors that facilitate or hinder technology adoption and implementation" and noted "it is not surprising then, that innovation diffusion is becoming an increasingly popular reference theory for empirical studies of information technologies" (Fichman, 1992, p. 1). However, he cautioned "much of diffusion theory was developed in the context of adopters making voluntary decisions to accept or reject an innovation based on the benefits they expect to accrue from their own independent use of the technology" (Fichman, 1992, p. 1), and that potential IT adopters in an organizational setting may face different circumstances. He concluded that "the opportunities to apply classical diffusion "as is" may be quite rare indeed" (Fichman, 1992, p. 1).

Fichman presents a two-way IT classification to distinguish "situations where most of the assumptions of classical diffusion are likely to hold" "from those where important assumptions are likely to be violated" (Fichman, 1992, p. 7). Classification dimensions are locus of IT adoption (individual or organizational) and class of technology (exhibits or does not exhibit high knowledge burden and/or user interdependencies). "As expected, strong results were most likely to be found in instances where the adoption context was a good match with classical diffusion assumptions, or when additional variables suggested by the adoption context were incorporated into the analysis" (Fichman, 1992, p. 2). Research settings most compliant with classical diffusion assumptions had an individual adoption locus and an IT innovation with neither high knowledge barriers nor user interdependencies. IT research situated in settings not exhibiting these characteristics (i.e., with an organizational locus of adoption, and, or IT innovations with either a high knowledge burden and, or high user interdependence) yielded results that were either weak or inconclusive relative to hypotheses based on innovation diffusion theories.

Fichman's research demonstrated that innovation diffusion can be a useful paradigm for studying volitional individual acceptance of IT innovations with no significant knowledge burdens and/or user interdependencies. However, he noted some of the "most valuable potential applications of diffusion theory" occur in the context of "organizational adoption of complex multi-user technologies" (Fichman, 1992, p. 16) that are not consistent with those used to develop classical innovation diffusion theories. He urged extending diffusion theory with concepts relevant to the adoption and diffusion of these important IT innovations such as absorptive capacity (Cohen & Levinthal, 1990), critical mass (Markus, 1987, 1990), institutions for reducing knowledge burdens (Attewell, 1992), and diffusion process research (Cooper & Zmud, 1990).

Fichman also recommended "studies of individual adoption within organizational settings must either incorporate managerial influences [e.g., usage mandates, usage/adoption rewards or incentives, training and consulting, hardware/software access, etc.] into the analysis or rule them out as a potentially confounding factor" (Fichman, 1992, p. 4).

Brancheau and Wetherbe's research was cited by Fichman for consistency with innovation diffusion theory assumptions. Postulating "innovation diffusion can be usefully conceptualized as a process of individual adoption decision making within organizational constraints" (Brancheau & Wetherbe, 1990, p. 121), they set out to "improve understanding of the social forces which affect the introduction and diffusion process within organizations" (Brancheau & Wetherbe, 1990, p. 115).

Their target IT innovation – an end-user computer spreadsheet application – imposed a low knowledge burden and no user interdependence. Brancheau and Wetherbe noted that "given the degree of autonomy that most knowledge workers have in the way they carry out their work", Rogers' volitional model was appropriate (Brancheau & Wetherbe, 1990, p. 121). Given this compliance with innovation diffusion theory assumptions, it is not surprising the findings of this research were generally supportive of hypotheses based these theories. A salient exception was the interaction between communications channel effectiveness and innovation process phase. Rogers found mass media (type) and external (source) communication channels would be dominant in the (earlier) knowledge stage of innovation while interpersonal (type) and internal (source) communication channels would dominate in the (later) persuasion stage of innovation decision making. However, "interpersonal channels dominated all phases of adoption decision making"

(Brancheau & Wetherbe, 1990, p. 134) and "the relationship between channel source and decision stage followed a similar pattern" (Brancheau & Wetherbe, 1990, p. 135). Brancheau and Wetherbe explained this by noting "prevailing norms in most organizations may necessitate this emphasis on internal channels....furthermore, the density of internal/interpersonal channels in organizations far exceeds those of social systems in which the theory developed (farming communities, local school districts, intra city medical networks, peasant villages, etc.)" (Brancheau & Wetherbe, 1990, p. 135). Of importance to this study, this finding suggests work group social influence may have more influence on individual adoption behavior in the organizational setting than in settings typically used in previous innovation diffusion research.

"It was apparent from group interviews that spreadsheet diffusion in accounting and finance was a user-led phenomenon" (Brancheau & Wetherbe, 1990, p. 133). Explaining this finding, Brancheau and Wetherbe observed "spreadsheet software's real strength is in supporting personal productivity" and "given this focus on individual productivity coupled with its relatively low cost, it is not surprising that individuals with the greatest need for, or interest in the technology led the diffusion process" (Brancheau & Wetherbe, 1990, p. 134). This application of innovation diffusion theory to the diffusion of an IT innovation reinforces the dominant finding of IT acceptance research; that perceptions of usefulness, performance improvement, and, or relative advantage are a powerful determinant of adoption/acceptance.

Agarwal and Prasad (1997) examined the influence of classical innovation attributes on individuals' adoption and continued use of the World Wide Web. Utilizing perceived characteristics of innovating constructs of Moore and Benbasat (1991) they found different perceptions salient for adoption and continued use behaviors. Perceived characteristics important to IT adoption behavior were compatibility, visibility, trialability, and voluntariness (Agarwal & Prasad, 1997, p. 574). Only instrumentality perceptions of relative advantage and result demonstrability were significant predictors of the continued use of the IT (Agarwal & Prasad, 1997, p. 569). Another important finding of this research illuminates the role of voluntariness in innovation implementation. Agarwal and Prasad believe that by mandating system use organizations can "increase initial system utilization" (Agarwal & Prasad, 1997, p. 575) and "may be able to induce individuals to overcome the hurdle of first-time use" (Agarwal & Prasad 1997 575). "The effects of such pressure, however, may erode beyond this point" (Agarwal & Prasad, 1997, p. 575). This reinforces the findings of others (e.g. Karahanna et al., 1999) that as users gain hands-on experience, instrumentality considerations increasingly dominate subjective norm/social influence factors as determinants of continued/increased IT usage behavior.

2.3.2.4 Social Influence in Information Technology Acceptance: Three foundational theories underlying IT acceptance research, the theory of reasoned action (TRA), classical innovation diffusion theory, and social cognitive theory each acknowledge explicitly the important role of social factors in shaping individual behavior. In TRA (Figure 2.12), cited specifically by Davis as TAM's theoretical basis, subjective norm is one of two determinants of behavioral intention, a strong determinant of behavior. Classical innovation diffusion theories based on Rogers' research emphasize the important role of communications. Rogers & Adhikarya (1979, p. 69) note "diffusion is a special type of communication." Gatignon and

Robertson (1985, p. 849) also refer to diffusion theory as a "theory of communications." Bandura's social cognitive theory (Figure 1.4) also emphasizes social influences emanating from behavior modeling, social learning, and the effect of persuasion on self-efficacy beliefs as an important factor shaping individual behavior. Given the prominence of social factors in these foundational theories, it seems that social influences should emerge as a salient factor in IT acceptance research. However, as Agarwal (2000, p. 97) concluded "empirical results related to the role of social influence in technology acceptance have been mixed."

In the first published TAM research, Davis, et al. (1989) compared TRA and TAM in predicting behavioral intention to use (BI), and self-reported usage of a word processor. Student subjects were surveyed immediately after a brief software introduction and fourteen weeks later.

In theoretical development of TAM, Davis, et al. rationalized exclusion of TRA's subjective norm (SN) construct due to its "uncertain theoretical and psychometric status" (Davis et al., 1989, p. 986). TAM outperformed TRA in this research, which also found that SN "had no significant influence on BI in either time" (Davis et al., 1989, p. 993). Davis, et al. termed this finding "surprising" (Davis et al., 1989, p. 998) and recommended it be interpreted "narrowly" (Davis et al., 1989, p. 998). They pointed out the SN instrument used was "particularly weak from a psychometric standpoint" (Davis et al., 1989, p. 998) and that "more sophisticated methods for assessing the specific types of social influence processes at work in a computer acceptance context are clearly needed" (Davis et al., 1989, p. 998). Davis, et al. also noted the word processing application studied in the research "is fairly personal and individual and may be driven less by social influences compared to more multi-person applications" (Davis et al., 1989, p. 999). They urged further research of social influences on IT acceptance to better understand their effects and to "investigate the conditions and mechanisms governing social influences on usage behavior" (Davis et al., 1989, p. 999).

Davis, et al. (1992) utilized TAM to investigate the relative effects of perceived usefulness and enjoyment on behavioral intentions and computer usage in the workplace. Usefulness and enjoyment were both found significantly related to intentions to use and usage. Davis (1993) researched the degree to which TAM's attitude, perceived usefulness, and perceived ease of use constructs mediated the influence of system design features on behavioral intention to use and usage. This research supported the hypothesis that TAM constructs fully mediate the effects of system design features on individuals' intentions and reinforced the importance of usefulness perceptions which were 50% more influential than ease of use perceptions in predicting intentions and usage. In both studies, the researchers hypothesized explicitly regarding the potential effect of social influence on intentions to use an IT and system usage. However, their comments regarding these potential effects were limited specifically to organizational scenarios in which usage was mandated. No justification or explanation for this limitation was offered.

Venkatesh and Davis (2000) examined the effect of social influences on perceived usefulness and intentions to use an IT system. Their longitudinal research included three data collections (immediately after initial training, one month after implementation, three months after implementation) and four organizations; two voluntary use settings and two mandatory use settings. Venkatesh and Davis attempted to differentiate the three dimensions of social influence; compliance (an effect operating "whenever an individual perceives that a social actor wants him or her to perform a specific behavior and the social actor has the ability to reward the behavior or punish nonbehavior" (Venkatesh & Davis, 2000, p. 188)), internalization ("the process by which, when one perceives that an important referent thinks one should use a system, one incorporates the referent's belief into one's own belief structure" (Venkatesh & Davis, 2000, p. 189)), and identification (where an individual adopts a behavior "if important members of a person's social group at work believe that he or she should perform a behavior (e.g., using a system)" and "performing it will tend to elevate his or her standing within the group" (Venkatesh & Davis, 2000, p. 189)).

They found compliance significantly related to behavioral intentions in mandatory settings but insignificant in voluntary settings. Compliance effects in mandatory settings also diminished over time. Internalization was significantly related to usefulness perceptions (and behavioral intentions) in the first two data collections not in the final data collection. Identification was significant in all three data collections. As hypothesized, and unlike the compliance effect, neither internalization nor identification social influence effects were affected by the voluntary/mandatory nature of the setting.

Venkatesh and Davis recommended against mandatory IT usage which they consider "less effective over time than the use of social influence" (Venkatesh & Davis, 2000, p. 199). Instead, they urged social information approaches such as "increasing the source credibility of social information to increase internalization or designing communication campaigns that raise the prestige associated with system use to increase identification" (Venkatesh & Davis, 2000, p . 199). They cited the need for future research to "integrate normative and utilitarian determinants" (Venkatesh & Davis, 2000, p. 200). In closing they commented on "the continuing trend in organizations from hierarchical, command and control structures to networks of empowered, autonomous teams" (Venkatesh & Davis, 2000, p. 200), noting that "as the adoption decision becomes more of a team- rather than individual decision, the nature and role of social influence processes (both within teams and across teams) will need to be elaborated." They predicted "conceptualization of perceived usefulness will need to be expanded from its current focus on expected individual level performance gains to encompass team based structures and incentives" (Venkatesh & Davis, 2000, p. 200).

Mathieson, like others (e.g., Davis et al., 1989; Venkatesh & Davis, 2000), anticipated difficulty distinguishing the influence of social norms as they affect instrumentality concerns (e.g., perceived usefulness and, or outcome expectations) from social influence effects not related to outcomes. True social influence effects occur when "individuals might use a system because they think they will be perceived by their coworkers as technologically sophisticated"; an effect "more likely to be captured by TPB than by TAM" (Mathieson, 1991, p. 178) due to its subjective norm (SN) construct.

In her research of student spreadsheet use, SN did not exhibit a significant relationship with behavioral intention. Mathieson noted that "limitations in the sampling of tasks, subjects, and contexts may explain the lack of significance of subjective norm in this study, in Davis, et al. (1989), and in Yeaman (1988). All three used student subjects in university environments. In other situations, subjective norms may influence intentions." (Mathieson, 1991, p. 186) She noted "TPB's handling of social issues is relatively poor, as suggested by Davis, et al."...."an objective for future research would be to identify the conditions under which subjective norms are important", and "perhaps a different framework, such as social network theory (used by Robertson, 1989), would prove more fruitful" (Mathieson, 1991, p. 186).

The research of Taylor and Todd (1995a and 1995b) compared TPB, TAM, and a decomposed TPB (DTPB). Their study of voluntary student use of a computing resource center (CRC) revealed a significant SN effect for TPB and DTPB models. DTPB decomposed subjective norm into two components; peer influence and superior influence. Both were significant but the peer influence effect was 50% stronger.

Taylor and Todd (1995b) examined the effects of experience on CRC usage with the same data used in Taylor and Todd (1995a). They found subjective norm a significant determinant of behavioral intention for both experienced and inexperienced CRC users, although the effect for inexperienced users was almost twice as strong. The larger effect of subjective norm on inexperienced users is consistent with other research (e.g., Karahanna et al. 1999; Venkatesh & Davis, 2000) findings that some social influence effects diminish with experience while instrumentality effects increase as users gain hands on experience, and form their own opinions of an IT. Like many others, Taylor and Todd (1995b) caution regarding the generality of their findings, noting "this study focuses on a student setting where subjective norms and perceived behavioral control may operate differently than in workplace settings" (Taylor & Todd, 1995b, p. 566).

Robertson (1989) found limited support for his hypothesis that "the social group of which an individual is a part will affect how that individual uses information systems" (Robertson, 1988, p. 55). Stating "social psychologists have known for years that the social system can change an individual's perception of unchanging physical objects" (Robertson, 1988, p. 58), he identified two mechanisms by which groups affect individual use of information technology; "(1) by affecting how the individual interprets [i.e., "how he or she decides when and how to use the system" (Robertson, 1988, p. 57)] the system, and (2) by the social pressures and demands from the group on the individual using the system" (Robertson, 1988, p. 57).

Robertson utilized the concept of structural equivalence ("a measure of similarity in interaction patterns" (Robertson, 1988, p. 58)) to identify groups expected to exhibit similar information system use. Individuals who regularly interact with the same others (e.g., seek technical and, or administrative help from the same sources) and/or who work for the same others are considered structurally equivalent, or to hold equivalent structural positions (Robertson, 1988). Structural equivalence, or the holding of an equivalent structural position, is hypothesized to be a predictor of similar information system usage behavior.

Robertson's research setting was an organization described as "small and highly connected, and the individuals within are very experienced in information technology" (Robertson, 1988, p. 65). He developed partial support for the hypotheses that "individuals in different structural positions will interpret and use information systems in different ways" (Robertson, 1988, p. 59) and that "individuals in different structural positions will have different social pressures and demands, and thus will use information systems in different ways" (Robertson, 1988, p. 60).

Robertson hypothesized the highly interconnected nature of the organization and the familiarity of its employees with IT suppressed social influence effects. He speculated larger organizations with employees not as experienced with IT would exhibit greater structural variety and increased individual interdependence in IT interpretation and usage. Robertson speculated that in such settings social forces would play a greater role in shaping system usage behavior (Robertson, 1988).

Several scholars including Fulk (1991, 1993), Fulk, et al. (1990), and Kraut, et al. (1998) have researched the effects of social influence on the use of modern communication innovations. While advocating for the effects of social influence, these researchers have not generally argued against rational theories of media selection such as media richness or social presence. Like Robertson, they assert that in the social environment of the organization both rational and social influences are important factors in technology selection (Kraut et al., 1998; Fulk et al., 1990).

Kraut, et al. (1998) examined "the manner in which the behavior of other people influenced individuals' adoption and use of a new communication medium, and the way in which influences changed with time" (Kraut et al., 1998, p. 438). Their goal was to "differentiate among several mechanisms that are often lumped under the rubric of 'social influence'" (Kraut et al., 1998, p. 438) and to highlight the complementary, compatible, and reinforcing nature of utility and normative theories of media selection (Kraut et al., 1998). They used quantitative and qualitative methods to study the process and forces leading to an organization's overwhelming selection of one of two very similar video telephone systems.

Kraut, et al. "found support for both utility and normative explanations for how people adopt and use" (Kraut et al., 1998, p. 450) the competing systems. Consistent with contingency theory, individuals with the most communication-intensive responsibilities used video telephones most heavily (Kraut et al., 1998, p. 450). Consistent with media richness theory, individuals with less analyzable tasks were the heaviest users of video telephones (Kraut et al., 1998). Inconsistent with media richness theory, individuals with people-management responsibilities did not use video telephones more (Kraut et al., 1998).

Video telephone use varied significantly over time and "among two virtually identical" systems, "one dominated over the other" (Kraut et al., 1998, p. 450); phenomena not explainable by contingency/rationale media selection theories. Eventual dominance of one system was attributed to network externality effects. As a system gained users, its utility increased due to its ability to connect more users. New users' adoption of the system also added to the "normative account" (Kraut et al., 1998, p. 440); i.e., each new user became "a model whose behavior can be imitated or taken as a basis for evaluation" (Kraut et al., 1998, p. 440).

Thus, "in many real world settings, utility and norms are inseparable" "because another's use of a communications system can be interpreted both as a resource that increases the objective value of the system (i.e., a utility variable) and as a symbolic act of endorsement (i.e., a normative variable) (Kraut et al., 1998, p. 440). Individuals' observation of others using the video telephone helped develop a "set of socially shared beliefs about the value of the systems and about how they should be used" (Kraut et al., 1998, p. 451). These beliefs "were an especially important determinant of a potential adopter's behavior" when the observed other was a member of one's primary work group (Kraut et al., 1998, p. 451). Like others (e.g., Venkatesh & Davis, 2000) they found normative and utility influences on individual technology adoption in the organizational environment tightly interwoven.

Fulk, et al. (1990) cite specific findings in organizational media use that are unexplainable using rationalist theories of media selection (e.g., media richness and social presence). They contend these rationalist media-use theories "fail to recognize a central premise of current organization theory: Behavior occurs in a very social world which is far from neutral in its effects" (Fulk et al., 1990, p. 117) and that "a realistic understanding of behavior requires knowledge not simply of objective features of the environment, but also the social milieu that alters and adjusts perceptions of that environment" (Fulk et al., 1990, p. 127).

Fulk, et al. assert that in an organization "behavior is subject to social influence in the form of widespread norms and pressure for sense-making" (Fulk et al., 1990, p. 125). "Four forms of social influences on media perceptions and media use: (a) direct statements by coworkers in the workplace, (b) vicarious learning, (c) norms for how media should be evaluated and used, and (4) social definitions of rationality" (Fulk, 1991, p. 411-412) can be drawn from premises of social information processing theory, social learning theory, and symbolic interactionism.

Fulk, et al. (1990) compare implicit assumptions underlying rationalist and social influence models of communications media choice (see Appendix M). Comparing processes individuals use to form task and media perceptions and to make media-use decisions, they conclude that media-use behavior is "subjectively rational" (Fulk et al., 1990, p. 125).

Fulk, et al. (1990) proposed a social influence model of media choice behavior "to explain social effects on individual attitudes and behavior" (Fulk et al., 1990, p. 924). The model (Figure 2.15) hypothesizes social influence effects on media and task evaluations and a direct effect on media use behavior.

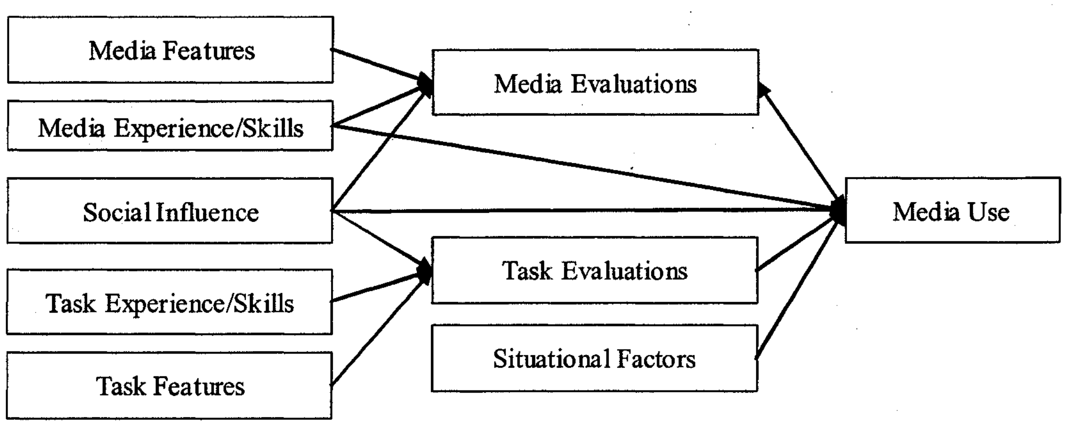


Figure 2.15

Social Influence Model of Media Use (Fulk et al., 1990, p. 128)

Fulk (1993) points to "a growing body of historical studies of the social shaping of technological systems as diverse as electrical power networks (Hughes, 1983), the bicycle (Pinch, 1986), and missile guidance systems (MacKenzie & Wajcman, 1985)" (Fulk, 1993, p. 921-922). She finds that effects of "multiple social psychological processes that can explain coordinated patterns of meanings and behaviors toward a technology within social groupings" and "decades of research in social psychology have demonstrated that formal work groups are the sites of important social influences and reality construction processes" (Fulk, 1993, p. 924). Citing social learning theory (Bandura, 1986) and social information processing (Salancik & Pfeffer, 1978), Fulk (1993, p. 923) asserts the "application of these principles to communication technology suggests that technology-related behaviors and attitudes can be produced in a work setting through processes of modeling, which increases the likelihood that attitudes and behavior will converge between modelers and observers" in closely knit networks and work groups.

Fulk's findings suggest work group attitudes are good predictors of the attitudes of individuals highly attracted to the group. Compliance effects result in work group technology use behavior being a predictor of individual technology use behavior for both high and low group attraction individuals, but a stronger link is expected for individuals with high group attraction. Work group social influence variables contributed unique behavioral variance explanatory power, and exerted greater influence than "ego networks" ("interconnected individuals who are linked by patterned communication flows to a focal individual" (Fulk, 1993, p. 926) (including the individual's supervisor)). Fulk concluded from her research that "both social influence and task variables contribute uniquely and significantly to explained variance in technology-related attitudes and behaviors" (Fulk, 1993, p. 940).

2.4 Conclusions

The topic of this research, organizational diffusion of IT encompasses aspects of the individual IT acceptance, innovation diffusion, and organizational behavior research streams. It may also be conceptualized as a subset of the broader organizational change management domain. The literature review has developed a theoretical foundation for this research by identifying key theories and findings in innovation diffusion and individual IT acceptance research and drawing attention to important theories of social influence that shape individual attitudes and behaviors toward technology in the organizational environment.

Among the key themes this research attempts to build upon and further illuminate, the following are considered the most significant.

- The diffusion of an innovation within an adopting organization following its adoption by the organization is an important phenomenon that has not been sufficiently researched.
- Most previous innovation diffusion and individual IT acceptance research has focused on volitional individual IT/innovation adoption decisions of individual-use IT/innovations.
- Previous organizational innovation research has focused on adoption decisions made at the organizational level (e.g., number of innovations adopted, earliness/lateness of adoption).
- Influences affecting individual innovation decisions within the organization are more numerous, diverse, and complex than those affecting personal innovation decisions.

- Influences affecting individual IT acceptance decisions within the organization are more numerous, diverse, and complex than those affecting volitional personal use IT acceptance decisions.
- Individual perceptions of the characteristics of innovating are important factors in individual IT innovation acceptance, but in the organizational environment there are other important influences that have not been adequately researched.
- Although behavioral theories of social psychology which undergird individual IT acceptance and innovation diffusion research explicitly acknowledge the effect of social influences on individual behavior, social factors have not to date played a prominent role in either research stream.
- Social influences, organizational structure effects, organizational environment conditions, and management interventions and facilitating conditions are additional factors which influence organizational innovation diffusion.
- Scholars have recognized the correspondence between organizational IT innovation implementation and innovation diffusion.
- Organizational diffusion of IT innovations has been identified as a potential explanation for difficulty in capturing organizational information technology investment benefits.
- Introduction and implementation of complex IT innovations can be viewed through the lens of organizational change management due to the broad range of complementary changes typically required to achieve successful organizational diffusion.

3.0 Research Methodology

3.1 Introduction

The methodology used in the research is described in this chapter. All significant aspects of the methodology are introduced and described.

The research model and the research hypotheses are presented in the first section of the chapter. Research model constructs and their measurement instruments are then introduced. The second section also provides justification in terms of theory and previous research for the presence of each research model construct. Construct measurement instrument literature sources are also identified.

A brief description of the data collection procedures and an overview of the statistical analysis methods/procedures used to investigate the hypotheses are then provided.

Research assumptions and limitations are then enumerated. The chapter concludes with a brief discussion of threats to research validity and mitigation considerations.

3.2 Research Model and Hypotheses

3.2.1 Research Model: The research model (Figure 3.1) is comprised of four categories of factors/predictors that theories and/or previous research findings suggests influence individual innovation acceptance/use behavior in the organizational environment; individual perceptions of the characteristics of innovating, social influences, managerial interventions, and characteristics of the organizational environment. Each of the four predictor categories is represented in the model by one or more predictors which are hypothesized to affect individual innovation acceptance/use behavior; the antecedent of innovation diffusion

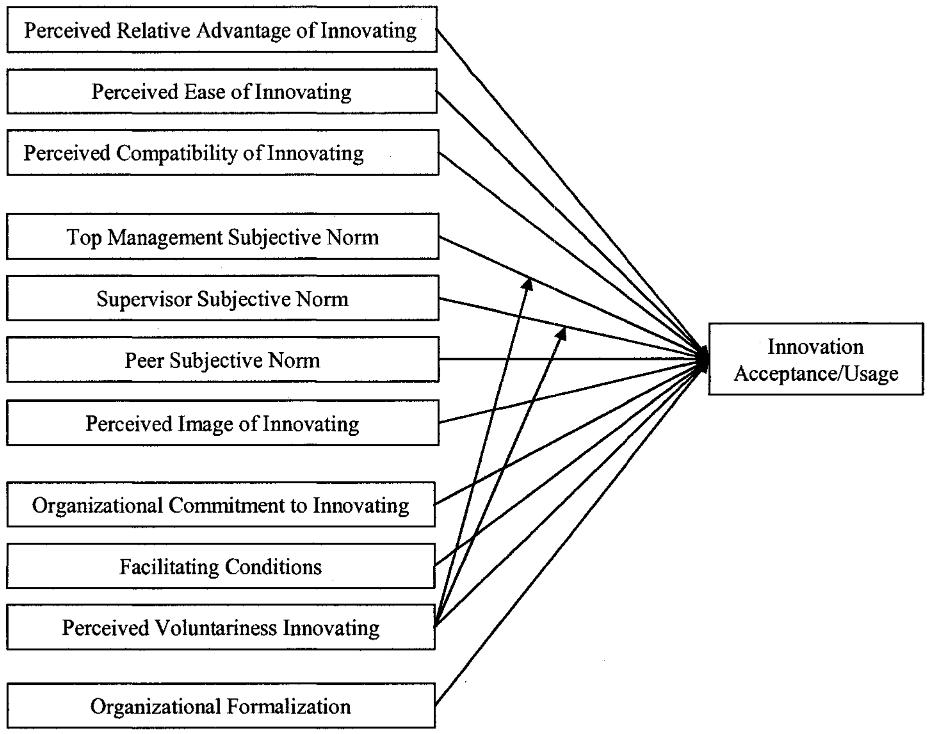


Figure 3.1
Research Model

Predictor Category	Construct
Perceived Characteristics of Innovating	Perceived Relative Advantage of Innovating (PRAD)
	Perceived Compatibility of Innovating (PCOM)
	Perceived Ease of Innovating (PEAS)
Social Influence	Top Management/Supervisor/Peer Subjective Norm (TMSN/SUSN/PRSN)
	Perceived Image of Innovating (PIMG)
Managerial Interventions	Organizational Commitment (COMT)
	Facilitating Conditions (FACN)
	Voluntariness (VOLN)
Organizational Structure	Formalization (FORM)

Table 3.1

Research Model Predictors and Categories

within the organization and the focal point of this research. Table 3.1 presents the research model predictor factor categories and the constructs included in each.

Conceptually: IT innovation acceptance/use behavior is influenced by the four categories of factors appearing in the research model.

IT Innovation Acceptance/Use f (Perceived Characteristics of Innovating, Social Influences, Managerial Interventions, Organizational Environment)

Regression Model Multiple Regression: The hypothesized integrated model of innovation acceptance/use appears below. It is shown in the form of a non-standardized multiple regression model which includes all behavioral predictors being investigated in this research.

Individual IT Innovation Acceptance/Use = β_1 **x** Perceived Relative Advantage + β_2 **x** Perceived Compatibility + β_3 **x** Perceived Ease + β_4 **x** Top Management Subjective Norm + β_5 **x** Supervisor Subjective Norm + β_6 **x** Peer Subjective Norm + β_7 **x** Perceived Image + β_8 **x** Organizational Commitment + β_9 **x** Facilitating Conditions - β_{10} **x** Voluntariness + β_{11} **x** Formalization + C

3.2.2 Research Hypotheses: This research examines hypotheses involving factors affecting organizational IT innovation diffusion at the secondary individual innovation acceptance level. Individual innovation acceptance is measured in terms of innovation use. The objective of the research is to evaluate the degree to which individual perceptions of innovating (relative advantage, compatibility, and ease), social influence (perceived image effects of innovating and subjective norm), organizational characteristics (formalization), and management interventions (organizational commitment, facilitating conditions/resources, perceived voluntariness) influence individual IT innovation acceptance.

Research hypotheses concerning relationships between the predictor/independent variables (i.e., individual perceptions of innovating, social influence, organizational characteristics, managerial interventions) on the criterion/dependent variable, innovation acceptance/use are as follows:

Hypothesis 1: Individually, and as a category group, perceived relative advantage of innovating, perceived ease of innovating, and perceived compatibility of innovating will be positively related to individual innovation acceptance/use behavior and will contribute to the explanation of its variance.

Hypothesis 2: Individually, and as a group, social influences of top management subjective norm, supervisor subjective norm, peer subjective norm, and perceived image of innovating will be positively related to individual innovation acceptance/use behavior and will contribute to the explanation of its variance. It is further hypothesized that the relationship between top management and supervisor subjective norms will be moderated by individual perceptions of voluntariness such that their effect will be greatest when perceptions of the voluntariness of innovation are lowest.

Hypothesis 3: Individually, and as a category group, managerial intervention factors organizational commitment and facilitating conditions will be positively related to individual innovation acceptance/use behavior and will contribute to the explanation of its variance. Perceived voluntariness will be negatively related to innovation acceptance.

Hypothesis 4: Organizational formalization will be positively related to individual innovation acceptance/use behavior and contribute to explanation of its variance.

Hypothesis 5: In an integrated model, perceived characteristics of innovating, social influence factors, managerial intervention factors, and organizational formalization will be positively related to individual innovation acceptance/use behavior and contribute to the explanation of its variance.

Thus, the research hypotheses postulate that each predictive factor except perceptions of voluntariness will be positively and statistically significantly related to individual innovation acceptance. It is also postulated that the predictors will contribute substantially to the explanation of observed variance in innovation acceptance. Perceived voluntariness of innovating is hypothesized to have a statistically significant negative relationship with innovation acceptance.

It is further hypothesized that the predictors, when grouped within the four categories and across the four categories will be significantly related to individual innovation acceptance and that they will contribute to the substantial explanation of its variance.

3.3 Research Model Constructs and their Operationalization

Research model behavioral predictor constructs will be introduced and discussed in the following sections. Construct measurement instruments and their sources in the literature will also be presented.

3.3.1 Innovation Acceptance: "Individual acceptance is a broad outcome" that "has been operationalized in prior research in a variety of ways" Agarwal (2000, p. 91). Lucas, et al. (1990, p. 25) defined acceptance as a "predisposition to use" in their research of innovation implementation. Saga and Zmud (1994, p. 69) found "*user acceptance* has taken on a variety of meanings" and that "authors have been ambiguous regarding whether their use of the user acceptance construct reflects an attitude, a belief, an intention, or an action." They propose the construct "be viewed as a process that is multifaceted and comprised of actions, intentions, and attitudes" (Saga & Zmud, 1994, p. 69). While conceptualizing additional graduated levels of innovation use including routinization and infusion, Saga and Zmud (1994) find that a positive attitude toward use, intentions to use, and/or frequent use can be indicators of innovation acceptance. They note also that the behavioral chain; beliefs→attitude→intentions→behavior is consistent with the theory of reasoned action (Saga & Zmud, 1994, p. 69).

Innovation usage behavior is the most tangible and unambiguous indicator of innovation acceptance. In this research, innovation acceptance is analyzed at the individual level and is measured in terms of individual innovation use. Measurement instruments from previous research are used to measure innovation acceptance/use of all survey respondents who indicate their awareness of the innovation. Innovation usage measurement items used in this research were taken from Agarwal and Prasad (1997). They appear below modified only as necessary to fit the research context.

<u>Innovation Usage</u>:

1. I use video teleconferencing a lot to do my work.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Somewhat	Neutral	Agree Somewhat	Agree	Agree Strongly

2. I use video teleconferencing whenever possible to do my work.
3. I use video teleconferencing frequently to do my work.
4. I use video teleconferencing whenever appropriate to do my work.

3.3.2 Individual Perceptions of Innovating: Tornatzky & Klein (1982, p. 28) termed the "relationship between the attributes or characteristics of an innovation and the adoption or implementation of that innovation" "one of the classic issues in the innovation literature." Scholars' preoccupation with innovation attributes may be traceable to Rogers' early claim that "from 49 to 87 percent of the variance in the rate of adoption is explained by five attributes" (Rogers, 1995, p. 206).

Adopter perceptions of IT innovation attributes have played a similarly dominant role in individual IT acceptance research. Perceptions of the instrumental benefits (e.g., perceived usefulness) and/or the effort required to learn and/or use (e.g., perceived ease of use) an IT have consistently emerged as most important determinants of individual IT acceptance behavior (Venkatesh et al., 2003).

In a meta-analysis of seventy-five studies of innovation characteristics, Tornatzky and Klein found only "three of the ten characteristics we reviewed in detail to be consistently related to adoption" (Tornatzky & Klein, 1982, 40). "Two of the characteristics, compatibility and relative advantage, were positively related to adoption" while "one other characteristic, complexity, was negatively related to adoption" (Tornatzky & Klein, 1982, p. 40).

The consistency and significance of findings in these two source research domains justify inclusion of individual perceptions of the relative advantage of innovating, the ease of innovating, and the compatibility of innovating in the research model. Each perception will be discussed in the following paragraphs. As will be evident in the measurement instruments presented, this research adopts the critical distinction between individual perceptions of an innovation and individual perceptions of innovating (Moore & Benbasat, 1990).

3.3.2.1 Perceived Relative Advantage of Innovating: "Relative advantage indicates the benefits and the costs resulting from adoption of an innovation" (Rogers, 1995, p. 216). Rogers found "relative advantage to be one of the best predictors of an innovation's rate of adoption." Tornatzky and Klein's (1982) meta-survey of innovation attribute research also revealed relative advantage to be one of only three innovation attributes consistently related to adoption.

Almost identical constructs have dominated IT acceptance research. Venkatesh and Davis noted that perceived usefulness a "has consistently been a strong determinant" and a "fundamental driver of usage intentions" (Venkatesh & Davis, 2000, p. 187). In their synthesis of IT acceptance research, Venkatesh et al. (2003) integrated items from five well-researched instrumentality constructs (relative advantage, job-fit, outcome expectations, extrinsic motivation, perceived usefulness) from the eight models studied into a "performance expectancy" construct ("the degree to which an individual believes that using a system will enable him or her to achieve gains in job performance" (Venkatesh et al., 2003, p. 447)). They found that for each model studied, performance/instrumentality constructs were the strongest predictors of intentions. These constructs remained significant throughout the longitudinal study, were unaffected by mandatory/non-mandatory usage settings, and reinforced previously consistent IT acceptance research findings. (Venkatesh et al., 2003)

The strength and consistency of findings in both research streams provide strong justification for including a construct which captures individual perceptions of the instrumental benefits of innovating. The reduced-item relative advantage construct of Moore and Benbasat (1991) was used due to its well-documented pedigree and application in previous research (e.g., Agarwal & Prasad, 1997). The instrument was designed to "measure user's perceptions of adopting an information technology (IT) innovation" in the "study of the initial adoption of IT by individuals in organizations, and the technology's diffusion within the organization" (Moore & Benbasat, 1991, p. 193). The instrument, with only cosmetic adjustments for the context of this research appears below. Respondent perception of the relative advantage of innovating is represented by the simple arithmetic mean of the scores for the five items in the construct.

Perceived Relative Advantage of Innovating:

1. Using video teleconferencing enables me to accomplish tasks more quickly.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Somewhat	Neutral	Agree Somewhat	Agree	Agree Strongly

2. Using video teleconferencing improves the quality of work I do.
3. Using video teleconferencing makes it easier to do my job.
4. Using video teleconferencing enhances my effectiveness on the job.
5. Using video teleconference gives me greater control over my work.

3.3.2.2 Perceived Ease of Innovating: Perceived ease of use (Davis, 1989) and similar constructs such as complexity (Rogers, 1962) have played an important, if somewhat ambiguous role in both innovation diffusion and individual IT acceptance research.

Rogers (1962, p. 130) defined complexity as "the degree to which an innovation is relatively difficult to understand and use." He noted that "although the research evidence is far from conclusive, the generalization is suggested that the complexity of an innovation, as perceived by members of a social system, affects its rate of adoption" and that "the complexity of farm innovations was more highly related (in a negative direction) to their rate of adoption than any other characteristic of the innovations except relative advantage" (Rogers, 1962, p. 130).

Tornatzky and Klein (1982) also found complexity one of only three innovation attributes consistently related (negatively) to adoption.

Observing some innovations impose inhibiting knowledge burdens on potential adopters, Attewell (1992) and Fichman (1992, 2000) advocate an alternative perspective regarding the effect of ease of use, or complexity on diffusion. A brief overview of their conceptualization of innovation diffusion and the roles of communications and complexity appears in Appendix N.

Constructs similar to complexity have also played an important role in IT acceptance research. Davis defined perceived ease of use, as "the degree to which a person believes that using a particular system would be free of effort" (Davis, 1989, p. 320). Some research suggests perceived ease of use is a component of perceived usefulness. However, Davis (1989) and Davis, et al. (1989) argued for a separate construct citing Bandura's concept of self-efficacy and factor analysis results.

Venkatesh (2000, p. 344) notes a "vast body of research in behavioral decision making and IS demonstrate that individuals attempt to minimize efforts in their behaviors, thus supporting a relationship between perceived ease of use and usage behavior" and that "other theoretical perspectives studying user acceptance have also employed similar constructs."

Venkatesh, et al. (2003) examined the effect over time of "effort expectancy" ("the degree of ease associated with the use of the system" (Venkatesh et al., 2003, p. 450)) (a construct synthesized from three similar constructs; perceived ease of use (Davis, 1989), complexity (Thompson et al., 1991), ease of innovating (Moore & Benbasat, 1991)). They found effort expectancy "significant in both voluntary and mandatory usage contexts"…"but only during the first time period….becoming non-significant over periods of extended and sustained usage" (Venkatesh et al., 2003, p. 450)); suggesting effort-oriented constructs are "more salient in the early stages of a new behavior, when process issues represent hurdles to be overcome, and later become overshadowed by instrumentality concerns" (Venkatesh et al., 2003, p. 450)

While the precise role of "effort expectancy" constructs in individual IT acceptance remains somewhat unclear, most research supports early findings of Davis, et al. (1989, p. 997) that perceived ease of use is a "significant secondary determinant" of intentions to use an IT.

Perceptions of the complexity of, and/or the effort required to use or to learn to use an innovation have played a salient in innovation diffusion and IT acceptance research. The strength of these findings justify including such a construct in the research model. The reduced-item perceived ease of innovating instrument developed by Moore and Benbasat (1991) is used. The measurement items appear below, with only cosmetic changes required to fit the research context. Scores for this construct were determined by computing the arithmetic mean of the responses to its three constituent items.

<u>Perceived Ease of Innovating:</u>

1. I believe that it is easy to get video teleconferencing to do what I want it to do.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Somewhat	Neutral	Agree Somewhat	Agree	Agree Strongly

2. Overall, I believe that video teleconferencing is easy to use.
3. Learning to operate/use video teleconferencing is easy for me.

3.3.2.3 Perceived Compatibility of Innovating: Rogers (1962, p. 126) defined compatibility as "the degree to which an innovation is consistent with existing values and past experiences of the adopters" and more recently as "the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters" (Rogers, 1995, p. 224).

Rogers found that "an idea that is not compatible with the cultural norms of a social system will not be adopted so rapidly as an idea that is compatible" (Rogers, 1962, p. 127)) and that an innovation must also be compatible "with previously adopted ideas" (Rogers, 1962, p. 127). Tornatzky and Klein found compatibility used to refer to both a potential adopter's values and/or practices and that it was "sometimes difficult to differentiate between the two" (Tornatzky & Klein, 1982, p. 33). Compatibility was the "most frequently cited characteristic that was studied or mentioned in forty (40) references" (Tornatzky & Klein, 1982, p. 33); perhaps because "the definition of compatibility is so broad" (Tornatzky & Klein, 1982, p. 33). Compatibility was one of only three innovation attributes they found consistently related (positively) to adoption.

Moore and Benbasat (1991) found compatibility revealed the greatest distinction between adopters and non-adopters; exceeding even relative advantage. They removed "needs" from Rogers' definition to avoid confounding with relative advantage (Moore & Benbasat, 1991).

Agarwal and Prasad (1997, p. 569) found "perceptions of compatibility, that is, the extent of behavior modification the use of the innovation necessitates on the part of potential adopters, appears to be the most important predictor of current usage, while relative advantage is the dominant predictor of future use intentions."

Fichman (2000) identified compatibility as an innovation-diffusion environment attribute positively related to organizational innovation implementation. Like Downs and Mohr (1976), Fichman (2000) views compatibility as a technology-organization factor; governed by the interaction of the innovation and the adopting organization.

Cooper and Zmud found compatibility one of the "key forces contributing to successful efforts to introduce technological innovations into organizations" (Cooper & Zmud, 1987, p. 233).

Previous research in primary research source domains, individual IT acceptance and innovation diffusion has consistently identified individual perceptions of the compatibility of innovating an important predictor of innovation acceptance/use behavior. They provide ample justification for including such a construct in the research model. The well known and highly regarded reduced-item instrument of Moore and Benbasat (1991) was chosen to measure this construct. Instrument items appear below with only cosmetic changes to fit the research context. The construct was scored by computing the arithmetic mean of the responses to the five items comprising the construct.

<u>Perceived Compatibility of Innovating:</u>

1. Using video teleconferencing is compatible with all aspects of my work.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Somewhat	Neutral	Agree Somewhat	Agree	Agree Strongly

2. I think that using video teleconferencing fits well with the way I like to work.
3. Using video teleconferencing fits into my work style.

3.3.3 Social Influences: It is "a central premise of current organizational theory" that individual "behavior occurs in a very social world that is far from neutral in its effects" (Fulk et al., 1990, p. 117). Agarwal (2000) asserts the influence of social factors on individual behavior in the organizational environment is established and well known. Behavioral models from social psychology including the theory of reasoned action

(Ajzen & Fishbein, 1975), the theory of planned behavior (Ajzen 1991), and social cognitive theory (Bandura, 1986) explicitly acknowledge the role of social influence and include constructs to capture its impact on individual behavior. Triandis (1971, p. 13) notes "a person's behavior intention, that is, what he would do toward an attitude object, is very closely related to norms of behavior, that is, what people think he should do."

Rogers (1962, 1995) stressed the role of social communication in the diffusion of new ideas, objects, and, or practices. Most research highlights the influence of interpersonal communications on adoption decisions. Karahanna, et al. (1999, p. 189) find "the subjective norm component is closely related to the communication network aspects of IDT [Innovation Diffusion Theory] which lie at the heart of the diffusion process." Their research showed that "for both users and potential adopters, work networks are important determinants of subjective norm" and that in the assessment of the subjective norm effect, "top management, peers, and one's supervisor were important referent groups" (Karahanna et al., 1999, p. 201)

Gatignon and Robertson (1985, p. 849) identify diffusion theory as a "theory of communications" with a "special focus" on "interpersonal communications" and note "personal influence is also a key factor accounting for the speed and shape of the diffusion process."

Most individual IT acceptance research is based on models from social psychology (e.g., TRA, TPB, SCT), or models such as TAM derived from them that emphasize the context-dependent role of social influences on individual behavior. Despite the strong presence of social influence factors/constructs in their foundational theories, neither research stream has emphasized their role in influencing focal behavior. Thus, Karahanna, et al. (1999, p. 189) concluded, "despite the importance of the communication network in innovation diffusion, most diffusion research has ignored the effects of social influence."

As Venkatesh and Davis (2000, p. 187) noted, "user acceptance research examining the direct effect of subjective norm on intention has yielded mixed results." Mathieson (1991) found no significant SN effect on intention to use. Taylor and Todd (1995) found a significant effect in research of voluntary student use of a computer resource center. Nevertheless, they observed that "studies in organizational settings have found subjective norm to be an important determinant of BI or self reported usage of IT" (Taylor & Todd, 1995, p. 150).

Venkatesh, et al. (2003) found a significant SN effect in mandatory use scenarios. However, the effect was moderated by gender, age, experience, and voluntariness such it was "stronger for women, older workers, under conditions of mandatory use, and with limited experience" (Venkatesh et al., 2003, p. 468). Agarwal (2000, p. 98) concludes "there is clearly a need for additional research that clarifies the precise role of social pressure in technology acceptance and isolates the contingencies under which such norms are likely to be more salient."

Hartwick and Barki's found "mandatory users"..."place greater weight on subjective norm; voluntary users weighted attitude more heavily" (1994, p. 459). Rationalizing their findings in the context of prior research that largely discounted subjective norm effects, they noted:

> "Neither Davis, et al. (1989), nor Mathieson (1991) found significant empirical support for the normative component in their studies. It is important, however, to look at the subjects and context of each study. Davis, et al. (1989) studied the use of a word processing package by MBA students. Mathieson (1991) looked at the use of a spreadsheet package by undergraduate students.

In neither case can normative influences be expected to be strong." (Hartwick & Barki, 1994, p. 460)

This observation follows directly from Fishbein and Ajzen who noted clearly the relative importance TRA, and TPB constructs would be context dependent: e.g., "The relative importance of attitude, subjective norm, and perceived behavioral control in the prediction of intention is expected to vary across behaviors and situations.....in some applications it may be found that only attitudes have a significant impact on intentions, in others that attitudes and perceived behavioral control are sufficient to account for intentions, and in still others that all three predictors make independent contributions" (Ajzen, 1991, p. 188-189).

IT acceptance research involving individual autonomous behavior, and/or a single-user IT is unlikely to find social factors significant. As Davis, et al. (1989, p. 998-999) noted:

"Lack of a significant SN-BI effect was surprising given previous IS research stressing the importance of top management support and user involvement. There are two reasons to interpret this finding narrowly. First, as pointed out in our discussion of TAM, compared to other measures recommended for TRA (Ajzen and Fishbein 1980), the SN scale is particularly weak from a psychometric standpoint. More sophisticated methods for assessing the specific types of social influence processes at work in a computer acceptance context are clearly needed. Second, the specific application studied, word processing is fairly personal and individual, and may be driven less by social influences compared to more multi-person applications such as electronic mail, project management or group decision support systems. Further research is needed to address the generalizability of our SN findings, to better understand the nature of social influences, and to investigate conditions and mechanisms governing the impact of social influences on usage behavior.

Lewis, et al. (2003) argue "individuals form beliefs about information technologies within a milieu of influences emanating from the institutional and social context in which they interact with information technologies" (Lewis et al., 2003, p. 658). Finding no significant effect of social influence, they observed:

"Although, at first, the finding of non-significance appears puzzling, there is a plausible explanation. As noted earlier, university faculty members have long been recognized for their autonomy and university environments have diminished roles for the traditional hierarchical structures and governance arrangements that characterize bureaucratic organizations. Indeed, independence and democracy are the two most salient defining characteristics of faculty work in an academic institution. It is not surprising, therefore, that messages emanating from the referent group of the academic dean and department chair were not significant in shaping individual beliefs about technology use." (Lewis, Agarwal, and Sambamurthy, 2003, p. 669-670)

Finding no evidence of peer social influence, the noted "the technology and task context examined" and that "the self-governance that characterizes academic life possibly tempers the influence exerted on faculty by the opinions of their professional peers as well as their departmental peers in regard to the use of technology" (Lewis et al., 2003, p. 671).

Karahanna, et al. (1999, p. 197) found "behavioral intention to adopt Windows is determined by normative considerations from the social environment" but intention to continue use is "determined by the user attitude and the degree of voluntariness."

Venkatesh and Davis (2000, p. 198) found evidence of social influence compliance effects noting; "subjective norm exerts a significant direct effect on usage intentions over and above perceived usefulness and perceived ease of use for mandatory (but not voluntary) systems." They also researched social influence internalization and identification effects, finding that "as individuals gained direct experience with a system over time, they relied less on social information in forming perceived usefulness and intention but continued to judge a system's usefulness on the basis of potential status benefits resulting from use" (Venkatesh & Davis, 2000, p. 199).

Noting compliance effects diminish over time, they urge "practical alternatives to usage mandates based on social information should be developed and tested, such as increasing the source credibility of social information to increase internalization or designing communication campaigns that raise the prestige associated with system use to increase identification" (Venkatesh & Davis, 2000, p. 199). Internalization effects "weaken over time, since greater direct experience will furnish concrete sensory information, supplanting reliance upon social cues" but identification effects do not "since status gains from system use will continue as long as group norms continue to favor use" (Venkatesh & Davis, 2000, p. 199).

This research examines social influence compliance, internalization, and identification effects. Compliance was assessed in terms of the subjective norm of the respondent's top management and/or immediate supervisor. Based on earlier research (e.g. Hartwick & Barki, 1994; Venkatesh & Davis, 2000), the compliance social influence effect of top management and/or supervisor subjective norms is expected to be moderated by voluntariness. Peer subjective norm is used as a measure of the internalization social influence effect. Peer subjective norm is not predicted to be moderated by voluntariness. SN measurement instruments were taken from Lewis, et al. (2003). Measurement instruments for both subjective norms appear below with only cosmetic changes to suit the research context. Subjective norm construct scores are determined using the expectancy value formulation. Subjective norm scores are computed by multiplying respondent scores for the two items comprising each construct.

3.3.3.1 Subjective Norms

Top Management Subjective Norm:

1. Top management of my organization thinks that using video teleconferencing is valuable for accomplishing our job.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Somewhat	Neutral	Agree Somewhat	Agree	Agree Strongly

2. The opinion of my organization top management is important to me.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Somewhat	Neutral	Agree Somewhat	Agree	Agree Strongly

Supervisor Subjective Norm:

1. My immediate supervisor thinks that using video teleconferencing is valuable for accomplishing our job.
2. The opinions of my immediate supervisor are important to me.

Peer Subjective Norm:

1. My peers think that using video teleconferencing is valuable for accomplishing our job.
2. The opinions of my peers are important to me.

3.3.3.2 Perceived Image of Innovating: Perceived image benefits of innovating ("the degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (Moore & Benbasat, 1991, 195)) is used in the research model to capture identification effects. This is an approach borrowed from Venkatesh and Davis (2000). The perceived image of innovating construct was introduced and developed by Moore and Benbasat (1991). They rationalized the construct based on Rogers' finding that "undoubtedly one of the most important motivations for almost any individual to adopt an innovation is the desire to gain social status" (Moore & Benbasat, 1991, p. 195). Their instrument, with only minor changes to fit the research context appears below. This construct was scored by computing the arithmetic mean of the responses to the four constituent items.

Perceived Image of Innovating:

1. Using video teleconferencing improves my image within the organization.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Somewhat	Neutral	Agree Somewhat	Agree	Agree Strongly

2. People in my organization who use video teleconferencing have more prestige than those who do not.
3. People in my organization who use video teleconferencing have a high profile.
4. Using the video teleconferencing is a status symbol in my organization.

3.3.4 Managerial Interventions: "Managerial interventions describe the actions taken and resources made available by managers to expedite secondary adoption, including mandating usage" (Gallivan, 2001, p. 61). Managerial interventions include a broad range of factors/initiatives such as mandating and/or encouraging usage, training, budgetary support, and/or hiring new employees or consultants or mentors experienced with the technology (Gallivan, 2001, p. 62). Fichman (1992, p. 4) asserts that "studies of individual adoption within organizational settings must either incorporate managerial influences into the analysis or rule them a potentially confounding factor." This study of individual IT innovation adoption in an organizational setting investigates three important managerial interventions: organizational commitment/support, facilitating conditions/resources, and voluntariness.

3.3.4.1 Organizational Commitment to Innovation: "One institutional factor that has received consistent attention in the literature as an important influence on technology adoption in organizations is managerial commitment and support" Agarwal (2000, p.

100). Management commitment and/or support of an innovation can be expressed in a variety of ways including provision of adequate resources, "by example" through personal use, and, or visible messages of encouragement and advocacy (Agarwal, 2000, p. 100).

"Executive support has been considered necessary to fully exploit the benefits of information technology (IT)" (Jarvenpaa & Ives, 1991, p. 205). Keen found "information systems development is an intensely political as well as technical process" (Keen, 1981, p. 24) and advised a "strategy for implementation must therefore recognize and deal with the politics of data and the likelihood, even legitimacy, of counter implementation" and be "spearheaded by a general, not coordinated by aides de camp" (Keen, 1981, p. 31).

"Research into the implementation of IS innovations considers management support as a critical factor in successful implementation" (Sharma & Yetton, 2003, p. 534); a finding confirmed by their research.

Premkumar and Potter (1995) found that compared with relative advantage, compatibility, complexity, cost-effectiveness, product champion, and IS expertise top management support was the second best predictor of innovation success, and concluded; "time and again, it has been observed in empirical studies on IS that top management support is critical for successful initiation of new ideas in organizations" (Premkumar and Potter, 1995, p. 117).

Zmud (1984, p. 729) found "the importance of an organization's 'power elite' to an innovation's successful implementation is generally accepted" because "innovation invariably requires the reallocation of (usually scarce) organizational resources" and "without the active support of management it is unlikely such allocations will occur or that necessary infrastructure (boundary spanning roles, risk-taking climate, etc.) will exist" (Zmud, 1984, p. 729).

Finding top management commitment/support positively affected user perceptions of World Wide Web technology usefulness and adoption, Lewis, et al. (2003, p. 661) concluded; "research has unequivocally established the importance of management support for technology use."

"The values of the elite inner circle are more important than those of the executive director or of the entire staff in predicting innovation" (Hage & Dewar, 1973, p. 287).

Research from several perspectives, including organizational change management, has found organizational/management commitment a consistently significant factor in innovation diffusion. Therefore, the research model includes a construct to capture this effect. It is measured using an instrument from Lewis, et al. (2003) who also re-verified its validity and reliability (Lewis et al., 2003, p. 665). The instrument appears below, with only cosmetic changes required to fit the context of this research.

<u>Organizational Commitment to Innovation:</u>

1. My organization is committed to a vision of using video teleconferencing.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Somewhat	Neutral	Agree Somewhat	Agree	Agree Strongly

2 My organization is committed to supporting my efforts to use video teleconferencing.
3. My organization strongly encourages the use of video teleconferencing.
4. My organization will recognize my efforts in using video teleconferencing.
5. The use of video teleconferencing is important to my organization.

3.3.4.2 Facilitating Conditions/Resources: The facilitating condition construct has also been interpreted and operationalized in diverse ways in both IT acceptance and innovation diffusion research (Gallivan, 2001). The perceived behavioral control (PBC) construct in the theory of planned behavior's (TPB) (Ajzen, 1991) provides a conceptual foundation for the facilitating conditions construct. PBC "refers to the perceived ease or difficulty of performing the behavior and it is assumed to reflect past experience as well as anticipated impediments and obstacles" (Ajzen, 1991, p. 188). Ajzen noted "it should be clear....behavioral intention can find an expression in behavior only if the behavior in question is under volitional control" and "to the extent that a person has the required opportunities and resources, and intends to perform the behavior he or she should succeed in doing so" (Ajzen, 1991, p. 183).

Ajzen's PBC embodied internal and external dimensions. Ajzen noted "much of our knowledge about the role of perceived behavioral control comes from....Bandura" (Ajzen, 1991, p. 184) and that PBC's internal dimension "is most compatible with Bandura's concept of perceived self-efficacy" (Ajzen, 1991, p. 184). PBC's external dimension encompasses "facilitating conditions (Triandis, 1979), which reflects the availability of resources needed to engage in a behavior, such as time, money, or other specialized resources" (Taylor & Todd, 1995a, p. 150).

Venkatesh, et al. (2003, p. 453) conceptualized facilitating conditions as "the degree to which an individual believes that an organizational and technical infrastructure exists to support use."

Thompson, et al. (1991, p. 129) described facilitating conditions as "objective factors out there in the environment that several judges or observers can agree make an act easy to do." Their research of personal computer (PC) use showed "provision of support for users of PCs may be one type of facilitating condition that can influence system utilization" (Thompson et al., 1991, p. 129). They noted their failure to find a positive relationship between the construct and PC usage is "inconsistent with most previous studies" (Thompson et al., 1991, p. 139) and likely attributable to their narrowly focused operationalization of the construct - which included only user support. They concluded that "other measures of facilitating conditions should have been used, such as ease of access to a PC" and that when operationalizing the construct, researchers "must take context into account" (Thompson et al., 1991, p. 139). Gallivan also warns of "inconsistent results" when researchers use "narrow, technically focused measures to operationalize facilitating conditions, while neglecting potential facilitators related to the organizational context or the individual" (Gallivan, 2001, p. 61).

Taylor and Todd (1995a) concluded "subjective norm and perceived behavioral control do contribute to the explanation of behavioral intention" (Taylor & Todd, 1995a, p. 167). Their decomposed TPB PBC construct embodied internal and external construct dimensions by including self-efficacy, resource facilitating conditions, and technology facilitating conditions. PBC was found to be a significant determinant of usage intentions and behavior in both TPB models (Taylor & Todd, 1995a).

Hartwick and Barki (1994) researched and compared the effects of user involvement ("a psychological state of the individual, and defined as the importance and personal relevance of a system to a user" (Hartwick & Barki, 1994, p. 440)) and user participation ("behaviors, assignments, and activities that users or their representatives perform during the ISD [information system development] process" (Hartwick & Barki, 1994, p. 441)). While their study was based on TRA they cited the critical importance of control implicit in TPB, commenting:

> "The greater the resources and opportunity that one has, and the fewer the impediments or obstacles that one faces, the greater one's perceived control. Thus, in IS, a number of individual difference (i.e., system knowledge and ability), task (i.e., task complexity, system ease of use), and situation (i.e., system availability and access) variables are apt to influence perceived behavioral control."..."individuals perform behaviors that they intend to, and are able to, perform" (Hartwick & Barki, 1994, p. 460)

In concluding they noted, "in the present study, perceived behavioral control was not measured"; "we view this as an important omission. The presence of such relationships needs to be investigated in future research." (Hartwick & Barki, 1994, p. 460)

A facilitating conditions construct was utilized to capture respondent PBC. The instrument item is from Venkatesh, et al. (2003) and represents a synthesis of constructs from the models studied in their comprehensive research. To reduce construct overlap, one item referring to IT innovation "compatibility" with "other systems that I use" was deleted. Venkatesh, et al. (2003) verified instrument reliability and validity. It appears below modified only to fit the research context.

Facilitating Conditions:

1. I have the resources necessary to use video teleconferencing.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Somewhat	Neutral	Agree Somewhat	Agree	Agree Strongly

2. I have the knowledge necessary to use video teleconferencing.
3. A specific person/group is available for assistance with video teleconferencing difficulties.

3.3.4.3 Voluntariness: Mandating system use is an intervention most researchers have found undesirable and not effective in the long run (e.g., Venkatesh & Davis, 2000; Agarwal & Prasad, 1997). However, regardless of formally stated organizational policies, individual perceptions of the voluntariness of adopting/using an innovation have been found to vary and to influence adoption/use behavior (e.g., Hartwick & Barki, 1994; Agarwal & Prasad, 1997). Moore & Benbasat (1991) conceived the voluntariness construct to acknowledge that individual perceptions of organizational pressure to innovate vary. Their research found voluntariness perceptions were not binary as expected, but distributed in a more normal-like distribution. Perceptions of the voluntariness of innovating are expected to be negatively related to innovation acceptance/use and to moderate the effect of top management/supervisor subjective norm on innovation adoption and acceptance. The voluntariness measurement instrument was taken from Moore and Benbasat (1991). It appears below with only cosmetic wording changes needed to fit the research context.

<u>Perceived Voluntariness of Innovating:</u>

1. My superiors expect me to use video teleconferencing.

1	2	3	4	5	6	7
Disagree Strongly	Disagree	Disagree Somewhat	Neutral	Agree Somewhat	Agree	Agree Strongly

2. My use of a video teleconferencing is voluntary (as opposed to being required by my superiors or job description).
3. My boss does not require me to use video teleconferencing.
4. Although it might be helpful, using video teleconferencing is certainly not compulsory in my job.

3.3.5 Organizational Environment: An organization's most salient feature is its structure (Zaltman et al., 1973). Organizational structure is typically represented by attributes such as: "(1) specialization, (2) standardization, (3) formalization, (4) centralization, (5) configuration, (6) flexibility" (Pugh et al., 1968, p. 66). Complexity (similar to specialization), centralization, and formalization are hypothesized to have the most effect on innovation (Zaltman et al., 1973). The effect of structural attributes on organizational innovation has been previously researched. However, virtually all this research studied the phenomenon of organizational adoption.

Formalization reflects "the extent to which rules, procedures, instructions, and communications are written" (Pugh et al., 1968, p. 75) and represents organizational efforts to structure employee's activities.

Rogers (1995, p. 380) defined formalization as "the degree to which an organization emphasizes following rules and procedures in the role performance of its members", and found "formalization acts to inhibit the consideration of innovations by organization members, but encourages the implementation of innovations" (Rogers, 1995, p. 380). Since the focus of this research is individual innovation adoption behavior, formalization is the most salient organizational structural characteristic.

Formalization is typically measured by "the proportion of codified jobs and the range of variation that is tolerated within the rules defining the jobs…the higher the proportion of codified jobs and the less the range of variation allowed the more formalized the organization" (Hall et al., 1967, p. 906). Aiken and Hage (1966) measure formalization in terms of job codification and rule observation. Job codification "reflects the degree to which job incumbents must consult rules in fulfilling professional responsibilities" (Aiken & Hage, 1966, p. 502). Rule observation "reflects the degree to which employees are observed for rule violations" (Aiken & Hage, 1966, p. 502).

Scholars (e.g., Rogers; Zaltman et al.) hypothesize that formalization exerts a phase-dependent effect on innovation; i.e. high formality inhibits initiation but facilitates implementation. They argue more formal conditions are "not likely to induce creative problem solving for those who are directed by formalized role prescriptions" (Pierce &

Delbecq, 1977, p. 31) but that "proposals are more likely to be adopted and implemented in systems where there are high degrees of formalization" (Pierce & Delbecq, 1977, p. 31). This "ambidextrous" theory is not well-researched. Neither Damanpour (1991), nor Grover and Goslar (1993) found support for the ambidextrous hypothesis. Summarizing their findings with regard to the effect of formalization on innovation, Kwon and Zmud found "many researchers in innovation have proposed or found negative association with initiation"..."also, consistently positive associations have been proposed or found with adoption"...."with adaptation"...."with usage"...."and with performance" (Kwon & Zmud, 1987, p. 236).

Downs and Mohr (1976) attribute mixed findings regarding organizational structural attribute effects to the fact that large firms are non-homogeneous and that different innovations involve decision making and support from different parts of the organization; a line of thinking supportive of the "dual core" theory of Daft (1978).

This research involves numerous small organizational units. They are hypothesized to be relatively homogenous internally with regard to organizational structure attributes such as formality. However, there are expected to be differences between the organizational units.

The formalization measurement instrument used in this research was developed and validated by Aiken and Hage (1966). It measures job codification (items one through five) and rule observation (items six and seven). This instrument's reliability and validity have been demonstrated in previous research (e.g., Michaels et al. 1988; Hage & Dewar 1973). The instrument appears below with only cosmetic changes needed to fit the research context.

Organizational Formalization:

1. I feel I am my own boss in most job-related matters.

1	2	3	4
Definitely False	More Often False Than True	More Often True Than False	Definitely True

2. A person can make his own decisions without checking with anybody else.
3. How things are done here is left up to the person doing the work.
4. People here are allowed to do their job almost as they please.
5. Most people here make their own rules on the job.
6. The employees are constantly being checked on for rule violations.
7. People here feel as though they are constantly watched, to see that they obey all the rules.

3.4 Data Collection

Research data were collected through a voluntary and anonymous survey posted on the host organization's intranet. The survey was easily accessible to personnel of all organizational units equipped with the IT innovation under study. Potential survey respondents could easily access the survey from their desktop computers. The survey was posted for a period of three weeks.

The research was well-supported by the leadership of the host organization. An e-mail encouraging/inviting survey response was promulgated to all innovation equipped organizational units. An e-mail describing the research and its purpose and encouraging survey completion was also sent to all organizational unit members. A hyperlink "shortcut" to the web-survey was embedded in the email inviting/encouraging survey participation.

Survey completion and data input and accumulation were entirely electronic. Upon accessing the survey from their office desktop computer workstations, respondents were requested to complete the rapid response survey items. The survey also included a limited number of demographic items, some contextual items, and provisions for discretionary respondent comments. Respondent survey inputs were recorded electronically in a data base that was available only to the researcher. There was no mechanism by which survey inputs could be tracked to individual respondents.

3.5 Data Analysis Procedures

Construct measurement instruments used in the study were all taken from previously published peer-reviewed research. Their reliability and validity have been demonstrated and are well-documented. Nevertheless, all research model construct except for the subjective norms were assessed for reliability and validity. Construct reliability was measured using the Cronbach Alpha. The generally accepted social science threshold value of .70 was used as a standard.

Construct validity was examined using factor analysis. Convergent and discriminant validity were assessed by grouping constructs and examining resulting intra/inter-construct item loading patterns. Individual constructs were also examined to assess the degree to which the variance/covariance of their constituent items was "explained" by their loadings on the latent factor of interest. Additional details of these assessments and their results are presented in chapter four. Reliability and validity of the subjective norm constructs could not be assessed due to their expectancy value structure.

Upon verification of acceptable construct measurement instrument reliability/validity, standard statistical procedures were employed to examine the degree to which hypothesized propositions/relationships were supported by the collected survey data.

Statistical procedures/methods employed included simple and multiple linear regression, mediation and moderation analysis, analysis of variance, and correlation analysis. Normalized data were used in all research hypothesis investigatory analyses performed. SAS for Windows Version 8e was used to perform all statistical analysis.

Table 3.2 summarizes the predicted relationships among research model predictor constructs and the criterion variable, individual IT innovation acceptance. The table also shows the planned methods of statistical investigation of the hypotheses.

3.6 Assumptions

The basic structure and methodology of the research embody several essentially implicit assumptions that should be acknowledged. These include:

- It is implicitly assumed all organizational units possess an equivalent IT innovation.
- It is implicitly assumed all survey respondents are participating voluntarily and that their survey inputs reflect their candid/objective individual perceptions.
- It is implicitly assumed that each organizational unit is essentially homogenous with regard to certain predictor factors (e.g., formalization, facilitating conditions).
- Organizational units are assumed to be faced with similar work task structures.
- All inputs are weighted equally in data analysis. This implicitly attributes equivalent accuracy/understanding/perceptions of organizational factors to individuals in different positions with varying organizational perspectives.

Hypothesis	Predictor(s)	Relationship With Innovation Acceptance	Statistical Method of Investigation
1	Individual Perceptions of Innovating Factors (Relative Advantage, Compatibility, Ease)	Significant IT Innovation Acceptance Explanatory Power	Multiple Regression
1.1	Perceived Relative Advantage of Innovating (PRAD)	1. Positive Relationship 2. Significant Explanatory Power	Simple Regression/ Correlation Analysis
1.2	Perceived Ease of Innovating (PEAS)	1. Positive Relationship 2. Significant Explanatory Power	Simple Regression/ Correlation Analysis
1.3	Perceived Compatibility of Innovating (PCOM)	1. Positive Relationship 2. Significant Explanatory Power	Simple Regression/ Correlation Analysis
2	Social Influence Factors (Top Management, Supervisor, Peer Subjective Norm, Image)	Significant IT Innovation Acceptance Explanatory Power Moderated per H2.1 and H2.2.	Multiple Regression/ Moderator Analysis
2.1	Top Management Subjective Norm (TMSN)[1]	Positive Correlation Moderated by Perceived Voluntariness[1]	Multiple Regression/ Moderator Analysis
2.2	Supervisor Subjective Norm (SUSN)[1]	Positive Correlation Moderated by Perceived Voluntariness[1]	Multiple Regression/ Moderator Analysis
2.3	Peer Subjective Norm (PRSN)	1. Positive Relationship 2. Significant Explanatory Power	Simple Regression/ Correlation Analysis
2.4	Perceived Image of Innovating (PIMG)	1. Positive Relationship 2. Significant Explanatory Power	Simple Regression/ Correlation Analysis
3	Managerial Intervention Factors (Organizational Commitment, Facilitating Conditions)	Significant IT Innovation Acceptance Explanatory Power	Multiple Regression
3.1	Organizational Commitment (COMT)	1. Positive Relationship 2. Significant Explanatory Power	Simple Regression/ Correlation Analysis
3.2	Facilitating Conditions (FACN)	1. Positive Relationship 2. Significant Explanatory Power	Simple Regression/ Correlation Analysis
3.3	Voluntariness (VOLN)	1. Moderate Top Management and Supervisor Subjective Norm 2. Negatively related to Innovation Usage 3. Significant Explanatory Power	Simple and Multiple Regression/ Moderator Analysis
4	Organizational Structure Factor (Formalization) (FORM)	1. Positive Relationship 2. Significant Explanatory Power	Simple Regression/ Correlation Analysis
5	All Predictor Category Integrated Model	Significant Explanatory Power	Multiple Regression Analysis

Note 1: The moderating effect of voluntariness on top management and supervisor subjective norm will be such that their effects will be greatest when perceptions of voluntariness are low.

Table 3.2

Research Hypotheses and Statistical Methods of Investigation

3.7 Threats to Validity

Research model construct measurement instruments used in this study were taken from previous scholarly research. All have been used in research appearing in peer-review journals and most have been researched quite heavily. Construct measurement instrument reliability and validity assessment performed following this study's data collection study provide additional evidence of construct validity. While these considerations provide a sense of assurance with regard to the reliability and validity of research model constructs, some (e.g., acceptance, subjective norm) are understood to present significant psychometric challenges. These could result in erroneous findings with regard to relationships among predictor and criterion constructs.

Survey respondents reported their individual perceptions of innovating and their innovation acceptance/use behavior. Thus, there is a potential concern with regard to common-method variance in the measurement of relationships involving individual perceptions of innovating and individual IT innovation acceptance/use.

3.8 Limitations

This research is subject to limitations which must be considered when interpreting, and/or attempting to generalize its findings. These include:

- The data collection supporting this research was cross-sectional. Caution must be exercised in reaching conclusions with regard to causal relationships between predictor and criterion variables.

- Because respondents were surveyed about their behavior and the perceptions that are theorized to influence that behavior. As noted above, there is legitimate concern regarding the appearance of common-method bias.
- As a consequence of the cross-sectional nature of the research, organizational units were observed at different stages of their innovation implementation process.
- Survey participation is voluntary. The sample was self-selected, and there is no assurance it represents a cross-section of the organization's employee population.
- This research focused on a single IT innovation. Scholars (e.g., Fichman, Downs & Mohr, Tornatzky & Fleischer) have cautioned with regard to generalizing innovation research findings across innovations. Individual acceptance/use behavior of other innovations (e.g., individual use) could be influenced by different factors/predictors.
- The context of this research was a very large government organization. It seems quite plausible individual behavior in such an environment might differ from the behavior of individuals working in a profit oriented commercial organizational environment.
- There is intense competition for employment in the organization studied in this research. As a result, the organization is highly selective in its hiring and is comprised of exceptionally well educated, highly professional, and highly motivated employees. This employee population is probably not representative of the employee population found in many organizations.
- It seems plausible the highly geographically dispersed nature of the host organization and the type of innovation studied could interact to affect the findings of this research. While many modern organizations are widely dispersed, some settings may not present

similar incentives to accept/use innovations that help mitigate organizational time and distance barriers to interaction.

- This field survey research utilized construct measurement instruments with Likert scales that provide ordinal data inputs. However, as in most social science research, these data are implicitly treated as ratio data in data analysis.

4.0 Data Analysis and Results

4.1 Introduction

The data analysis performed in support of the research is presented and discussed in this chapter. The chapter begins with an overview of the research data analysis process. A brief synopsis of the data collection effort follows. A demographic overview of the data collection sample population is then presented.

Research model construct measurement instrument reliability and validity analyses are then discussed. Results of the reliability and validity analyses are presented and discussed in the context of social science research psychometric standards. Top level descriptive statistics are then presented and discussed.

Finally, data analysis methods and procedures used to examine each hypothesis are presented. For each research hypothesis, the statistical method(s) of investigation and significant data analysis findings are presented and discussed. A summarization of research hypotheses findings is also presented. The chapter concludes with an overall summarization of data analysis findings.

4.1.1 Data Analysis Process

Figure 4.1 provides a top level depiction of the data analysis process used in this research. Data analysis begins with web-based survey data collection and proceeds through subsequent data handling, preparation, and statistical analysis procedures necessary to generate empirical evidence relevant to each of the research hypotheses.

Research data were collected by means of an electronic web survey posted on the host organization's intranet. The web survey application used to post the survey and collect data included an embedded capability to export survey response inputs to a formatted

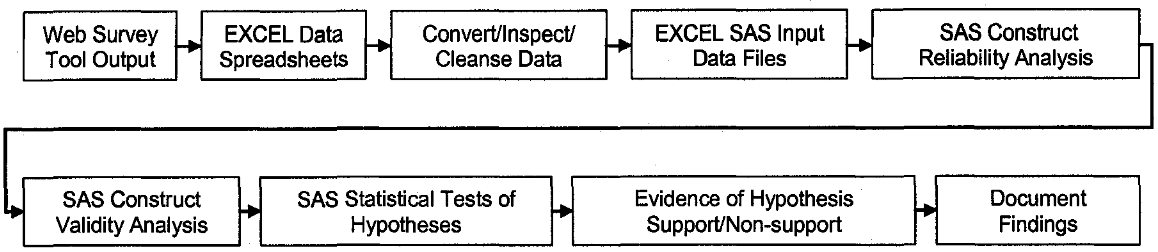


Figure 4.1
Data Analysis Process

Microsoft EXCEL spreadsheet. Survey input data contained in the EXCEL spreadsheet internet survey tool file was transferred manually to an EXCEL workbook created by the researcher. The EXCEL workbook was used to convert the data from text format (web survey tool output format) to numerical values required for statistical analysis, to facilitate inspection of survey responses for completeness, and to cleanse those responses containing missing items. Survey cleansing included removal of incomplete constructs in the case of missing survey items. The researcher-created EXCEL workbooks included computation of scores for each of the constructs appearing in the research model. When data cleansing and construct evaluations were completed, the raw item data and the construct score values were transferred manually to spreadsheets used for direct input to the appropriate SAS statistical procedures/methods.

4.2 Data Collection

The research survey instrument was comprised of constructs drawn from previous scholarly research published in peer reviewed journals (Instrument sources are cited in Section 3.2 of chapter three.). Following George Washington University Institutional Review Board survey approval, meetings were held with subject matter experts from the host organization to review and discuss the survey on an item-by-item basis. Following these meetings, the survey was posted on the host organization's intranet and a limited pilot study was performed. Selected members of the organization were requested to complete the survey and provide comments/recommendations concerning its content, structure, etc. Nine complete survey responses were received from organization personnel. No substantive survey item changes were recommended. Analysis of the survey response data revealed no significant inconsistencies and, or aberrations. A print out of the survey ultimately used in the data collection is included in Appendix O. Research construct measurement items appearing in the survey were as close to verbatim from the literature as possible. Changes to the construct items were strictly limited to cosmetic terminology adjustments necessary to fit the research context. All measurement instrument Likert scales were used verbatim.

The survey was subsequently posted on the organization's intranet and made accessible to potential respondents. In parallel, emails were sent to approximately nineteen-hundred (1,900) employees at one hundred and nine (109) innovation-equipped organization sites world-wide. These e-mails requested voluntary survey completion and were addressed to individuals at innovation-equipped organizational locations using addresses taken from the intranet "home page" of respective locations/sites. Survey participation e-mails were sent under the title of the organization's innovation program managers/implementation team.

The survey was accessible to organizational employees for just over three weeks. Two-hundred responses were received the first week. Thirty-four additional responses were received the second week. The survey was deactivated early in the fourth week when daily responses dropped significantly. Three survey inputs were submitted during the last seven days the survey was active and accessible to potential respondents.

Table 4.1 provides a summarization of survey distribution and response data. Two hundred sixty-five (265) survey responses were received. Five survey responses were too incomplete to be included in research hypothesis data analysis. Thirty-six survey responses indicated the respondent had no awareness of the target innovation. These inputs were excluded from the data analysis. Two hundred twenty-five (225) survey

Survey Sample Metrics	Number
E-mail Distribution Pattern	1904
Undeliverable/Out of Office/Off Intranet	250
E-mail Accessibility/Distribution	1654
Survey Responses Received	265
Net Response Rate	16.0%
Surveys too Incomplete to be Useful	5
Useful Surveys	260
Not Aware of VTC (Not Analyzed)[1]	36/14%
Aware of VTC[1]	229/86%
Surveys Included in Data Analysis	225
Note 1: Includes data from surveys (5) too incomplete to be useful in analysis.	

Table 4.1

Data Collection Summary Statistics

responses were sufficiently complete to be included in the data analysis. One hundred and ninety (190) surveys were complete in terms of research model construct items. Thirty-five (35) surveys exhibited some – mostly quite minor - degrees of incompleteness. As indicated above, surveys were visually inspected for missing items. All constructs with any missing constituent items were removed from the analysis. The effect of missing items on the research is considered minimal. At both the individual item and construct levels, survey responses were more than 98% complete. Missing survey items had the effect of slightly reducing sample size for some constructs. Table 4.2 presents item and construct level response completeness data. It can be seen only

Construct	Construct Items (Total Possible)	Total Construct Items Missing	Complete (Incomplete) Constructs
Intention to Use Innovation	3 (675)	1	224 (1)
Innovation Usage	4 (900)	0	225 (0)
Perceived Relative Advantage of Innovating	5 (1125)	7	222 (3)
Perceived Ease of Innovating	3 (675)	6	221 (4)
Perceived Compatibility of Innovating	3 (675)	8	220 (5)
Top Management Subjective Norm	2 (450)	4	223 (2)
Supervisor Subjective Norm	2 (450)	5	222 (3)
Peer Subjective Norm	2 (450)	8	220 (5)
Perceived Image of Innovating	4 (900)	11	220 (5)
Organizational Innovation Commitment	5 (1125)	14	219 (6)
Facilitating Conditions	3 (675)	7	222 (3)
Perceived Voluntariness of Innovating	3 (675)	11	222 (3)
Organizational Formalization	7 (1575)	43	211 (14)
Total/Summary	47 (10,575)	125 (1.2%)	2870 (55/1.9%)

Table 4.2

Survey Response Item/Construct Completeness

two research constructs had a sample size of less than 220; organizational commitment, (219) and organizational formalization (211).

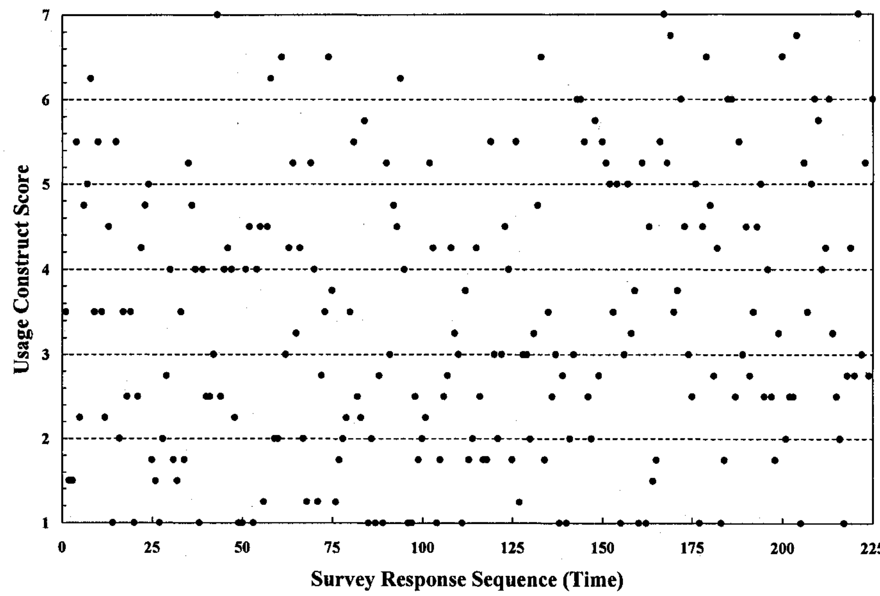


Figure 4.2
Usage Construct Score Scatter Plot

Survey responses were examined for evidence of bias on both an item-by-item and construct-by-construct basis. Figures 4.2 and 4.3 show scatter plot and frequency distribution of innovation acceptance/usage construct scores. There is no evidence of bias in the scores of a construct which would likely signal bias if it were present.

Figure 4.2 scatter plot shows that response scores are well-distributed across the seven Likert scale choices which are represented numerically on the vertical axis. The horizontal axis represents the sequential order of survey responses received over the duration of the data collection. There is no evidence of a time-related bias or trend among the response scores.

Figure 4.3 presents a frequency distribution depiction of innovation acceptance/usage construct responses in each response range of the seven-item Likert measurement scale. The distribution shows no evidence of systematic bias. Other research model construct scores were analyzed similarly. Item response distribution plots equivalent to Figures 4.2 and 4.3 were created for all research constructs and are presented in Appendix P.

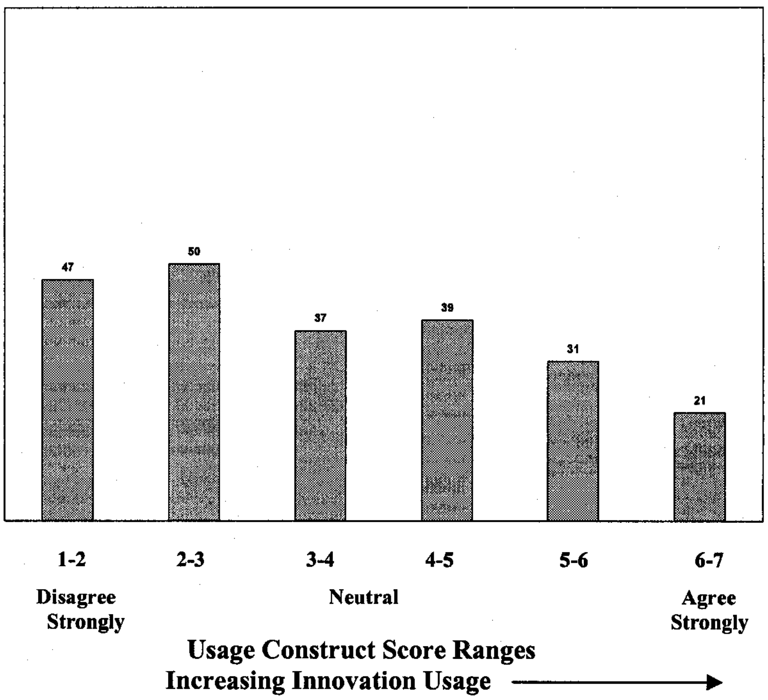


Figure 4.3

Usage Construct Score Frequency Distribution

Individual survey inputs were examined for evidence of bias and/or "straight lining" (i.e., response uniformity). No significant trends were observed although a handful of surveys exhibited a large number of identical responses. Most of these responses were on the low end (i.e., "Strongly Disagree") of the scale. None of these responses were excluded from the data analysis.

4.3 Sample Demographics

The survey included ten respondent demographic items; gender, age, educational achievement, organizational association, measures of organization, location, and professional experience, prior and current location VTC experience, and number of direct/indirect reporting employees. Respondent age, gender, and educational achievement demographics are summarized in Table 4.3.

Age	**Number/Percent (N=219)**
25 or Under	1/.5%
26-35	24/11%
36-45	71/32%
46-55	88/40%
56-65	34/16%
65+	1/.5%
Gender	**Number/Percent (N=202)**
Female	58/29%
Male	144/71%
Education Completed	**Number/Percent (N=220)**
Some High School	1/.5%
High School Degree	3/1%
Some College	27/12%
College Degree	57/26%
Some Graduate	31/14%
Graduate Degree	101/46%

Table 4.3
Sample Age, Gender, Education Demographics

These data indicate younger age brackets were not strongly represented in the sample, a majority of respondents were male, and that the sample population was highly educated. Results of non-hypothesis related analysis provided evidence that none of these demographics were substantially related to innovation acceptance/usage. Tables presenting similar summarizations of all ten survey demographic data are included in Appendix Q.

4.4 Construct Reliability and Validity Analysis

Constructs used in this research were measured through the use of survey instruments taken from previous scholarly research. There were no substantive changes made to these instruments, only wording adjustments necessary to fit the research setting (i.e., organizational and/or innovation). Instrument sources are cited in Section 3.2 of Chapter Three.

Use of established construct measures is conducive to knowledge accumulation and facilitates comparison of research findings over time and settings. For these reasons, the use of well known and established measures is deemed a noteworthy attribute of this research.

Despite their pedigree, research construct instruments were examined for evidence of reliability and validity. Accepted social science research methods and standards were used. Reliability and validity of the subjective norm constructs could not be analyzed due to their expectancy value structure. Unlike other research measures which are computed by averaging multiple items intended to measure the same construct, subjective norm scores are the product of a measure of the respondent's awareness of the opinions of salient others and an equivalently scaled measure of the importance they attach to that opinion. (Ajzen, 1991)

Reliability and validity analysis findings and results are presented and discussed in the following sections.

4.4.1 Construct Reliability Analysis

Cronbach's Alpha is a widely accepted and used measure of construct reliability in social science research. (Gefen, Straub, & Boudreau, 2000) Cronbach's Alpha was calculated for all compatible research model constructs using the SAS 8e PROC CORR (ALPHA) procedure. Results of the analysis appear in Table 4.4.

A Cronbach Alpha reliability score of .70 is considered evidence of acceptable construct reliability in social science research. (Gefen, Straub, & Boudreau, 2000) Scores appearing in the table confirm that all the research constructs exceeded the threshold reliability value. All constructs except for facilitating conditions scored comfortably above the recommended threshold.

Review of the facilitating condition construct provides insight into its somewhat lower reliability score. The three item construct inquires regarding respondent perceptions of the availability of the "resources" (item 41), "knowledge" (item 42), and/or "assistance" (individual or group) (item 43) needed to use the innovation. Thus, the construct essentially measures three different and potentially independent variables rather than a single latent variable. Other research constructs comprised of multiple items typically inquire with regard to a single common latent variable. Retrospectively, disparate responses, which result in a lower Cronbach Alpha score, seem quite plausible in the case of the facilitating conditions construct.

Construct	No. Items	Cronbach Alpha[1]
Intention to Use	3	.983/.984
Usage	4	.917/.918
Perceived Relative Advantage of Innovating	5	.966/.966
Perceived Ease of Innovating	3	.868/.869
Perceived Compatibility of Innovating	3	.894/.896
Perceived Image of Innovating	4	.882/.885
Organizational Commitment	5	.891/.890
Facilitating Conditions	3	.717.722
Voluntariness	3	.800/.799
Formalization	7	.840/.845
Note 1: Scores for both raw and standardized data are shown (Raw/Standardized).		

Table 4.4

Construct Reliability

One other aspect of Table 4.4 warrants special attention. The table contains two entries for the voluntariness construct. The original voluntariness construct included four items. One ("My superiors expect me to use VTC.") is a reverse coded item that exhibited markedly lower correlation with other construct items, thereby detracting from the reliability score. As will be discussed in the validity assessment, factor analysis also showed this item was measuring a different latent construct than the other three voluntariness construct items.

In addition, this item's loading on the factor measured by the other three voluntariness construct items was below the accepted item retention threshold. Analysis confirmed that removal of this item would result in a more reliable and more valid measure. Thus, it was removed from the data analysis. The reliability of the remaining three item construct (.800/.799) appears in the Table 4.4.

4.4.2 Construct Validity Analysis

Factor analysis is an accepted and widely used method of examining social science research construct validity (Gefen, Straub & Boudreau, 2003). Item loadings computed in factor analysis reflect the degree to which a common latent factor of interest (e.g., a construct such as a perceived characteristic of innovating) accounts for, or explains the variation in an observed variable and of the co-variation among multiple observed variables (e.g., survey items intended to measure a latent construct or factor). High loadings are indicative of a strong relationship between the latent factor and the observed items. When a variable (item) has a high factor loading, it "means that the variable is "measuring" that factor" (Hatcher, 1998, p. 89). Multiple items which load heavily on a single latent factor constitute a good measure of that factor.

There are no strict standards as to what constitutes an acceptably high factor loading. According to Gefen, Straub, & Boudreau (2000, p. 13), .40 is a "commonly cited … minimum" construct item loading that indicates acceptable evidence of construct validity. Hatcher (1998) also recommends a .40 factor loading threshold. Item factor loadings .40 and above, but less than .60 are occasionally referred to as "moderate". Loadings of .60 and above are considered "strong". Discriminant validity requires construct items load significantly on only one factor. Thus, items with loadings of .40 or above on more than one factor are undesirable.

Factor analysis was performed to confirm the convergent and discriminant validity of research model constructs and the degree to which their individual items loaded on a single latent factor. As indicated earlier, subjective norm construct validity could not be assessed due to their expectancy value structure which is not compatible with the validity assessment.

4.4.2.1 Construct Convergent/Discriminant Validity Analysis: Research construct convergent and discriminant validity were examined by separating the research constructs into two groups. Construct groups were intended to include similar, but different constructs, thereby enabling assessment of convergent/discriminant validity.

One group was comprised of constructs intended to measure individual perceptions of innovating (perceived relative advantage, perceived ease of use, perceived compatibility, and perceived image). The second group included constructs that measure organizational factors. These included managerial interventions (facilitating conditions, organizational commitment, and perceptions of voluntariness) and organizational formalization.

Construct group survey items were consolidated and examined using SAS 8e PROC FACTOR. Results of initial factor analyses of these two groups appear in Tables 4.5 and 4.6. The tables present the survey items grouped by the construct they are intended to measure. Factor loadings above the .40 threshold are underlined for ease of reference.

An item's loading on a given factor is an indicator of the degree to which it measures that factor. Higher loadings indicate that an item is a good measure of a factor. Low factor loadings indicate an item is not a good measure of a factor.

Convergent validity is indicated when all items intended to measure a construct have higher loadings on one factor. Discriminant validity is indicated when the items that load heavily on one common factor also exhibit low loadings on all other factors.

A desirable factor pattern is one in which all the survey items intended to measure a common latent variable or construct exhibit higher loadings (>/= .40) on a single factor and lower loadings (< .40) on other factors. Factor loading patterns with these characteristics provide evidence of construct convergent and discriminant validity.

Survey Item	Construct	Factor One Loading	Factor Two Loading	Factor Three Loading	Factor Four Loading
Q15	Perceived Relative Advantage	.88	.09	-.02	-.03
Q16		.97	-.04	-.05	.01
Q17		.96	-.05	.01	.02
Q18		.86	.02	.05	.04
Q19		.82	.09	.00	.03
Q20	Perceived Ease	.33	-.01	.62	-.01
Q21		.03	.04	.87	-.03
Q22		-.13	-.04	.84	.10
Q23	Perceived Compatibility	-.02	.09	.15	.66
Q24		.38	-.03	.01	.65
Q25		.28	-.02	-.01	.71
Q32	Perceived Image	.29	.47	.07	.11
Q33		.07	.82	.01	.06
Q34		-.14	.82	.05	-.10
Q35		-.48	.89	-.08	.05

Table 4.5

Perceived Characteristics of Innovating Item Factor Loadings

Tables 4.5 and 4.6 reveal that almost all survey items intended to measure research constructs exhibit a desirable factor loading pattern. As might be expected due to the use of known and established measures, items intended to measure a common construct exhibit higher loadings on a common factor and generally low loadings on other factors.

One important exception is voluntariness item forty-four which loads more heavily (.46) on the factor measured by organizational commitment construct items (items 36-40) than on factor three (.34) for which the other three voluntariness construct (items 45-47) exhibit high loadings. This factor loading pattern indicates item forty-four is not measuring the same latent construct as the other three voluntariness construct items and may be considered for removal. Hatcher (1998)

Survey Item	Construct	Factor One Loading	Factor Two Loading	Factor Three Loading	Factor Four Loading	Factor Five Loading
Q36	Organizational Commitment	.86	.04	.05	-.10	.03
Q37		.67	-.10	.05	.11	.01
Q38		.91	.05	.01	-.03	.01
Q39		.57	-.11	-.07	.15	.02
Q40		.92	.07	.01	-.05	-.01
Q41	Facilitating Conditions	.06	.03	.05	.71	-.05
Q42		.05	.01	-.11	.58	.10
Q43		.23	.03	.20	.60	-.03
Q44	Voluntariness	-.46	.04	.34	-.23	.04
Q45		.12	.02	.73	.12	-.06
Q46		-.11	.02	.79	-.11	-.03
Q47		-.05	-.08	.69	.04	.16
Q48	Formalization (Items 48-52 Job Structure/ Items 53-54 Rule Compliance)	-.07	.60	-.09	-.03	.06
Q49		.00	.74	-.04	.02	.10
Q50		-.05	.81	-.08	.00	.06
Q51		-.01	.87	.04	.06	-.04
Q52		.10	.71	.11	-.02	-.10
Q53		.02	.05	.07	-.03	.73
Q54		.04	.02	.00	.05	.80

Table 4.6

Management Intervention and Formalization Item Factor Loadings

Table 4.6 indicates (correctly) that organizational formalization items load on two distinct factors. Items 48-52 (relating to the degree to which organizational jobs are structured) load on factor two while items 53 and 54 (which focus on organizational rule enforcement) load on factor five. This loading pattern is not surprising given the structure of the formalization measure. Distinguishing the two dimensions of the formalization construct (job structure and rule enforcement) serves to highlight the effectiveness and the value of the procedure.

Survey Item	Construct	Factor One Loading	Factor Two Loading	Factor Three Loading	Factor Four Loading	Factor Five Loading
Q36	Organizational Commitment	.84	.04	.02	-.07	.03
Q37		.65	-.11	.03	.12	.01
Q38		.89	.04	-.01	-.02	.01
Q39		.56	-.11	-.10	.16	.02
Q40		.90	.06	-.01	-.03	-.01
Q41	Facilitating Conditions	.06	.02	.02	.71	-.06
Q42		.05	.00	-.13	.57	.10
Q43		.22	.03	.16	.60	-.03
Q44	Voluntariness	Deleted				
Q45		.11	.03	.72	.10	-.05
Q46		-.12	.03	.78	-.13	-.02
Q47		-.06	-.08	.69	.02	.16
Q48	Formalization (Items 48-52 Job Structure/ Items 53-54 Rule Compliance)	-.07	.60	-.08	-.03	.06
Q49		-.01	.73	-.04	.02	.10
Q50		-.05	.81	-.08	.00	.06
Q51		-.01	.87	.05	.05	-.04
Q52		.10	.71	.11	-.02	-.10
Q53		.01	.05	.08	-.04	.73
Q54		.03	.02	.00	.05	.80

Table 4.7

Revised Management Intervention and Formalization Item Factor Loadings

Factor loadings for the organizational environment constructs after removal of item forty-four appear in Table 4.7. Survey items intended to measure these constructs now exhibit a desirable loading pattern indicative of convergent/discriminant validity.

Factor loading patterns in Tables 4.5, 4.6, and 4.7 resulted from oblique (PROMAX) factor rotations which acknowledge the inter-construct correlations evident in the construct correlation matrix (Table 4.10).

4.4.2.2 Survey Item Loading and Communality Analysis: Research constructs were also subjected to individual factor analysis to assess construct item factor loadings and the degree to which construct item variance was explained by a single common factor. This analysis indicated moderate to high loadings for the individual construct items. Communality ("percent of variance in an observed variable that is accounted for by the retained components (or factors)" (Hatcher, 1998, 13)) estimates also confirmed that a common latent factor explained significant proportions of the observed variance for most items. This analysis provided additional evidence supporting elimination of survey item forty-four which exhibited the lowest individual item loading and communality scores of the forty-seven research construct items. Results of the comprehensive item-by-item analysis appear in tabular form in Appendix S.

4.4.3 Construct Reliability and Validity Analysis Summary

Research construct measurement instruments exhibited high Cronbach Alpha reliability scores. The reliability of all constructs exceeded the .70 social science research threshold. Facilitating conditions was the only construct with a Cronbach Alpha reliability score lower than .80. This is attributed to the structure of the three item construct which essentially measures three separate facilitating conditions.

Factor analysis of construct measurement instrument groupings generated solid evidence of convergent and discriminant validity. Factor analysis of individual constructs with a single retained factor also indicated acceptable levels of individual item factor loadings. This analysis also indicated that observed variance of survey items was sufficiently well explained by a single underlying latent factor.

Factor analysis results were consistent with construct correlation analysis which revealed significant inter-construct correlations. Correlations were most prevalent among the perceived characteristics of innovating. The perceived relative advantage, compatibility, and/or ease of innovating are not conceptually distinct. The presence of correlations among these linked constructs is not surprising. Among the organizational environment and management intervention factors, inter-factor correlations were low except in the case of the organizational commitment and facilitating conditions constructs. The presence/absence of conditions that facilitate innovation (i.e., resources, help desk(s), etc.) can be quite easily interpreted as representing evidence of strong/weak organizational commitment to innovating. Correlation between perceptions of organizational commitment to innovating and the presence of facilitating conditions is not surprising.

Overall results of the construct reliability and validity analyses provide confidence the conclusions of this research will be based on reliable and valid measurement of research model constructs.

4.5 Sample Descriptive Statistics

4.5.1 Construct Descriptive Statistics

Frequency distribution and scatter plots for all research model construct scores can be found in Appendix P. Sample size, mean, and standard deviation statistics for the research model constructs are shown in Table 4.8.

Most constructs were measured on the seven-item Likert scale depicted in Figure 4.3. The organizational formalization construct was measured using a four-item Likert scale as depicted in Figure 4.4. Due to their expectancy value structure, scores for the three subjective norm constructs are most easily understood and interpreted by reviewing the individual items that comprise them. Statistics for these six items appear in Table 4.9.

Construct	N	Mean	Standard Deviation
Innovation Usage	225	3.42	1.65
Perceived Relative Advantage of Innovating	222	3.91	1.68
Perceived Ease of Innovating	221	4.24	1.41
Perceived Compatibility of Innovating	220	3.86	1.45
Top Management Subjective Norm	223	15.15	5.88
Supervisor Subjective Norm	222	15.07	5.83
Peer Subjective Norm	220	13.09	5.55
Perceived Image of Innovating	220	3.28	1.34
Perceived Organizational Commitment to Innovating	219	4.51	1.25
Perceptions of Facilitating Conditions	222	5.03	1.33
Perceived Voluntariness of Innovating	222	5.41	1.24
Organizational Formalization	211	2.33	.536

Table 4.8

Construct Level Summary Statistics

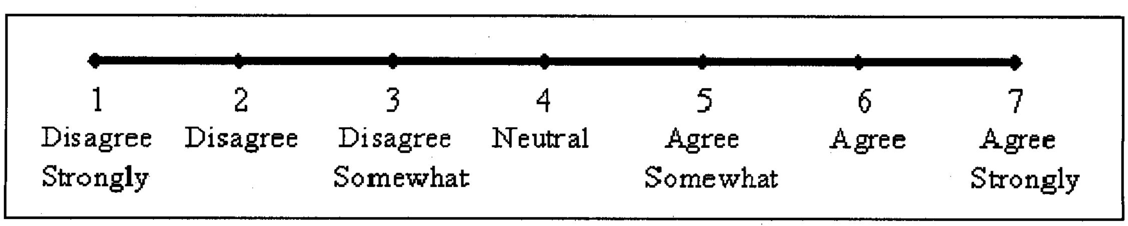


Figure 4.4

Seven Item Likert Scale (All Constructs Except Formalization)

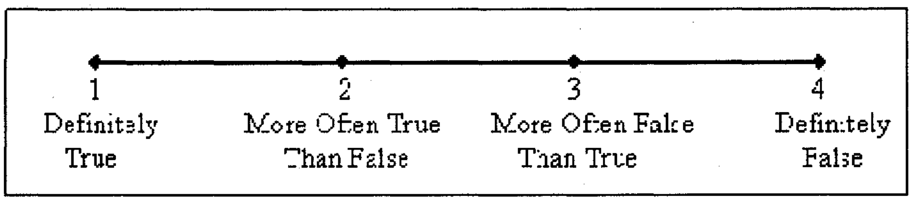


Figure 4.5

Four Item Organizational Formalization Likert Scale

Research hypotheses focus on the nature of the relationships among model constructs, not their relative/absolute values. However, construct descriptive statistics appearing in Tables 4.8 and 4.9 provide contextual insight that contributes to the interpretation and comprehension of the research findings.

Survey items were stated in such a way that a higher score reflects stronger agreement with a positive statement regarding the item's construct. Conversely, lower scores reflect disagreement with the positive statement about the construct. Thus, a high score on perceived relative advantage of innovating indicates a respondent's agreement with the proposition that there are instrumental advantages associated with innovating. A low organizational commitment score is indicative of disagreement on the part of the respondent that the organization is truly committed to the innovation. "Neutral" (i.e., 4) scores can be interpreted as reflecting neither agreement nor disagreement with the positive statement.

Among predictor constructs measured on the seven item Likert Scale (this includes all but the subjective norms and formalization), perceptions of voluntariness (μ = 5.41), facilitating conditions (μ = 5.03), organizational commitment (μ = 4.51), and ease (μ = 4.24) received a higher than "neutral" (μ = 4.0) mean score indicating some level of agreement with positive assertions regarding the construct.

Perceptions of the relative advantage of innovating, usually an important determinant of behavior in IT acceptance and diffusion innovation research scored slightly below neutral (μ = 3.91). Individual perceptions of compatibility, also typically a strong innovation predictor were also slightly below "neutral" (μ = 3.86). However, survey data indicate a stronger disagreement that individuals who innovate derive positive image effects (μ = 3.28).

Responses to subjective norm items (26, 28, 30) indicate individuals are somewhat aware of the fact that their organization's top management (μ = 4.92), their immediate supervisors (μ = 4.81), and their peers (μ = 4.52) consider innovation use to be valuable in job accomplishment. Subjective norm items (27, 29, 31) indicate survey respondents attach considerable importance to the opinions of top management (μ = 6.01), their immediate supervisors (μ = 6.15), and, to a lesser degree, their peers (μ = 5.67).

These construct scores support some general qualitative observations and conclusions. Survey respondents tended to agree innovation use is voluntary, that facilitating conditions (e.g., knowledge, resources, and assistance they need to use the innovation) conducive to innovating exist, and that their organizations are committed to the innovation. To a somewhat lesser extent they perceive that innovating is easy.

Respondents disagree slightly with the proposition that there is a relative advantage to innovating or that using the innovation is compatible with their work. They disagree more strongly with the proposition that individuals who use the innovation accrue image benefits.

Respondents indicate moderate agreement with the proposition that their peers and/or superiors consider innovation use valuable to the organization. However, they hold the

Subjective Norm Constructs/Items[1]	N	Mean	Standard Deviation
Top Management Subjective Norm	**223**	**15.15**	**5.88**
26. The top management of my post/location thinks using VTC is valuable for accomplishing our job.	223	4.92	1.56
27. The opinions of the top management of my post/location are important to me.	223	6.01	1.14
Supervisor Subjective Norm	**222**	**15.07**	**5.83**
28. My immediate supervisor thinks using VTC is valuable for accomplishing our job.	223	4.81	1.55
29. The opinions of my immediate supervisor are important to me.	222	6.15	1.01
Peer Subjective Norm	**221**	**13.09**	**5.55**
30. My peers think using VTC is valuable for accomplishing our job.	221	4.52	1.52
31. The opinions of my peers are important to me.	221	5.67	1.07
Note: 1. Subjective norm items (26-31) scored on seven item Likert Scale shown above in Figure 4.4.			

Table 4.9

Subjective Norm Survey Item Descriptive Statistics

opinions of their peers and superiors in high regard. Items referring to the importance of colleague's opinions received substantially higher levels of agreement than any other survey items.

Responses to the formalization survey items indicate respondents do not have strong feelings about the degree to which their job activities are structured or the extent to which rules are enforced in their organization. A complete table of item response data appears in Appendix R.

4.5.2 Construct Correlation Statistics

Research construct Pearson linear correlation coefficients were computed using SAS 8e PROC CORR. These correlations appear in Table 4.10. Statistically non-significant correlation coefficients appear in bold font and lightly shaded cells.

	USGE	PRAD	PEAS	PCOM	TMSN	SUSN	PRSN	PIMG	COMT	FACN	VOLN	FORM
USGE	1.00 225	.754 <.0001	.472 <.0001	.683 <.0001	.506 <.0001	.583 <.0001	.549 <.0001	.463 <.0001	.615 <.0001	.470 <.0001	-.264 <.0001	**-.072 .296**
PRAD		1.00 222	.502 <.0001	.740 <.0001	.580 <.0001	.588 <.0001	.630 <.0001	.542 <.0001	.616 <.0001	.459 <.0001	-.201 <.003	**-.011 .872**
PEAS			1.00 221	.568 <.0001	.448 <.0001	.320 <.0001	.411 <.0001	.401 <.0001	.558 <.0001	.631 <.0001	**-.091 .180**	**-.009 .903**
PCOM				1.00 220	.536 <.0001	.527 <.0001	.615 <.0001	.518 <.0001	.592 <.0001	.397 <.0001	-.199 <.003	**-.022 .753**
TMSN					1.00 223	.713 <.0001	.695 <.0001	.499 <.0001	.724 <.0001	.438 <.0001	**-.094 .163**	**-.044 .526**
SUSN						1.00 222	.720 <.0001	.369 <.0001	.610 <.0001	.397 <.0001	-.249 .0002	**-.043 .536**
PRSN							1.00 220	.469 <.0001	.683 <.0001	.430 <.0001	**-.121 .075**	**.001 .984**
PIMG								1.00 220	.588 <.0001	.252 <.0001	-.236 .0004	**.049/ .483**
COMT									1.00 219	.550 <.0001	-.173 .011	**-.084 .226**
FACN										1.00 222	**-.035 .604**	**-.069 .313**
VOLN											1.00 222	**-.042 .542**
FORM												1.00 211

Legend			
USGE	Usage	**PRSN**	Peer Subjective Norm
PRAD	Perceived Relative Advantage of Innovating	**PIMG**	Perceived Image of Innovating
PEAS	Perceived Ease of Innovating	**COMT**	Organizational Commitment to Innovation
PCOM	Perceived Compatibility of Innovating	**VOLN**	Perceived Voluntariness of Innovating
TMSN	Top Management Subjective Norm	**FORM**	Organizational Formalization
SUSN	Supervisor Subjective Norm		

Table 4.10

Construct Correlation Matrix

The correlation matrix reveals moderate to high statistically significant linear correlations among most research model constructs. Exceptions include organizational formalization (FORM) and perceived voluntariness of innovating (VOLN). Organizational formalization (FORM) exhibits no statistically significant correlation with any other construct. Perceived voluntariness exhibits statistically significant negative correlations with innovation usage, perceptions of the relative advantage, compatibility, and image of innovating, supervisor subjective norm, and organizational commitment to innovating.

Correlations between innovation usage (USGE) and individual perceptions of innovating (PRAD, PEAS, PCOM), social influence (TMSN, SUSN, PRSN, PIMG), and two managerial intervention constructs (COMT, FACN) are all positive, moderate to high, and very statistically significant. These findings indicate that each of these perceptions of innovating, social influences, and managerial interventions are significantly associated with innovation usage behavior.

Statistically significant negative correlation between individual perceptions of the voluntariness of innovating and innovation acceptance/usage indicates this desired behavior is positively affected when perceptions of voluntariness are reduced (i.e., a perception that innovation use is not entirely volitional). Negative statistically significant correlations with perceived relative advantage and perceived compatibility of innovating are indicative of a similar relationship with these key predictors.

Absence of a statistically significant relationship between formalization and innovation usage seems attributable to a rather heavy clustering of scores in the middle of the construct's four-item Likert scale. As mentioned above, this would suggest no strong feelings regarding the degree to which jobs are structure or rules enforced.

4.6 Research Hypothesis Analysis and Discussion

Research hypotheses are structured to address the four categories of predictors postulated to influence individual innovation usage; individual perceptions of innovating (perceived relative advantage, ease, and compatibility of innovating), social influences (top management subjective norm, immediate supervisor subjective norm, peer subjective norm, and perceived image of innovating), managerial interventions (organizational commitment, facilitating conditions, and voluntariness), and organizational structure (formalization).

The research hypotheses postulate that these predictors, both individually and collectively, will be significantly related to innovation adoption/usage behavior and will contribute to the explanation of significant portions of its variance.

4.6.1 Research Hypotheses

Hypothesis 1 – Perceived Characteristics of Innovating: Individually, and as a category group, perceived relative advantage of innovating, perceived ease of innovating, and perceived compatibility of innovating will be positively related to individual innovation usage and will contribute to the explanation of its variance.

Hypothesis 2 – Social Influences: Individually, and as a category group, the social influences of top management subjective norm, supervisor subjective norm, peer subjective norm, and perceived image of innovating will be positively related to individual innovation acceptance and will contribute to the explanation of its variance.

The relationships between top management and supervisor subjective norms and innovation are predicted to be moderated by perceptions of voluntariness. The moderation is expected to be such that when perceptions of voluntariness are low (i.e., individuals feel organizational pressure to innovate), the effect of top management and the supervisor subjective norms on innovation usage/acceptance will be greatest.

Hypothesis 3 – Managerial Interventions: Individually, and as a category group, managerial intervention factors of organizational commitment and facilitating conditions will be positively related to individual innovation acceptance and will contribute to the explanation of its variance. Voluntariness of innovating will be negatively related to innovation acceptance.

Hypothesis 4 – Organizational Formalization: Perceptions of organizational formalization will be positively related to individual innovation acceptance and will contribute to the explanation of its variance.

Hypothesis 5 – Innovation Usage Integrated Model: In an integrated model, perceived characteristics of innovating, social influence factors, managerial intervention factors, and organizational formalization will be positively related to individual innovation acceptance and contribute to the explanation of its variance.

In summary, the research hypotheses postulate that each predictor except perceptions of voluntariness will be positively related to individual innovation usage and will contribute to the explanation of its variance. The relationships between top management and supervisor subjective norms and innovation usage are hypothesized to be moderated by perceptions of the voluntariness of innovating. Perceived voluntariness of innovating is hypothesized to have a significant negative relationship with innovation acceptance.

It is also hypothesized that the predictors, when grouped within and across the four categories will be significantly related to individual innovation acceptance and will contribute to the explanation/prediction of its variance.

4.6.2 Hypothesis Data Analysis and Discussion

Data analysis conducted to investigate the research hypotheses was performed using SAS 8e for Windows (PROC CORR, PROC GLM and PROC REG procedures). Because survey construct measurement instruments drawn from the literature utilized different Likert measurement scales, regression analyses were performed using standardized data (zero mean, unit standard deviation). Data were standardized using SAS 8e PROC STANDARD. Use of standardized data also makes it possible to compare directly the relative influence of different predictors on innovation acceptance/usage. Except where otherwise noted, all regression results presented in subsequent sections are derived from regressions using standardized data.

4.6.2.1 Correlation Analysis: Correlation analysis was used to investigate hypothesized statistically significant bivariate relationships between the individual predictors and innovation usage. Pearson correlation coefficients and their statistical significance were calculated using SAS 8e PROC CORR. A statistically significant correlation of the predicted sign (i.e., +/-) was provided necessary and sufficient evidence of hypothesis confirmation. As with all hypothesis-related statistical tests in this study, statistical significance is indicated by a "p-value" of .05 or less, indicating a maximum five-percent random probability of the computed correlation coefficient if the variables were actually uncorrelated. Correlation analysis results appearing in Table 4.11 provide empirical evidence of hypothesized relationships with innovation acceptance/usage for all predictors except formalization.

Predictor	Criterion	Postulated Relationship	Linear Correlation Coefficient	Correlation Coefficient p-value	Statistically Significant?
Perceived Relative Advantage of Innovating	Innovation Usage	Positive	.754	<.0001	Yes
Perceived Ease of Innovating	Innovation Usage	Positive	.472	<.0001	Yes
Perceived Compatibility of Innovating	Innovation Usage	Positive	.683	<.0001	Yes
Peer Subjective Norm	Innovation Usage	Positive	.549	<.0001	Yes
Perceived Image of Innovating	Innovation Usage	Positive	.463	<.0001	Yes
Organizational Commitment	Innovation Usage	Positive	.615	<.0001	Yes
Facilitating Conditions	Innovation Usage	Positive	.470	<.0001	Yes
Voluntariness	Innovation Usage	Negative	-.265	<.0001	Yes
Organizational Formalization	Innovation Usage	Positive	-.072	.296	No

Table 4.11

Construct Correlation Analysis Results

4.6.2.2 Simple Regression Analysis: Simple linear regression analysis was used to investigate hypotheses of the bivariate explanatory value of individual predictors. Each predictor was individually regressed on innovation acceptance/usage. A statistically significant regression coefficient of determination (R^2) and a statistically significant predictor regression coefficient provide necessary and sufficient evidence of the hypothesized explanatory value of a predictor. Regression results appear in Table 4.12.

Criterion	Predictor	Predictor Coefficient/ p-value	Statistically Significant?	Regression R^2 (Adjusted R^2)/ p-value	Statistically Significant?
Innovation Usage	Perceived Relative Advantage of Innovating	.758<.0001	Yes	.568 (.566)/<.0001	Yes
	Perceived Ease of Innovating	.472<.0001	Yes	.223 (.220)/<.0001	Yes
	Perceived Compatibility of Innovating	.678<.0001	Yes	.466 (.464)/<.0001	Yes
	Peer Subjective Norm	.549<.0001	Yes	.301 (.298)/<.0001	Yes
	Perceived Image of Innovating	.463<.0001	Yes	.214 (.211)/<.0001	Yes
	Organizational Commitment	.615<.0001	Yes	.378 (.375)/<.0001	Yes
	Facilitating Conditions	.469<.0001	Yes	.221 (.217)/<.0001	Yes
	Voluntariness	-.265/<.0001	Yes	.07 (.066)/<.0001	Yes
	Organizational Formalization	-.073/.296	No	.005 (.001)/.296	No

Table 4.12
Simple Regression Results

All predictors except formalization demonstrated hypothesized statistically significant innovation acceptance/usage explanatory value. Perceptions of the relative advantage of innovating and of the compatibility of innovating exhibited the greatest innovation acceptance/usage explanatory value. As hypothesized, peer subjective norm is a statistically significant social influence predictor. All three managerial interventions demonstrate statistically significant usage behavior explanatory value. Within this category of predictors, perceived organizational commitment is the most powerful.

Perceived voluntariness of innovating exhibited a minor negative influence on innovation acceptance/usage. However, this construct provides little (~7%) explanatory value.

4.6.2.3 Multiple Regression Analysis: Hypotheses involving multiple predictors were examined using SAS 8e PROC GLM and PROC REG procedures. These analyses included; investigation of the hypothesized moderating effect of voluntariness perceptions on the relationships between innovation usage and top management and supervisor subjective norms, investigation of the multivariate explanatory value of each category of predictors, and identifying and testing of an integrated model comprised of statistically significant predictors from the four predictor categories. Confirmation/non-confirmation of these multivariate hypotheses is somewhat more complex. Each hypothesis will be addressed individually.

Moderation Analysis: It was hypothesized that a positive relationship between top management subjective norm and innovation acceptance/usage would be moderated by perceptions of the perceived voluntariness of innovating. The moderating effect was predicted to be such that the influence of top management subjective norm on innovation usage would be greatest when perceptions of voluntariness were low (i.e., social influence would be most influential when a respondent perceived an organizational mandate or pressure to accept/use the innovation).

To examine this hypothesis, top management subjective norm, voluntariness, and an interaction variable comprised of the product of these constructs were regressed on innovation acceptance/usage. A statistically significant regression coefficient of determination (R^2) and a statistically significant interaction term regression coefficient were required to confirm the hypothesis. Multiple regression results appear in Table 4.13.

Criterion	Predictors	Predictor Coefficient/ p-value	Statistically Significant?	Regression R^2 (Adjusted R^2)/ p-value	Statistically Significant?
Innovation Usage	Top Management Subjective Norm	.465/.051	No	.303 (.293)/<.0001	Yes
	Perceived Voluntariness of Innovating	-.233/.168	No		
	Top Management Subjective Norm **x** Perceived Voluntariness of Innovating	.024/.931	No		

Table 4.13

Top Management Subjective Norm/Voluntariness Moderation Analysis Results

The statistically significant coefficient of determination indicates the regression explains approximately 30% of innovation acceptance/usage variance. However, the statistically non-significant interaction variable (i.e., top management subjective norm **x** voluntariness) regression coefficient does not support a positive finding with regard to the hypothesized moderating relationship. Top management subjective norm regression coefficient is marginally statistically significant. The regression coefficient of perceived voluntariness is also statistically non-significant.

Perceived voluntariness of innovating was also hypothesized to moderate the relationship between supervisor subjective norm and innovation usage. The same methods and testing criteria were utilized to investigate this equivalent moderator hypothesis.

Multiple regression results appear in Table 4.14. The statistically significant coefficient of determination indicates the regression explains some 35% of innovation usage variance. However, the statistically non-significant interaction variable (i.e., supervisor subjective norm **x** voluntariness) regression coefficient does not support the

Criterion	Predictors	Predictor Coefficient/ p-value	Statistically Significant?	Regression R^2 (Adjusted R^2)/ p-value	Statistically Significant?
Innovation Usage	Supervisor Subjective Norm	.524/.025	Yes	.354 (.345)/<.0001	Yes
	Perceived Voluntariness of Innovating	-.149/.390	No		
	Supervisor Subjective Norm **x** Perceived Voluntariness of Innovating	.032/.898	No		

Table 4.14
Supervisor Subjective Norm/Voluntariness Moderation Analysis Results

hypothesis of a voluntariness moderated relationship between supervisor subjective norm and innovation acceptance/usage. Perceived voluntariness of innovating has a statistically non-significant negative regression coefficient. The regression coefficient of supervisor subjective norm is statistically significant and of moderate magnitude.

Research hypotheses predicting that individual perceptions of the voluntariness of innovating would moderate the relationships between top management and supervisory subjective norm and innovation usage behavior were not supported. A statistically significant interaction variable (i.e., variable that is the product of the two predictors) regression coefficient constitutes evidence of a moderated relationship between the two predictors. Neither of the subjective norm/voluntariness interaction variable regression coefficients was statistically significant. These findings indicate that the relationship between innovation acceptance/usage and the top management subjective and the supervisor subjective norms is not moderated – or qualitatively influenced – by individuals' perceptions of the voluntariness of innovating.

Within Predictor Category Multiple Regression Analysis: It was hypothesized that predictors within the four categories (i.e., perceived characteristics of innovating, social influences, managerial interventions, and organizational formalization) would contribute to the explanation of innovation usage variance in a multivariate model. It was also hypothesized that an integrated model composed of predictors from the various predictor categories would provide innovation usage explanatory/predictive value.

Multiple regression analyses were performed to investigate these hypotheses of the combined explanatory value of predictors within each category and the hypothesis of an integrated model composed of statistically significant predictors from each of the four factor categories. A discussion of the findings of each of these four analyses follows.

Perceived Characteristics of Innovating: Perceptions of the relative advantage of innovating, the ease of innovating, and the compatibility of innovating were regressed on innovation usage to examine the hypothesis concerning their combined explanatory value. Results of this regression appear in Table 4.15. These predictors provided a statistically significant coefficient of determination, explaining 62% of observed innovation usage variance. Perceived relative advantage and perceived compatibility standardized regression coefficients were statistically significant. Perceived ease of innovating did not provide hypothesized unique multivariate explanatory value.

Results of a regression of the two statistically significant perceived characteristics of innovating appear in Table 4.16. Perceived relative advantage of innovating exhibits twice the predictive power of perceived compatibility of innovating. Removal of

Criterion	Predictors	Predictor Coefficient/ p-value	Statistically Significant?	Regression R^2 (Adjusted R^2)/ p-value	Statistically Significant?
Innovation Usage	Perceived Relative Advantage of Innovating	.536/<.0001	Yes	.616 (.611)/<.0001	Yes
	Perceived Ease of Innovating	.038/.459	No		
	Perceived Compatibility of Innovating	.273/<.0001	Yes		

Table 4.15

Perceived Characteristics of Innovating Predictor Category Multiple Regression Results

Criterion	Predictors	Predictor Coefficient/ p-value	Statistically Significant?	Regression R^2 (Adjusted R^2)/ p-value	Statistically Significant?
Innovation Usage	Perceived Relative Advantage of Innovating	.558/<.0001	Yes	.609 (.605)/<.0001	Yes
	Perceived Compatibility of Innovating	.278/<.0001	Yes		

Table 4.16

Significant Perceived Characteristics of Innovating Category Predictors Multiple Regression Results

perceived ease of innovating from the regression results in a very small (<1%) coefficient of determination reduction. Constructs virtually identical to perceived ease of innovating have played an important role in both individual IT acceptance/usage research and in the broader domain of innovation diffusion research. The non-significant role of this predictor in this research is considered a noteworthy finding.

Social Influences: Four social influence predictors (top management, supervisor, and peer subjective norms, and perceived image of innovating) were regressed on innovation usage to examine the hypothesis concerning their combined explanatory value. Regression results appear in Table 4.17. Social influence predictors provide a statistically significant coefficient of determination, explaining almost 42% of observed innovation usage variance. Supervisor subjective norm and perceived image of innovating standardized regression coefficients are statistically significant. Standardized regression coefficients indicate supervisor subjective norm has more than one and a half times as much influence on innovation usage as individual perceptions of the image benefits of innovating.

Criterion	Predictors	Predictor Coefficient/ p-value	Statistically Significant?	Regression R^2 (Adjusted R^2)/ p-value	Statistically Significant?
Innovation Usage	Top Management Subjective Norm	.030/.728	No	.417 (.405)/<.0001	Yes
	Supervisor Subjective Norm	.367/<.0001	Yes		
	Peer Subjective Norm	.148/.076	No		
	Perceived Image of Innovating	.236/.0002	Yes		

Table 4.17
Social Influence Predictor Category Multiple Regression Results

Regression results provide partial support of the hypothesis concerning the combined explanatory value of social influences. Supervisor subjective norm and perceived image of innovating are significant multivariate predictors. Top management subjective norm and peer subjective norm are not statistically significant in this regression. This indicates they do not contribute significantly to the explanation of innovation acceptance/usage variance in this model.

Important results of the regression of the two significant social influence predictors on innovation usage appear in Table 4.18. Supervisor subjective norm and perceived image of innovating are both significant predictors, combining to explain almost 41% of observed innovation usage variance.

Criterion	**Predictors**	**Predictor Coefficient/ p-value**	**Statistically Significant?**	**Regression R^2 (Adjusted R^2)/ p-value**	**Statistically Significant?**
Innovation Usage	Supervisor Subjective Norm	.474/<.0001	Yes	.405 (.400)/<.0001	Yes
	Perceived Image of Innovating	.290/<.0001	Yes		

Table 4.18

Significant Social Influence Predictor Category Multiple Regression Results

Managerial Interventions: Managerial intervention predictors (organizational commitment to innovating, facilitating conditions, and perceptions of the voluntariness of innovating) were regressed on innovation usage to examine their hypothesized multivariate explanatory value. Regression results appear in Table 4.19. The regression was statistically significant, explaining almost 43% of observed innovation usage variance. All three predictor regression coefficients were statistically significant. Regression results support the hypothesis that managerial intervention predictors contribute uniquely to the explanation of innovation usage variance in this multivariate model. Comparison of the standardized regression coefficient comparison indicates that organizational commitment

Criterion	Predictors	Predictor Coefficient/ p-value	Statistically Significant?	Regression R^2 (Adjusted R^2)/ p-value	Statistically Significant?
Innovation Usage	Organizational Commitment	.468/<.0001	Yes	.427 (.419)/<.0001	Yes
	Facilitating Conditions	.211/.0008	Yes		
	Perceived Voluntariness	-.155/.004	Yes		

Table 4.19

Managerial Intervention Predictor Category Multiple Regression Results

was the most influential managerial intervention, followed in order by perceptions of facilitating conditions and perceptions of voluntariness. Voluntariness perceptions were negatively related indicating higher innovation acceptance/usage is associated with lower perceptions of the voluntariness of that behavior (i.e., a sense of organizational pressure/mandate to accept/use the innovation).

Integrated Model of Innovation Acceptance/Usage: The overarching goal of this research was to identify an integrated model of innovation acceptance/usage. Based on the literature review, the model was envisioned to include perceived characteristics of innovating, social influence, managerial intervention, and organizational environmental attribute predictors able to explain innovation usage in terms of a more diverse set of factors. Analyses and research hypotheses discussed thus far were intended to provide an empirical foundation for development of the desired model.

Hatcher (1994) recommends consideration of predictor/criterion bivariate relationships, standardized regression coefficient statistical significance and relative magnitude, and indices of uniqueness (measures of the additional explanatory value of a predictor added to a model) when identifying a preferred set of predictors.

Statistically significant bivariate regression results appear in Table 4.20. Perceived relative advantage, perceived compatibility, organizational commitment, and supervisor subjective norm emerge as the best bivariate predictors.

Criterion	Predictor	Predictor Coefficient/ p-value	Regression R^2 (Adjusted R^2)/ p-value
Innovation Usage	Perceived Relative Advantage of Innovating	.758<.0001	.568 (.566)/<.0001
	Perceived Compatibility of Innovating	.678<.0001	.466 (.464)/<.0001
	Organizational Commitment	.615<.0001	.378 (.375)/<.0001
	Supervisor Subjective Norm	.585/<.0001	.340 (.337)/<.0001
	Peer Subjective Norm	.549<.0001	.301 (.298)/<.0001
	Top Management Subjective Norm	.507/<.0001	.256 (.253)/<.0001
	Perceived Ease of Innovating	.472<.0001	.223 (.220)/<.0001
	Facilitating Conditions	.469<.0001	.221 (.217)/<.0001
	Perceived Image of Innovating	.463<.0001	.214 (.211)/<.0001
	Voluntariness	-.265/<.0001	.070 (.066)/<.0001

Table 4.20

Statistically Significant Bivariate Predictor Regression Results

At the next level of analysis, multiple regressions were performed within the predictor groups. Results from within-group multivariate analysis are shown in Table 4.21. Seven predictors were statistically significant at the within-group analysis level. Regressions incorporating only statistically significant predictors within each category produced parsimonious models with statistically significant coefficients of determination in excess of .40, indicating that they explained almost 41% or more of the observed variation in innovation usage/acceptance.

Predictor Category	**Criterion**	**Predictor**	**Predictor Coefficient/ p-value**	**Regression R^2 (Adjusted R^2)/ p-value**
Perceived Characteristics of Innovating	Innovation Usage	Perceived Relative Advantage of Innovating	.558/<.0001	.609 (.605)/<.0001
		Perceived Compatibility of Innovating	.278/<.0001	
Social Influences	Innovation Usage	Supervisor Subjective Norm	.474/<.0001	.405 (.400)/<.0001
		Perceived Image of Innovating	.290/<.0001	
Managerial Interventions	Innovation Usage	Organizational Commitment	.468/<.0001	.427 (.419)/<.0001
		Facilitating Conditions	.211/.0008	
		Perceived Voluntariness	-.155/.004	

Table 4.21
Statistically Significant Within-Category Predictors

A multiple regression of the ten research predictors exhibiting a significant bivariate relationship with innovation usage was performed. Regression results appear in Table 4.22. The statistically significant regression explained almost 68% of the observed variance in innovation usage. However, only four predictors (perceived relative advantage, perceived compatibility, supervisor subjective norm, and organizational commitment) made statistically significant contributions to the regression. Remaining predictor p-values were statistically non-significant.

Three predictors (top management and peer subjective norms, and facilitating conditions) were marginally statistically not significant (although negatively signed subjective norm regression coefficients seem problematic). Three remaining predictors (perceived ease of innovating, perceived image of innovating and perceived voluntariness of innovating) did not contribute significantly to the explanatory value of the model.

Criterion	**Predictor**	**Predictor Coefficient/ p-value**	**Regression R^2 (Adjusted R^2)/ p-value**
Innovation Usage	Perceived Relative Advantage	.444/<.0001	.676 (.659)/<.0001
	Perceived Ease	-.054/.373	
	Perceived Compatibility	.292<.0001	
	Top Management Subjective Norm	-.143/.057	
	Supervisor Subjective Norm	.198/005	
	Peer Subjective Norm	-.126/.073	
	Perceived Image	-.017/.768	
	Organizational Commitment	.220/.004	
	Facilitating Conditions	.103/.072	
	Voluntariness	-.052/.250	

Table 4.22

Statistically Significant Bivariate Predictor Integrated Model Multiple Regression Results

Bivariate and multivariate regression results were consistent in terms of predictor significance and explanatory power. At each level, perceived relative advantage, perceived compatibility, organizational commitment, and supervisor subjective norm were the most influential predictors of innovation usage. Based on these findings a regression including these four predictors was performed. Results of this regression analysis appear in Table 4.23.

The statistically significant regression model explained almost 65% of observed innovation usage variance and all four predictors were statistically significant. This model was compared with a list of optimum four-predictor regression models generated using SAS PROC REG MODEL RSQUARE option which can generate optimal regression subsets grouped by the number

Criterion	Predictor	Predictor Coefficient/ p-value	Regression R^2 (Adjusted R^2)/ p-value
Innovation Usage	Perceived Relative Advantage	.439/<.0001	.646 (.639)/<.0001
	Perceived Compatibility	.242/.0002	
	Organizational Commitment	.136<.021	
	Supervisor Subjective Norm	.111/.046	

Table 4.23

Candidate Integrated Innovation Acceptance/Usage Model Multiple Regression Results

of predictors included and explanatory power. Individual examination via regression of the optimum four-predictor models revealed none provided both superior innovation usage explanatory power and a statistically significant predictor set.

Each of the six predictors not included in this model was then examined in a systematic process of hierarchical regression. Each predictor was added to the model and tested for significant explanatory contribution and maintenance of statistically significant predictor regression coefficients. Results of this analysis appear below.

Table 4.24 indicates no predictor added as much as one percent to the explanatory/predictive value of the baseline model. Coefficient of determination (R^2) increase with the addition of top management subjective norm was statistically

Predictor	R^2 Increase	R^2 Increase F Statistic/ p-value	Comment
Perceived Ease of Innovating	.75%	.03/.873	Not Significant
Top Management Subjective Norm	.78%	4.59/.033	Significant Negative Coefficient
Peer Subjective Norm	.49%	3.79/.053	Not Significant
Perceived Image of Innovating	.21%	.32/.572	Not Significant
Facilitating Conditions	.6%	2.69/.103	Not Significant
Voluntariness	.3%	1.76/.186	Not Significant

Table 4.24
Hierarchical Regression Analysis Results

significant and its contribution to criterion explanation was the greatest in magnitude among the variables tested for inclusion to the four predictor model. However, the model resulting from addition of top management subjective norm produced a problematic finding in the form of a negative regression coefficient for the added predictor.

This finding would imply that as the importance an employee attaches to top management's positive feelings toward innovation acceptance/use increase, his/her innovation acceptance/usage behavior would decline. In addition to being somewhat counter intuitive, the existence of such a relationship would seem to conflict with some empirical findings of this research. Top management subjective norm construct scores were the highest among the three subjective norms measured. This indicates respondent awareness of top management's opinion that innovation acceptance/use is valuable to the organization and that respondents hold the opinions of top management in high regard.

A seemingly plausible explanation for this finding was suggested by the strong correlations (all greater than .60 in magnitude and of high statistical significance) observed among top management subjective norm, supervisor subjective norm, and organizational commitment. Regression analysis generated evidence the strong positive bivariate relationship observed between top management subjective norm and innovation acceptance/usage is actually enabled through perceptions of organizational commitment and supervisor subjective norm.

Organizational commitment and supervisor subjective norm were found to mediate the positive relationship between top management subjective norm and innovation acceptance/usage. Multiple regression of these three predictors (top management and supervisor subjective norms and organizational commitment) on innovation acceptance/usage provided convincing additional evidence that supports this explanation. In this three-predictor regression, when the effects of both organizational commitment and supervisor subjective norm were controlled statistically, top management subjective norm became non-significant statistically and, as in the regression discussed above, exhibited negative regression coefficient.

These findings suggest that individuals' innovation acceptance/usage behavior is directly and positively influenced by their individual perceptions of their organization's commitment to innovating and the influence of their supervisors. Regression analysis revealed that when the effects of these two predictors are removed, top management subjective norm retains no significant/unique explanatory value. Thus, although respondents have a high regard for the opinions of their top management, their commitment to the organization and the influence of supervisors appear to be the predictors that really explain innovation acceptance/usage behavior. Details of these analyses appear in Appendix T.

The SAS RSQUARE procedure was employed to examine all optimum five-predictor models. The procedure revealed two five-predictor models exhibiting greater explanatory power (i.e., larger R^2) than the model resulting from addition of top management subjective norm to the best four-predictor model. Independent regression analyses of these two optimum five-predictor models revealed that neither produced a model comprised of all statistically significant predictors.

Additional RSQUARE procedure/multiple regression analyses of all optimum models comprised of six or more predictors revealed none in which all included predictors were statistically significant.

4.7 Summary of Data Analysis Results

Correlation analysis supported research hypotheses of statistically significant relationships between all but one predictor and innovation acceptance/usage.

Correlation analysis also revealed generally high and statistically significant inter-construct correlations. High inter-construct correlations can reduce the statistical power of data analysis methods used to examine research hypotheses. (Hatcher, 1994)

Simple regression analysis confirmed hypothesized statistically significant bivariate explanatory/predictive values of all but one predictor.

Only formalization failed to exhibit a statistically significant relationship with innovation acceptance/usage or with any other research construct. Formalization construct scores were quite heavily clustered in the center of its four-item Likert measurement scale. Mid-scale clustering and resulting low construct score variance may have contributed to non-support of formalization related hypotheses.

Data analysis results did not support hypothesized voluntariness-moderated relationships between innovation acceptance/usage and top management subjective norm and innovation usage and supervisor subjective norm. Clustering of scores at the high end of the construct's seven-item Likert measurement scale (indicating strong perceptions of the voluntariness of innovation acceptance/use) and resulting low score variance may have contributed to the inability of the research to detect hypothesized moderating effects.

Investigation of hypothesized significant multivariate relationships for statistically significant predictor categories (perceived characteristics of innovating, social influences, managerial interventions) was partially successful. Each predictor category produced a model with at least two statistically significant predictors. Each of these models explained a substantial percentage of innovation acceptance/usage variance. All managerial intervention predictors (organizational commitment, facilitating conditions, and voluntariness) contributed significantly to the explanation of innovation usage variance.

Among the predictor groups, perceived characteristics of innovating provided the most innovation usage explanatory/predictive power. Managerial interventions and social influences exhibited comparable levels of explanatory/predictive power.

Bivariate and multivariate regression analyses provided a solid foundation for examination of the overarching research hypothesis of an integrated model of innovation usage. Hierarchical regression and other powerful SAS modeling/analysis tools were utilized to identify a candidate integrated model of innovation usage. This model includes statistically significant predictors from three categories and exhibits a statistically significant R^2 of .646 (.639). It appears in non-standardized regression equation form as Equation 4.1.

$$\text{Innovation Acceptance/Usage} = .432 \times \text{Perceived Relative Advantage} + .275 \times \text{Perceived Compatibility} + .179 \times \text{Organizational Commitment} + .032 \times \text{Supervisor Subjective Norm} - .615$$

Equation 4.1

Candidate Integrated Model of Innovation Acceptance/Usage

Table 4.25 provides a complete summary of research hypothesis support/non-support/partial support findings based on data analysis results.

Hypothesis	Finding	Comment
Perceived relative advantage of innovating positively related to/explains innovation usage variance.	S	Evidence of significant bivariate correlation and predictive value.
Perceived ease of innovating will be positively related to/explains innovation usage variance.	S	Evidence of significant bivariate correlation and predictive value.
Perceived compatibility of innovating positively related to/explains innovation usage variance.	S	Evidence of significant bivariate correlation and predictive value.
Perceived characteristics of innovating positively related to/explain innovation usage variance.	P	Perceived relative advantage and compatibility significant multivariate predictors. Perceived ease not.
Top management S/N positively related to/explains innovation usage variance. Moderated by voluntariness.	P	Moderating effects not found. Significant bivariate relationship and predictive value found.
Supervisor S/N positively related to/explains innovation usage variance. Moderated by voluntariness.	P	Moderating effects not found. Significant bivariate relationship and predictive value found.
Peer S/N positively related to/explains innovation usage variance.	S	Evidence of significant bivariate correlation and predictive value.
Perceived image of innovating positively related to/explains innovation usage variance.	S	Evidence of significant bivariate correlation and predictive value.
Social influences positively related to/explain innovation usage variance. Top management/supervisor S/N moderated by voluntariness.	P	Supervisor S/N, perceived image significant multivariate predictors. All social influences significant bivariate predictors.
Organizational commitment positively related to/explains innovation usage variance.	S	Evidence of significant bivariate correlation and predictive value.
Facilitating conditions will be positively related to and explain variation in innovation usage.	S	Evidence of significant bivariate correlation and predictive value.
Perceived voluntariness of innovating negatively related to/explains innovation usage variance.	S	Evidence of significant bivariate correlation and predictive value.
Managerial interventions positively related to/explain innovation usage variance.	S	All management intervention factors statistically significant multivariate predictors.
Organizational formalization positively related to/explains innovation usage variance.		Neither positive relationship nor predictive value found.
Integrated model with significant predictors from all categories explains substantial innovation usage variance.	P	Candidate integrated model with four significant predictors identified ($R^2 = .646$ (.639)).
Legend: S – Evidence Supported P – Evidence Partially Supported N – Evidence Not Supported		

Table 4.25

Summary of Research Hypothesis Findings

5.0 Research Conclusions, Limitations, and Implications

5.1 Introduction

This chapter presents and discusses the conclusions supported by the findings of the research. Limitations of these conclusions and their implications for future research and for managers/practitioners are also identified and discussed.

5.2 Discussion of Research Results

The overarching goal of this research was to develop a more inclusive model of individual information technology (IT) innovation acceptance in the organizational environment. The desired model was hypothesized to include, in addition to heavily researched perceived innovation attributes, other factors such as social influences known to exist in the organizational environment, managerial interventions that might influence innovation acceptance, and/or characteristics of the organizational environment that could affect diffusion of the innovation within the organization.

The literature review of relevant theory and previous research findings resulted in identification of a diverse set of candidate IT innovation acceptance/use predictors. Each predictor is well supported theoretically and/or empirically in the individual IT acceptance, diffusion of innovations, and/or organizational behavior literature. A model comprised of these predictors was postulated and served as a focus for this research. The research is motivated by the fundamental desire to expand our understanding of IT innovation acceptance/use by investigating factors other than already heavily studied innovation attributes/perceived characteristics of innovating that might be important determinants of individual innovation acceptance/use; thereby contributing to increased understanding of organizational innovation acceptance/use and diffusion.

This research utilized established construct measurement instruments published in peer-review journals. Empirical findings support the fundamental hypothesis of the research that individual acceptance/use of an innovation within an organization is positively related to a diverse set of contextual factors - as well as innovation attributes.

Data analysis presented in the preceding chapter showed clearly that a diverse set of factors and conditions were statistically significantly related to innovation acceptance/use behavior, and that these factors explained significant proportions of observed innovation acceptance/use behavior. Perceived characteristics of innovating, social influence, and managerial intervention predictors were found to be significantly related to - and meaningful predictors of - innovation acceptance/use. Only one predictor investigated in the research, organizational formalization, exhibited no significant relationship with innovation acceptance/use.

5.2.1 Perceived Characteristics of Innovating: As hypothesized in this study, and found in much previous IT acceptance and innovation diffusion research, individuals' perceptions of important characteristics of innovating were found to be significant innovation acceptance predictors. Individual perceptions of the relative advantage of innovating, the ease of innovating, and the compatibility of innovating were found to be significantly related to innovation usage and to be effective bivariate predictors of this behavior. The perceived relative advantage of innovating and the perceived compatibility of innovating (in that order) were found to be the best individual predictors of innovation acceptance/use.

Multiple regression analysis of a model comprised of the three perceived characteristics of innovating predictors revealed that perceived relative advantage and perceived compatibility remained statistically significant and valuable predictors of innovation acceptance/use when the contributions of all three were controlled for statistically. This analysis also revealed that perceived ease of innovating was not a statistically significant predictor of innovation acceptance/use when the effects of relative advantage and compatibility were controlled in the multiple regression. Individual perceptions of the ease of innovating, and conceptually similar constructs have played an important role in previous individual IT acceptance and in innovation diffusion research. Statistically non-significant findings regarding the influence of this construct are deemed a noteworthy result of this study that indicates a need for further research of the relationship among these important predictors.

In an effort to help illuminate the complex relationship among these three important perceived characteristics of innovating, the findings discussed above were investigated in further analysis. Mediation analyses conducted using the procedures and criteria of Baron and Kenny (1986) provided evidence suggesting that perceived relative advantage of innovating and perceived compatibility of innovating each play a mediating role in the relationships between perceived ease of innovating and innovation acceptance/use. This finding would seem to support the notion that rather than influencing innovation acceptance/use behavior directly, perceptions of the ease of innovating influence innovation acceptance/use behavior indirectly through individual perceptions of the relative advantage and/or the compatibility of innovating. Under these circumstances, it would be more accurate to view perceptions of the ease of innovating as an attribute or dimension of the perceived relative advantage and/or compatibility of innovating (i.e., his/her perceptions of the ease of innovating essentially contribute to, or help shape, an individual's perceptions of relative advantage and/or compatibility which have a direct effect on behavior). This is an intuitively reasonable idea that has been postulated in previous research and seems to be supported by the findings of this study.

In summary, individual perceptions of the relative advantage of innovating and of the compatibility of innovating demonstrated substantial unique explanatory value in all multiple regression analyses performed to identify integrated models of innovation usage. Perceptions of the ease of innovating appear to influence innovation acceptance/use indirectly through their influence on perceptions of relative advantage and/or compatibility. In this research setting, these perceptions of innovating were found to be important behavioral determinants.

5.2.2 Social Influences: While some hypotheses concerning the relationship between social influences and innovation acceptance/use were not supported, this research generated important, and, it is believed new, insight into the role of social influence predictors. As hypothesized, four social influence predictors (top management, supervisor, and peer subjective norm, and perceived image of innovating) exhibited statistically significant relationships with innovation acceptance/use. Of particular interest was the bivariate explanatory value exhibited by supervisor subjective norm and peer subjective norm. In simple regression, each of these social influence predictors individually explained more than thirty-percent of innovation acceptance/use variance. They were among most powerful bivariate predictors of innovation acceptance/use (ranking behind only relative advantage, compatibility, and organizational commitment).

Top management subjective norm and perceived image effect of innovating explained slightly less, but still noteworthy percentages of innovation acceptance/use behavior.

The nature of the relationships found between innovation acceptance/use and top management subjective norm and innovation acceptance/use and supervisor subjective norm were not as hypothesized. It was expected these relationships would be moderated by individual perceptions of the voluntariness of innovating. These hypotheses were examined using accepted multiple regression methods intended to detect predictor interaction effects. In each analysis, the interaction term regression coefficient was statistically non-significant, indicating no evidence of a moderating relationship. Additional regressions performed using centered data, recommended by Schwab (2005) to enhance the statistical power of moderator regression analysis testing, yielded qualitatively equivalent results.

While reported in the literature (e.g., Hartwick & Barki, 1994; Venkatesh & Davis, 2000) and supported theoretically, the inability of this research to uncover hypothesized moderating effects is congruent with other findings and known methodological limitations.

Mc Clelland and Judd (1993) point out that "despite frequently compelling theoretical reasons for expecting moderator effects and despite the widespread knowledge of how to identify such effects statistically, moderator effects are notoriously difficult to detect in non-experimental field studies" (Mc Clelland & Judd, 1993, p. 377). Contrasting non-experimental field studies with experimental research, in which moderator effects are routinely reported, Mc Clelland and Judd highlight measurement errors and "non-optimal distributions of X and Z [hypothesized interacting predictors]" (Mc Clelland & Judd, 1993, p. 386) as principal reasons why field researchers rarely detect moderator effects. They observe that "clustering of observations" and other factors which effectively reduce the variance or range of the predictor observations compound the difficulty of finding hard-to-detect moderator effects. The ability of experimentalists to control the range and variation of predictor samples provides a substantial moderator hypothesis testing power advantage when compared to non-experimental studies.

Construct-score frequency distribution plots for the relevant predictors (top management subjective norm, supervisor subjective norm, and voluntariness) (Appendix P, Figures P.10, P.12, and P.22 respectively) were examined to see if this might illuminate the non-supportive findings. Voluntariness construct scores were in fact quite heavily skewed – or clustered - to the right (i.e., higher construct scores ($\mu = 5.41$; $\sigma = 1.24$)). This observed pattern of predictor construct scores (i.e., clustering, limited variations) is consistent with the observations of Mc Clelland and Judd. The limited variance of voluntariness responses contributes to a plausible explanation of the failure to detect hypothesized and theoretically supported moderator effects in this research setting.

The hypothesized relationships involving innovation acceptance/use and the top management and supervisor subjective norms were not found. However, additional analyses were performed to clarify the nature of the relationships between these important constructs. Simple regression analysis revealed that both top management subjective norm and supervisory subjective norm were statistically significant bivariate predictors of innovation acceptance/use behavior.

While not formal hypotheses of this research, these findings are of interest and significance in view of the paucity of previous empirical findings of significant relationships between subjective norms and innovation usage behavior (e.g., Agarwal, 2000). Regression results appear in Table 5.1.

Criterion	Predictor	Predictor Coefficient/ p-value	Statistically Significant?	Regression R^2 (Adjusted R^2)/ p-value	Statistically Significant ?
Innovation Usage	Top Management Subjective Norm	.507<.0001	Yes	.256 (.253)/<.0001	Yes
	Supervisor Subjective Norm	.585<.0001	Yes	.340 (.337)/<.0001	Yes

Table 5.1

Top Management and Supervisor Subjective Norm Simple Regression Results

Multiple regression of the four social influence factors included in the research explained substantial innovation acceptance/use variance. Subsequent regression including only the two statistically significant predictors (supervisor subjective norm and perceived image of innovating) resulted in explanation of more than forty percent of the observed variance in innovation acceptance/use. This indicates compliance and identification, the two forms of social influence represented by these constructs, combined to explain a greater proportion of innovation acceptance/use than has been found in previous research.

Supervisor subjective norm proved to be the most robust and consistently statistically significant social influence predictor. However, empirical evidence that all four social influence predictors were significantly related to innovation acceptance/use behavior is deemed noteworthy. Most previous individual IT acceptance and innovation diffusion research has not uncovered these important linkages in spite of the central role of social influences in the social psychology behavioral theories that undergird these research streams.

5.2.3 Managerial Interventions: Managerial interventions are a category of theoretically influential factors that seem to have drawn relatively little attention in previous individual IT acceptance and innovation diffusion empirical research. The influence of three managerial interventions was examined in this research; individual perceptions of organizational commitment, the existence/availability of facilitating conditions, and the voluntariness of innovating. All three were found to be statistically significant related to, and predictors of innovation acceptance/use.

As hypothesized, the three managerial interventions were statistically significant bivariate predictors of innovation acceptance/use. Perceptions of organizational commitment and the existence of facilitating conditions were positively related to innovation acceptance/use. Perceptions of voluntariness were negatively related to acceptance/use behavior. Among all predictors researched, individual perceptions of organizational commitment to innovating were the third most valuable bivariate predictor of innovation acceptance/use.

Multiple regression analysis including the three managerial interventions revealed all to be statistically significant, denoting each predictor's unique contribution to the explanation of innovation acceptance/use. Collectively, the managerial interventions explained forty-two percent of innovation acceptance/use behavior.

This level of predictive/explanatory power is considered a noteworthy finding of this study. It compares respectably with the explanatory/predictive performance reported in much previous individual IT acceptance and/or innovation diffusion research, which has tended to focus almost exclusively on individual perceptions of innovation attributes. The effects of managerial intervention factors found in this research suggest this category of predictors may warrant increased research – and practitioner – attention.

5.2.4 Organizational Formalization: Hypotheses that organizational formalization would be positively related to innovation acceptance/use and contribute to its explanation were not supported. Formalization was the only predictor in the research that did not exhibit a statistically significant bivariate relationship with innovation acceptance/use. Formalization was also distinctive in that it exhibited no statistically significant relationship with any other construct studied in the research. Its inter-construct correlation coefficients were small in magnitude (all less than .10) and not statistically significant. Individual correlation and regression analyses performed using formalization's two sub-constructs (job structure and rule enforcement) produced similarly non-significant results.

The notion that high levels of organizational formalization ("the degree to which an organization emphasizes following rules in the role performance of its members" (Rogers, 1995, p. 380)) contribute to individual acceptance/use of innovations adopted by the organization enjoys substantial theoretical support in the literature (e.g., Rogers, 1995; Pierce & Delbecq, 1977; Zaltman et al., 1973). While intuitively appealing, there has been little empirical study of this effect – and less empirical confirmation. As in this research, Damanpour (1991) and Grover and Goslar (1993) failed to find support for this hypothesis.

The distribution of formalization construct scores (Appendix P, Figure P.24) exhibits a rather heavy concentration close to the middle of the four item Likert measurement scale. The mean formalization construct score was 2.33 with a standard deviation of .54.

Qualitatively, the concentration of scores in the middle of the scale indicate an absence of strong feelings among respondents about the degree to which their job activities are structured and/or the degree to which their organizations enforce workplace rules.

Statistically, the observed clustering of scores reduces the likelihood that the postulated relationship between formalization and innovation acceptance/use would be detected – or that it exists - in this sample.

A more varied distribution of formalization response scores was anticipated due to the collection of survey inputs from more than a hundred independent and geographically dispersed organizational locations. It was hypothesized these sites would differ more with regard to their individual levels of organizational formalization. However, the data suggests they are relatively similar in terms of exhibiting moderate levels of organizational formalization. As a consequence, the research does not contribute new insight into the effects of organizational environmental attributes on individual acceptance/use of innovations adopted by the organization.

5.2.5 Integrated Model of Individual Innovation Acceptance/Use: The research was designed to investigate a diverse set of factors theorized to influence individual innovation acceptance/use in the organizational environment. These included individual perceptions of the characteristics of innovating, social influences within the organization, management initiatives that might influence individual behavior, and characteristics of the organizational environment that might affect innovation diffusion.

In this research setting, three of the four categories of predictors were found to be significantly related to innovation acceptance/use and to provide substantial explanatory/predictive power. Formalization, the predictor theorized to capture salient effects of the organizational environment exhibited no significant relationship to innovation usage behavior.

The research was partially successful in its ultimate objective; development of an integrated model of innovation acceptance/use comprised of predictors from all four categories researched. However, it succeeded in generating more persuasive evidence than previous research of the importance of social influences and managerial interventions in the determination of innovation acceptance/use behavior.

Through a systematic process described in Chapter Four, a candidate integrated model of individual innovation acceptance/use was identified. The candidate model includes four statistically significant predictors and explains almost 64% of the observed variation in innovation acceptance/use behavior. The model includes two predictors from the perceived characteristics of innovating category, one managerial intervention, and one social influence. Each predictor in the candidate model is well supported in the literature and the model itself has strong direct linkages to foundational individual behavior models that underpin this research. These include the Theory of Reasoned Action, the Theory of Planned Behavior, and Social Cognitive Theory.

In terms of explanatory power, the model compares favorably with others that have appeared in the literature. The candidate integrated model of innovation acceptance/use is held to be very justifiable theoretically and empirically, and the best model for the data collected in this research. However, it is not purported to be "the" model of innovation acceptance/use generalizable to any organizational environment. As a host of distinguished scholars (e.g., Tornatzky and Fleischer (1990), Downs and Mohr (1976), and Fichman (2000) to mention only a few) have observed, innovation adoption decisions are situation dependent. This suggests that a somewhat different subset of the diverse but highly inter-related innovation acceptance/use predictors studied in this research could prove to be more salient in a different research setting.

A noteworthy finding of this research is that the set of diverse predictors studied – all theoretically and/or empirically supported – are inter-related in a network of significant and substantial correlations. Further examination of this study's research model in different organizational settings might help shed light on the nature of these inter-relationships and help reduce/eliminate predictor conceptual overlap(s). This would contribute valuably to our understanding of the important antecedents of innovation acceptance/use in the organizational setting.

The candidate integrated model appears below in non-standardized regression equation form.

$$\boxed{\begin{gathered}\textbf{Innovation Acceptance/Use} = .432 \times \textbf{Perceived Relative Advantage} \\ + .275 \times \textbf{Perceived Compatibility} + .179 \times \textbf{Organizational Commitment} + \\ .032 \times \textbf{Supervisor Subjective Norm} - .615\end{gathered}}$$

Equation 5.1

Candidate Integrated Innovation Acceptance/Use Model

Key indicators of the model's statistical significance and explanatory/predictive performance appear in Table 5.2.

Predictor	Predictor Coefficient p-value	Regression R^2 (Adjusted R^2)/ p-value
Perceived Relative Advantage	<.0001	.646 (.639)/<.0001
Perceived Compatibility	.0002	
Organizational Commitment	.021	
Supervisor Subjective Norm	.046	
Intercept	.019	

Table 5.2

Candidate Integrated Innovation Acceptance/Use Model

5.2.6 Summary of Research Results: The findings of the research support the fundamental proposition that a diverse set of factors can be important determinants of individual innovation adoption/use behavior in the organizational environment. These include the perceptions individuals form concerning key characteristics of innovating, social influences within the organizational unit, and discretionary management actions or interventions that may influence organizational diffusion of the innovation.

Empirical evidence generated in the research confirmed that these factors are not independent, but in fact quite highly correlated. Based on the high observed correlation among the predictors, and the fact that some approached statistical significance, it is postulated that in other settings different subsets of these theoretically and empirically supported factors may emerge as more powerful predictors of behavior. This proposition, while not demonstrated empirically in this research is fully consistent with Ajzen's

(1991) proposition that the predictive/explanatory power of the three constructs (subjective norm, attitude, perceived behavioral control) comprising his Theory of Planned Behavior would vary from setting to setting.

The research findings were consistent with those of much previous individual IT acceptance and diffusion of innovation research in reaffirming the role of key individual perceptions of the characteristics of innovating. Perceptions of the relative advantage and the compatibility of innovating were the most important predictors of individual innovation usage behavior. Though not specifically addressed as a formal hypothesis, the research also generated evidence that individual's perceptions of the ease of innovating exert an indirect rather than direct influence on innovation usage behavior.

The research uncovered what appear to be new and more significant empirical links between social influences and innovation acceptance/use than have been found in previous research. If corroborated in subsequent studies, these would establish a better linkage between empirical research findings and their underlying social psychology behavioral theories.

Failure of the research to detect hypothesized moderating effects of voluntariness perceptions on the relationships between innovation acceptance/use and top management subjective norm and supervisor subjective norm may be attributable to characteristics of the research setting. Clustering of voluntariness scores at the high end of the measurement scale resulted in low variance in construct scores. Mc Clelland and Judd (1993) identify such non-optimum predictor variation as a characteristic of field research that makes – usually quite modest - moderator effects even more difficult to detect. Therefore, it is believed this relationship warrants further research in a setting that provides increased variance in the perceptions of the voluntariness of innovating. A decentralized organization with multiple dispersed locations free to exercise more autonomy than the organization studied might provide such a setting.

Managerial interventions including organizational commitment to the innovation, provision of facilitating conditions, and efforts to influence perceptions of the voluntariness of innovation usage were found to have greater influence on innovation usage behavior than shown in previous research. To the extent that these findings are confirmed in future research, they should encourage practitioners to undertake such interventions whenever possible.

The hypothesis that a structural characteristic of the organization, or its environment would be a significant determinant of innovation usage was not supported. Formalization exhibited virtually no relationship with innovation usage behavior, or with any other construct studied in the research. There is reason to speculate this finding may be also be attributable to clustering of survey construct response scores which resulted in limited variation in the formalization construct. Since previous research (e.g., Damanpour, 1991; Grover & Goslar, 1993) also resulted in negative findings with regard to the influence of formalization, it may be that this construct does not play a significant role in innovation acceptance/use in the organizational environment.

With regard to its overarching objective, the research was partially successful. A candidate integrated model of individual innovation acceptance/use exhibiting substantial innovation behavioral predictive/explanatory power was identified. The proposed model is comprised of predictors well-supported theoretically and empirically and that also demonstrated the best mix of explanatory/predictive capability and statistical significance in this study. However, it seems quite possible that, among the diverse set of theoretically and empirically justified innovation acceptance/use predictors studied, other predictors/subsets may be more salient in other research settings. Such a premise is entirely consistent with the predictions of social psychologists such as Bandura and Ajzen who theorized that the relative influence of factors comprising their models of individual behavior (Social Cognitive Theory; Theory of Planned Behavior) would prove to be context dependent.

5.3 Research Limitations

Like all research, this study suffers from limitations which affect the generalizability of its findings and conclusions. The most significant limitations of the research are attributable to either its methodology or characteristics of the context in which it was conducted.

From the perspective of methodology, it is important to emphasize that no causal relationships can be inferred due to the cross-sectional nature of survey data collection process. Thus, it is impossible to assume temporal relationships among the factors studied. Longitudinal research is required to gain very important insights into how the relative influence of factors and the relationships among them evolve over time.

Another important methodological limitation that must be acknowledged is the nature of the sample. Survey response was voluntary and the entire population of potential respondents was not surveyed. Survey respondents were, in essence, self-selected research participants. Although examination of the data reveals no distinguishable bias or trend in terms of respondents' disposition toward the innovation, it is not possible to know precisely how truly representative the sample is of the total employee population of the adopting organization.

A third potential methodological limitation of the research relates to the conceptual clarity or distinctness of the factors studied and the ability of existing tools to measure them accurately. Measures used in this research were taken from scholarly sources of high quality and applied in virtually verbatim form. Use of these well-established and known measures was an important fundamental precept of this research. Nevertheless, the measures exhibited a notable pattern of moderate to high inter-construct correlation. Inter-construct correlations cloud and complicate data analysis. More importantly, highly correlated constructs adversely affect the clarity of the conclusions that can be drawn from the research. More accurate and meaningful insights into the influence of, and relationships among factors thought to affect behavior depend upon their being defined and measured with more accuracy and clarity.

A fundamental assertion or proposition of this research is that context or setting, and behavior are inextricably mutually inter-related. Consequently, potentially important characteristics of the setting of this research cannot be ignored when considering the generalizability of its findings.

The research was conducted in the context of a large government organization and it focused on a single innovation implemented in locations distributed world-wide. The research setting is accurately described as a modern organization, but it is not a commercial enterprise subject to the forces of business competition and the market place. However, the organization is comprised of highly professional, motivated, and well educated employees and pursues some of the most important and pressing knowledge work of our country.

The study of a single innovation in this research can be viewed from two diametrically opposed perspectives. It can be viewed as one of the study's strengths or, as one of its limiting factors. On the negative side, focusing on one innovation imposes limitations on the generalizability of the research findings. On the positive side, the study of a single innovation has the effect of controlling for technology and enhancing the comparability of survey results relevant to other contextual factors of interest.

The innovation studied, video teleconferencing, is not an individual, private use technology. It seems plausible to postulate that the somewhat social nature of the innovation and its use may have had the effect of increasing the salience of social influences and/or managerial interventions. It would be valuable to study the acceptance/use of an individual use – perhaps desktop – innovation in the same organizational context to see if the salient factors were different.

It was noted earlier the survey sample was disproportionately male, comprised of primarily older age group employees, highly educated, and generally more experienced. Previous research (e.g., Venkatesh, et al., 2003) has generated evidence that demographics such as age, gender, and experience can be important factors in innovation acceptance and usage. These effects were not studied explicitly in this research and may have affected the generalizability of its findings.

The research revealed very high regard among respondents for the opinions of their peers, supervisors, and top management. Given the existence of what appears to be exceptionally high "colleague regard", it seems plausible to infer that social influences might be more salient in this research setting than in others. This is perhaps especially true if the findings of this study were to be compared with those of research conducted in an educational environment.

It also seems plausible to infer that in the organizational setting of this research, employees' perceptions of the commitment of the organization to innovating might be a more influential determinant of behavior than in other organizations in which employees might not feel an equally high level of organizational allegiance.

5.4 Implications of the Research

5.4.1 Future Research: It is hoped the findings of this research, their inevitable limitations notwithstanding, will invoke increased interest in the empirical research of contextual factors that can and likely do affect individual acceptance/use of IT innovations in the organizational environment. The literature review provided ample theoretical support of the notion that individual behavior and the context in which it occurs are interactively and reciprocally determined. This research has generated persuasive empirical evidence that contextual factors are significantly related to innovation acceptance/use behavior.

Given the importance of context and the broad range of potentially important factors which define it, much more research situated in other organizational settings and focused on other IT innovation types is needed. It is hoped scholars will consider including richer and more diverse sets of theoretically/empirically supported constructs in their research of innovation acceptance/use. This may demand clearer statement of hypotheses and research frameworks to identify and confirm or reject contingent interactions among real world organizational setting attributes and the factors which influence individual innovation acceptance/use behavior therein.

Our understanding of the factors affecting this important behavior is determined in large measure by our ability to measure them accurately and precisely. This research has revealed what appear to be significant overlaps and/or intersections among important conceptual constructs. Additional research is needed to provide more precise definition and measurement of the factors theorized to influence innovation acceptance/use. Additionally, some constructs dominating current individual IT acceptance and innovation diffusion research are so broad conceptually that the information they provide is of problematic value. More precise construct definitions and measures should contribute to the unraveling of complex inter-construct relationships identified in this research and lead to more definitive and actionable research findings and conclusions.

5.4.2 Managerial/Practitioner: Individual IT acceptance and innovation diffusion research has focused almost exclusively on how an innovation's characteristics or attributes affect its acceptance/diffusion. This research generated empirical evidence that factors associated with the organizational context, not only innovation attributes or characteristics, were also significantly and substantially associated with innovation acceptance/use behavior. Managerial interventions and social influences exhibited statistically significant and substantial association with innovation acceptance/use behavior. These findings should be of both interest and utility to managers considering organizational IT innovation implementation. They suggest that in addition to the perceived characteristics or attributes of the candidate innovation, other factors within the organizational environment warrant consideration and manipulation/strengthening for the implementation of a highly desirable or potentially strategic IT innovation. Significantly, these situational factors are often within the control of managers, and/or influenced by them over time.

Although there was some apparent confounding among the social influence factors when analyzed collectively, each of the four factors in this category exhibited statistically significant and substantial bivariate association with innovation acceptance/use behavior. These findings suggest that social influences are related to innovation acceptance/use behavior of employees making secondary adoption decisions. Managers planning IT innovation implementation should consider deliberate efforts to enlist and nurture the positive support of the managers and/or supervisors of employees targeted for innovation usage. The findings also suggest that efforts to recognize in a positive way the behavior of innovation adopters and to nurture positive support for innovation acceptance/use within the peer group can contribute to successful diffusion within the organization.

In addition, although not explicitly studied in this research, social influences can affect individual perceptions of innovating that have important effects on individual attitudes and behavior (Fulk et al., 1990; Fulk, 1993; Fichman, 2000). This constitutes another potentially important mechanism through which social influences can very positively affect innovation acceptance/use behavior in an organizational setting.

Managerial interventions are actions taken by managers to enable or facilitate secondary innovation adoption, including the provision of resources and/or mandates to adopt (Gallivan, 2001). In this research, managerial interventions, both individually and as a group, were significantly and substantially associated with innovation acceptance/use behavior. These findings suggest that managers responsible for IT innovation implementation can design and undertake concrete supportive actions that can enhance the likelihood of successful IT innovation diffusion.

In this research, individual perceptions of organizational commitment to the innovation were the third most influential bivariate predictor of innovation acceptance/use behavior. Thus, managers should consider carefully initiatives designed to effectively convey to targeted employees the organization's commitment to the innovation and/or the importance to the organization of innovation acceptance/use.

Facilitating conditions is another managerial intervention factor that exhibited significant and substantial association with secondary innovation adoption behavior. This finding suggests that managers should also consider carefully the provision of resources designed to support innovation implementation. These might include user training and/or knowledge resources, provision of help desk services, and/or ensuring easy adequate access to innovation usage.

Organizationally mandated innovation use/adoption is not supported in the literature (e.g., Venkatesh & Davis, 2000; Agarwal & Prasad, 1997). Limited research of the effects of organizational innovation use/adoption mandates suggests their influence is temporary, declining over time as employees develop concrete individual perceptions of the innovation. Organizational adoption/use mandates may influence potential adopters to try an innovation, but research suggests that they are not likely to exert a significant long term influence on individual behavior. It has been hypothesized, however, that if an organization establishes conditions conducive to successful innovation diffusion, such a mandate might influence otherwise hesitant employees to try the innovation. This could contribute to successful innovation diffusion if employees react positively to their initial use experience.

In conclusion, the research provides empirical evidence that suggesting there is more to successful organizational IT innovation implementation than simply identifying an IT innovation perceived to possess a favorable mix of perceived attributes/characteristics.

Organizational IT innovation diffusion is built on a foundation of broad individual employee innovation acceptance/use. This study's findings suggest that situational factors within the organizational environment can be significantly and substantially associated with successful innovation diffusion because of their relationship with individual innovation acceptance/use behavior. These situational factors can be tangible (e.g., help desks, user training, and/or convenient/easy innovation use access) or intangible (e.g., social influences, expressions of organizational commitment). However, most can be controlled, and/or influenced over time, by management.

Although not studied explicitly in this research, it seems likely that situational factors could combine in a complementary way to enhance organizational innovation diffusion. For example, facilitating condition initiatives seem to complement, and/or to go hand in hand with managerial efforts designed to convey or demonstrate organizational commitment. Similarly, creation of positive top management and/or supervisory subjective norm effects would tend to reinforce managerial interventions designed to convey organizational commitment and the provision of facilitating conditions conducive to innovation acceptance/use.

The findings of this research suggest that organizations desiring to reap the potential benefits of modern IT innovations must not focus exclusively on the technology. To create conditions for successful IT innovation implementation, managers must consider carefully, and attempt to influence favorably, important contextual factors shown to be positively related to employee innovation acceptance/use behavior.

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Appendix A

Organizational Innovation Process

(Rogers, 1995)

Stage	Sub-Stage	Sub-Stage Description
Initiation	Agenda Setting	"The agenda-setting stage in the innovation process in organizations amounts both to identifying and prioritizing needs and problems on one hand, and to searching the organization's environment to locate innovations of potential usefulness to meet the organization's problems." (Rogers, 1995, p. 391)
	Matching	"The stage in the innovation process at which a problem from the organization's agenda is fit with an innovation"...."at this second stage in the innovation process, the problem is conceptually matched with the innovation to establish how well they fit." (Rogers, 1995, p. 394)
Implementation	Redefining/ Restructuring	"The innovation imported from outside the organization gradually begins to lose its foreign character. Redefining/restructuring occur when the innovation is re-invented to accommodate the organization's needs and structure more closely, and when the organization's structure is modified to fit with the innovation." (Rogers, 1995, p. 394)
	Clarifying	"The innovation is put into more widespread use in an organization, so that the meaning of the new idea gradually becomes clearer to the organization's members." (Rogers, 1995, p. 399)
	Routinizing	"Routinization occurs when the innovation has become incorporated into the regular activities of the organization, and the innovation loses its separate identity. At that point, the innovation process in an organization is complete. Organizational members no longer think of the innovation as a new idea. It has been completely absorbed into the organization's ongoing activities." (Rogers, 1995, p. 399)

Appendix B

Organizational Innovation

Implementation Sub-stage Processes and Products

(Cooper & Zmud, 1990, p.124)

Organizational Innovation Process Stage	Stage Process	Stage Product
Initiation	Active and/or passive scanning of organizational problems/opportunities and solutions are undertaken. Pressure to change evolves from either organizational need (pull), technological innovation (push), or both.	A match is found between an IT solution and its application in the organization.
Adoption	Rational and political negotiations ensue to get organizational backing for implementation of the IT application.	A decision is reached to invest resources necessary to accommodate the implementation effort.
Adaptation	The IT application is developed, installed, and maintained. Organizational procedures are revised and developed. Organizational members are trained both in new procedures and the IT application.	The IT application is available for use in the organization.
Acceptance	Organization members are induced to commit to IT application usage.	The IT application is employed in organizational work.
Routinization	Usage of the IT application is encouraged as normal activity.	Organization's governance systems are adjusted to account for the IT application; the IT application is no longer perceived as something out of the ordinary.
Infusion	Increased organizational effectiveness is obtained through use of the IT application in a more comprehensive and integrated manner to support higher level aspects of organizational work	The IT application is used within the organization to its fullest potential.

Appendix C

Characteristics of Mechanistic and Organic Organizations

(Zaltman et al., 1973, p. 131)

Mechanistic Organization	Organic Organization
Tasks are broken into very specialized abstract units	Tasks are broken down into subunits, but relation to total task of organization is much more clear
Tasks remain rigidly defined	There is adjustment and continued redefinition of tasks thro ugh interaction of organizational members
Specific definition of responsibility that is attached to individual's functional role only	Broader acceptance of responsibility and commitment to organization that goes beyond individual's functional role
Strict hierarchy of control and authority	Less hierarchy of control and authority sanctions derive more from presumed community of interest
Formal leader assumed to be omniscient in knowledge concerning all matters	Formal leader not assumed to be omniscient in knowledge concerning all matters
Communication is mainly vertical between superiors and subordinates	Communication is lateral between people of different ranks and resembles consultation rather than command
Content of communication is instructions and decisions issued by superiors	Content of communication is information and advice
Loyalty and obedience to organization and superiors is highly valued	Commitment to tasks and progress and expansion of the firm is highly valued
Importance and prestige attached to identification with organization itself	Importance and prestige attached to affiliations and expertise in larger environment

Appendix D

Organizational Structural Attribute Effects on Innovation

(Zaltman et al., 1973)

Organizational Structural Characteristic	Innovation Process Stage		Rationale
	Initiation[1]	Implementation[1]	
Complexity	Positive	Negative	"At the initiation stage, highly diverse organizations apparently are able to bring a variety of bases of information and knowledge to bear that can increase the awareness and knowledge of innovations and general proposals for innovation." (Zaltman et al., 1973, p. 137) "At the implementation stage high complexity, because of potential conflicts, makes it more difficult for the organization to actually implement the innovation." (Zaltman et al., 1973, p. 137)
Formalization	Negative	Positive	"During the initiation stage the organization needs to be as flexible and as open as possible to new sources of information and alternative courses of action." (Zaltman et al., 1973, p. 139) "During the implementation stage...singleness of purpose is required." (Zaltman et al., 1973, p. 140)
Centralization	Negative	Positive	In initiation, "less emphasis on hierarchy of authority and more participation in decision making is likely to Increase the information available and thus facilitate the awareness of innovations". (Zaltman et al., 1973, p. 146) "At the implementation stage it may be that more strict channels of authority can reduce potential conflict and ambiguity that could impair implementation." (Zaltman et al., 1973, p. 146)
Note 1: "Positive" effects contribute to achievement of innovation phase objectives. "Negative" effects make achieving innovation phase objectives more difficult.			

Appendix E

Factors Affecting Innovation/Change Resistance

(Zaltman et al., 1973, p. 102-103)

Category	Change/Innovation Resistance Mitigation Principle
Who brings the change/innovation?	Resistance will be less if the persons involved, teachers, board members, and community leaders, feel that the project is their own - not one devised and operated by outsiders.
	Resistance will be less if the project clearly has wholehearted support from top officials of the system.
What kind of change/innovation?	Resistance will be less if participants see the change as reducing rather than increasing their present burdens.
	Resistance will be less if the project accords with values and ideals that have long been acknowledged by participants.
	Resistance will be less if the program offers the kind of new experience that interests participants.
	Resistance will be less if participants feel that their autonomy and their security are not threatened.
Procedures in instituting change/innovation	Resistance will be less if participants have joined in diagnostic efforts leading them to agree on the basic problem and to feel its importance
	Resistance will be less if the project is adopted by consensual group decision.
	Resistance will be reduced if proponents are able to empathize with opponents, to recognize valid objections, and to take steps to relieve unnecessary fears.
	Resistance will be reduced if it is recognized that innovations are likely to be misunderstood and misinterpreted, and if provision is made for feedback of perceptions of the project and for further clarification as needed.
	Resistance will be reduced if participants experience acceptance, support trust, and confidence in their relations with one another.
	Resistance will be reduced if the project is kept open to revision and reconsideration if experience indicates that changes would be desirable.
Organizational climate for change/innovation	Readiness for change gradually becomes a characteristic of certain individuals, groups, organizations, and civilizations. They no longer look nostalgically at a golden age in the past but anticipate their utopia in days to come. The spontaneity of youth is cherished and innovations are protected until they have had a chance to establish their worth. The ideal is more and more seen as possible.

Appendix F

Organizational Variables Theorized to Affect Innovation, Their Predicted Effect, and Research Findings (Damanpour, 1991, p. 558-559, p. 588-590)

Organizational Attribute (Predicted Effect on Innovation/ Confirmed in this Research?)	Definition	Predicted Innovation Effect Rationale
Administrative Intensity (Positive/Yes)	"Also referred to as administrative ratio, this variable is an indicator of administrative overhead (Blau & Schoenherr, 1971) It is measured by the ratio of managers to total employees in an organization."	"A higher proportion of managers facilitates innovation because the successful adoption of innovations depends largely on the leadership, support, and coordination managers provide (Daft & Becker, 1978; Damanpour, 1987)".
Slack Resources (Positive/Yes)	"Reflects the resources an organization has beyond what it minimally requires to maintain operations. A financial measure of slack is typically used such as change in an organization's budget and sources of finance (Aiken & Hage, 1971) or changes in expenditures for the organization's main activity" (Daft & Becker, 1978) "Miller and Friesen's (1982) measure includes both financial and human resource slack."	"Slack resources allow an organization to afford to purchase innovations, absorb failure, bear explore new ideas in advance of an actual explore new ideas in advance of an actual need. (Rosner, 1968)"
External Communication (Positive/Yes)	"Represents an organization's ability to be in contact with and scan its task environment. It is typically measured by the degree of organization members' involvement and participation in extra-organizational professional activities involving various elements of the task environment. Studies analyzed here included variables that reflect the external professional activities of organization members rather than those of executives alone. Such as activities of teachers rather than of principals (Corwin, 1975), and "organizational cosmopolitanism" rather than administrative cosmopolitanism (Kaluzny et al., 1974)".	"Environmental scanning and extra-organizational professional activities of members can bring innovative ideas (Jervis, 1975; Miller & Friesen, 1982). Innovative organizations exchange information with their environments effectively (Tushman, 1975)."

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Organizational Variables Theorized to Affect Innovation, Their Predicted Effect, and Research Findings (Damanpour, 1991, p. 558-559, p. 588-590)

Organizational Attribute (Predicted Effect on Innovation/ Confirmed in this Research?)	Definition	Predicted Innovation Effect Rationale
Internal Communication (Positive/Yes)	"Reflects the extent of communication among organizational units or groups. It is measured by various integration mechanisms, such as the number of committees in an organization and the frequency of committee meetings (Aiken & Hage, 1971), the number of contacts (face-to-face and others) among people at the same and different levels (Aiken et al., 1980), and the degree to which units share decisions (Hull & Hage, 1982)."	"Facilitates dispersion of ideas within an organization and increases their amount and diversity, which results in cross-fertilization of ideas (Aiken & Hage, 1971). Also creates an internal environment favorable to the survival of new ideas (Ross, 1974)."
Vertical Differentiation (Negative/No)	"Represents the number of levels in an organization's hierarchy. It is measured by the number of levels below the chief executive level."	"Hierarchical levels increase links in communication channels, making communication between levels more difficult and inhibiting the flow of innovative ideas (Hull & Hage, 1982)."
Specialization (Positive/Yes)	"Represents different specialties found in an organization. Some studies have used other names to portray this variable, such as "complexity" {Hage & Aiken, 1967} and "role specialization" (Aiken et al., 1980); it is typically measured by the number of different occupational types or job titles in an organization."	"A greater variety of specialists would provide a broader knowledge base (Kimberly & Evanisko, 1981) and increase the cross-fertilization of ideas (Aiken & Hage, 1971)."
Functional Differentiation (Positive/Yes)	"Represents the extent to which an organization is divided into different units. Authors have also used names such as "horizontal differentiation" (Aiken et al., 1980), "structural differentiation" (Blau & McKinley, 1979), and "departrnentation" (Young et at, 1982). The name notwithstanding, this variable is normally measured by the total number of units under the top management (chief executive) level."	"Coalitions of professionals form in differentiated units (Baldridge & Burnham, 1975) that both elaborate on and introduce changes in the units. Technical systems and influence changes in their administrative systems."

Appendix F

Organizational Variables Theorized to Affect Innovation, Their Predicted Effect, and Research Findings (Damanpour, 1991, p. 558-559, p. 588-590)

Organizational Attribute (Predicted Effect on Innovation/ Confirmed in this Research?)	Definition	Predicted Innovation Effect Rationale
Professionalism (Positive/Yes)	"Reflects professional knowledge of organizational members, which requires both education and experience. It has been measured either by the number or percentage of professional staff members with certain educational backgrounds (Corwin, 1975; Daft & Becker, 1978) or by an index reflecting degree of professional training of organizational members (Aiken & Hage, 1971; Kaluzny et al., 1974)."	"Increases boundary-spanning activity, self-confidence, and a commitment to move beyond the status quo (Pierce & Delbecq, 1977).
Formalization (Negative/No)	"Reflects the emphasis on following rules and procedures in conducting organizational activities. Formalization is typically measured by the presence of rule manuals and job descriptions, or more generally, by the degree of freedom available to organizational members as they pursue their functions and responsibilities versus the extent of rules that precisely define their activities (Cohn & Turyn, 1980; Kaluzny et al., 1974)."	"Flexibility and low emphasis on work rules facilitate innovation (Burns & Stalker, 1961; Thompson, T 965; Aiken & Hage, 1971). Low formalization permits openness, which encourages new ideas and behaviors (Pierce & Delbecq, 1977).
Centralization (Negative/Yes)	"Reflects the locus of authority and decision-making and is the extent to which decision-making autonomy is dispersed or concentrated in an organization (Pfeffer, 1961). The inverse of decentralization, it is usually measured by the degree of organizational members participation in decision making (Aiken & Hage, 1971); Kaluzny et al., 1974) or by the degree of authority and freedom organizational members have to make their own decisions (Corwin, 1975)."	"Concentration of decision-making authority prevents innovative solutions. While the dispersion of power is necessary for innovation (Thompson, 1965), participatory work environments facilitate innovation by increasing organizational members' awareness, commitment, and involvement."

Appendix F

Organizational Variables Theorized to Affect Innovation, Their Predicted Effect, and Research Findings (Damanpour, 1991, p. 558-559, p. 588-590)

Organizational Attribute (Predicted Effect on Innovation/ Confirmed in this Research?)	Definition	Predicted Innovation Effect Rationale
Managerial Attitude Toward Change (Positive/Yes)	"Represents the extent to which managers or members of the dominant coalition are in favor of change. It is also referred to as "elites' change value" or "managerial receptivity to change". It has typically been measured by using Neal's (1965) battery of items assessing values favoring change (Dewar & Dutton, 1986; Hage & Dewar, 1973)."	"Managers' favorable attitude toward change leads to an internal climate conducive to innovation. Managerial support for innovation is especially required in the implementation stage, when coordination and conflict resolution among individuals and units are essential."
Managerial Tenure (Positive/No)	"Represents the length of service and experience that managers have with an organization. It is normally measured by the number of years an organization has employed a manager."	"Longevity of managers in their jobs provides legitimacy and knowledge of how to accomplish tasks, manage political processes, and obtain desired outcomes (Kimberly & Evanisko, 1981)."
Technical Knowledge Resources (Positive/Yes)	"Reflects an organization's technical resources and technical potential. It is measured by the presence of a technical group (Ettlie et al., 1984) or technical personnel (Dewar & Dutton, 1986). Miller and Friesen's (1982) "technocratization" is measured more broadly but it also represents the role of professional members' technical knowledge in the adoption of innovations."	"The greater the technical knowledge resources, the more easily can new technical ideas be understood and procedures for their development and implementation be attained (Dewar & Dutton, 1986)"
Note on Complexity	"Specialization, differentiation, and professionalism represent the complexity of an organization (Zaltman et al., 1973). Wherever possible, those three indicators were coded separately. When separation into two or three components was not feasible, an overall indicator of complexity was used. Overall complexity has typically been measured by the availability or the number of distinct services an organization offers (Baldridge & Burnham, 1975; Blau & McKinley, 1979; Meyer & Goes, 1988), which reflects Wilson's (1966) notion of '"task diversity.""	

Appendix G

Forces Affecting Organizational Innovation

(Kwon & Zmud, 1987, p. 233-241)

Factor Type	Factor	Definition	Primary Findings
Individual	Job Tenure	"Job tenure is generally related to institutional legitimacy. A positive relationship is usually expected through increased functional or political knowledge, while a negative relationship could be argued through an individual's bounded capacity."	"Consistently positive relationships with adoption have been found in innovation research (Rogers and Shoemaker, 1971; Kimberly and Evanisko, 1981; Paolillo and Brown, 1979). In the IS literature, however, negative associations have been reported with usage and satisfaction (Lucas, 1975, 1976, 1978). Mixed results have been found with performance (Lucas, 1975)."
	Cosmopolitanism	"Cosmopolitanism is generally associated with receptivity to change."	Generally, positive associations have been proposed or found due to increased outside contacts and holding broader perspectives (Becker, 1970; Kimberly and Evanisko, 1981; Rogers and Shoemaker, 1971). Some negative (Counte and Kimberly ,1976; Kimberly and Evanisko, 1981) associations have been also found with adoption. Positive associations have been proposed or found between professionalism, a closely related construct, and adoption (Aiken and Hage, 1971; Pierce and Delbecq, 1977; Thompson, 1969) and incorporation (DiMaggio and Powell, 1983; Galbraith and Edstrom, 1976; Hawley, 1968; Rogers and Shoemaker, 1971)."

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Forces Affecting Organizational Innovation

(Kwon & Zmud, 1987, p. 233-241)

Factor Type	Factor	Definition	Primary Findings
	Education	"Education is also related to receptivity toward change. Consistently positive associations have been found with initiation and/or adoption (Becker, 1970: Kaplan, 1967; Kimberly and Evanisko, 1981; Mytinger, 1968; Rogers and Shoemaker, 1971)."	"The study of normative isomorphism suggests a positive association with incorporation (Hawley, 1968; DiMaggio and Powell, 1983) due to internalized norms and dominant models. In the IS literature, negative associations have been found with usage and satisfaction (Lucas, 1975, 1976, 1978). Mixed results have been found with performance (Lucas, 1975; Taylor, 1975)."
	Role Involvement	"Another factor associated with receptivity toward change. Broader involvement in managerial activities has been proposed or reported to be positively related to adoption (Cyert and March, 1963; Kimberly and Evanisko, 1981; March and Simon, 1958). Closely related constructs such as elite (top management) values and user participation are associated with attitude toward change."	"In the innovation literature, positive associations have been proposed or found with adoption (Baldridge and Burnham, 1975; Cox 1967; Hall 1977; Hage and Dewar 1973) (Baldridge and Burnham 1975; Cox, 1967; Hall 1977; Hage and Dewar,1973) and with acceptance (Davis, 1965). OR/MS/MIS research has found positive associations with adaptation and usage (Garry and Scott Morton, 1971; Neal and Radnor, 1973; Mason and Mitroff, 1973; Radnor and Bean, 1973; Robey and Zeller, 1978) and with satisfaction (Zmud, 1979). But, inconsistent results have been observed between user participation and usage (Zmud, 1979)."

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Forces Affecting Organizational Innovation

(Kwon & Zmud, 1987, p. 233-241)

Factor Type	Factor	Definition	Primary Findings
Structural	Specialization	"Refers to the diversity of specialists within the organization. Technical rationality are used to explain the positive effects of specialization. However, the potential for increasing social and political conflict has also been raised."	"There have been some negative associations with adoption (Wilson, 1966; Sapolsky, 1967; Zaltman et al., 1973) and with usage (Robey and Zeller, 1978). Specialization has generally been proposed or found to be positively associated with both initiation and adoption (Aiken and Hage, 1968 and 1971; Kimberly and Evanisko, 1981; Moch and Morse, 1977; Pierce and Delbecq, 1977; Thompson, 1969; Sapolsky, 1967; Wilson, 1966; Zaltman et al., 1973) and with performance (Dalton et al., 1980)."
	Centralization	"Reflects the degree of concentration of decision-making activity. A bounded perspective and decreased autonomy are often described as negative aspects of centralization, while increased efficiency is given as a positive aspect."	"Generally negative associations have been proposed or found with initiation (Clark, 1968; Hage and Aiken,1967; Kaluzny et at., 1970; Moch and Morse, 1977; Thompson, 1969; Zaltman et al., 1973), with adoption and adaptation (Pierce and Delbecq, 1977), and with performance (Dalton et al., 1980). However, some positive associations have been proposed or found with adoption (Corwin, 1970; Kimberly and Evanisko, 1981; Zaltman et al., 1973; Zmud, 1982a) and with usage (Robey and Zeller 1978; Zmud, 1982a)."

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Forces Affecting Organizational Innovation

(Kwon & Zmud, 1987, p. 233-241)

Factor Type	Factor	Definition	Primary Findings
	Formalization	"The degree of functional differentiation. Functional differentiation is believed to develop clear work definition and procedure, but less autonomy."	"Although there have been a few exceptions (Pierce and Delbecq, 1977; Thompson, 1967) many researchers in innovation have proposed or found negative associations with initiation (Duncan, 1974; Evan and Black, 1967; Hag,e 1965; Hage and Aiken, 1967, 1970; Kaluzny et al., 1972; Organ and Greene, 1981; Palumbo, 1969; Rosner, 1968; Rowe and Boise, 1974; Zaltman et al., 1973; Zmud, 1982a). Also, consistently positive associations have been proposed or found with adoption (Kimberly and Evanisko, 1981; Moch and Morse, 1977; Pierce and Delbecq, 1977; Rowe and Boise 1974; Zmud 1982a). Also, consistently positive associations have been proposed or found with adoption (Pierce Delbecq 1977; Rowe and Boise 1974; Zmud, 1982a), with adaptation (Pierce and Delbecq, 1977), with usage (Neal and Radnor 1973; Radnor and Bean 1973; Robey and Zeller 1978; Zmud 1982a), and with performance (Dalton et al. 1980). "

Appendix G

Forces Affecting Organizational Innovation

(Kwon & Zmud, 1987, p. 233-241)

Factor Type	Factor	Definition	Primary Findings
	Informal Network	Research findings stress the importance of multiple, valuable sources of relevant information for reasons of access, reliability and legitimization. In general, these communication network studies have focused on adoption behaviors. The most widely used communication network variables focus on the social location and social contacts of an organization's members."	Positive associations have been proposed or reported between communication links and initiation behaviors (Allen, 1967; Tushman 1977), adoption behaviors (Becker, 1970; Menzel, 1966), adaptation behaviors (Ebadi and Utterback, 1984), and the diffusion of technological information (Festinger et al., 1950; Katz and Lazarsfeld, 1955; Katz et al., 1963; Rogers, 1983). In the IS literature, however, only a single related study is known to exist (Zmud, 1983b).
Technological	Compatibility	"Importance of an innovation's compatibility to an adopting organization is a frequently cited factor explaining the success of innovation efforts. This factor is related to an innovation's organizational 'fit' as well as its impact on individuals' attitudes regarding change, convenience of change, power shifts, etc."	"Generally, positive associations (Barnett, 1953; Ettlie and Vellenga, 1979) with adoption and adaptation have been found, with a few exceptions (Fliegel and Kivlin, 1966; Carlson, 1965). However, other research does indicate that the influence of compatibility may primarily reflect an interaction effect (Rogers, 1983) or act as a moderating factor (Zmud, 1982a, 1982b). "

Appendix G

Forces Affecting Organizational Innovation

(Kwon & Zmud, 1987, p. 233-241)

Factor Type	Factor	Definition	Primary Findings
	Relative Advantage	"Reflects the degree to which an innovation is perceived as providing greater organizational benefits than either other innovations or the status quo." These cost and benefits may reflect economic legitimacy and/or social or po1itica1 1egitimacy."	"In general, positive associations (Ettlie and Vellenga 1979; Petrini 1966; Mansfield 1961, 1968; Singh 1966) with adoption and adaptation have been found. A few studies, however, have exhibited weak negative associations, possibly due to the strong 'publicity values' involved (Carlson, 1965; Fliegel and Kivlin, 19~6). "
	Complexity	"Related to the degree of difficulty users experience in understanding and using an innovation. Lack of skill and knowledge is believed to be a primary factor behind efforts to resist organizational innovations. Thus, unless adopters and users have high needs for growth and achievement, complexity is likely to be associated negatively to the innovation."	"Negative associations (Graham, 1956; Fliegel and Kivlin, 1966; Singh 1966) have been found with adoption and adaptation. Positive associations, however, have also been found (Carlson, 1965). "
Task-Related	Task Uncertainty	"A multi-facet construct reflecting the degree of routinization, programmability and exceptions in accomplishing organizational tasks."	"As positive influence, task difficulty is likely to motivate initiation and usage behaviors: e.g. information search (Blandin and Brown, 1977; Culan, 1983; Ricketts, 1982). As negative influence, it is also likely to act as an implementation constraint (Thompson, 1967)."

Appendix G

Forces Affecting Organizational Innovation

(Kwon & Zmud, 1987, p. 233-241)

Factor Type	Factor	Definition	Primary Findings
	Autonomy	"Concerned with the degree to which individuals exercise personal control over their assigned tasks. A higher degree of autonomy is likely to increase worker motivation, idea generation, satisfaction and performance."	Griffin et al. (1981) reviewed the organizational literature and noted inconclusive findings for performance. These inconclusive findings were attributed to the moderating effect of individual growth need strength and satisfaction level with the work environment. Generally, a positive association has been found with satisfaction (Hackman and Oldham, 1976; Umstot et al., 1976)."
	Responsibility	"Related to the degree of authority invested in an individual to oversee the completion of a task and to improve existing task behaviors. "	"Tasks with low responsibility are expected to create less worker motivation to accept and to seek work system changes (Mumford, 1969). Generally, positive associations have been proposed or found with satisfaction {Hackman and Oldham, 1976; Umstot et al., 1976) and performance (Griffin et al., 1981). "
	Variety	"It is commonly believed that simplified and routinized tasks are not likely to lead to higher performance and satisfaction, particularly with tasks requiring 'value-added' contributions by the task-incumbent."	Positive associations have been proposed or found with satisfaction {Hackman and Oldham, 1976; Umstot et al., 1976) and performance (Griffin et al., 1981). In addition, Mumford (1969) argues that when the tasks become routinized, employees are divorced from change and tend to resist change. Quinn (1973) found task variety to be positively associated. With adoption, adaptation, and usage."

Appendix G

Forces Affecting Organizational Innovation

(Kwon & Zmud, 1987, p. 233-241)

Factor Type	Factor	Definition	Primary Findings
	Identity	"Ultimately refers to an individual 'internalizing' an assigned task."	"Increased identification with and belief in assigned work is likely to increase an individual's task involvement and, hence, lead to the potential or more innovative behaviors. Generally, a positive association has been proposed or found with satisfaction (Hackman and Oldham, 1976; Umstot et al., 1976), while inconclusive results arise with performance (Griffin et al., 1981)."
	Feedback	Refers to the existence of a mechanism for informing individuals of their task performance levels."	"Based on reinforcement and learning theory, positive associations are expected between the frequency of feedback and the level of innovation displayed in behavior. As with other task factors, the association with satisfaction has been generally positive {Hackman and Oldham, 1976; Umstot et al., 1976) but inconclusive with performance (Griffin et al., 1981)."
Environmental	Heterogeneity	"Refers to the similarity of environmental entities, e.g. customer diversity, with which an organization must interact."	"Positive associations with innovativeness have been proposed or found (Baldridge and Burnham, 1975; DiMaggio and Powell,1983; Hawley, 1968; Heydebrand, 1973)." "Rational selection advocates do not agree on this argument (Thompson, 1967) as they tend to view environmental contingencies as organizational constraints."

Appendix G

Forces Affecting Organizational Innovation

(Kwon & Zmud, 1987, p. 233-241)

Factor Type	Factor	Definition	Primary Findings
	Uncertainty	"Related to the variability of organizational environments." Encompasses both instability and turbulence."	"In general, positive associations have been proposed or found (Cyert and March, 1963; DiMaggio and Powell, 1983; Hawley, 1968; Mohr, 1969; Palumbo, 1969; Pierce and Delbecq, 1977; Schroeder and Benbasat, 1975; Van de Ven and Ferry, 1980) as uncertainty is believed to stimulate innovation through an organization's effort to survive and grow. Others, however, predict a negative association with adoption due to the imposition of constraints on the amount and scope of adaptation available to an organization. (Lawrence and Lorsch, 1967; Thompson, 1967)."
	Competition	"Related to environmental capacity (scarcity of resources) and population density."	"Economists have believed that competition increases the likelihood of innovative activities (Utterback, 1974). Kimberly and Evanisko (1981) have found positive associations between competition and adoption."
	Concentration/ Dispersion	"Represents the extent to which resources are evenly spread throughout the environment."	"Resource concentration is likely to facilitate organizational learning, and hence innovation, in efforts to compete for limited resources (Aldrich, 1979). Positive associations have been proposed or found with adoption (Pfeffer and Salancik, 1978) and with incorporation due to coercive learning pressures (Thompson, 1967)."
	Inter-Organizational Dependence	"Related to the degree to which an organization has a program of sharing resources or exchanging ideas with other organizations"	"Positive associations have been proposed or found with initiation (Pierce and Delbecq, 1977), with adoption (Pierce and Delbecq, 1977), with adoption (Aiken and Hage, 1968, 1971; Pugh et al., 1968, 1969; Becker, 1970); with adaptation (Pierce and Delbecq, 1977), and with diffusion at a population level (Clark, 1965; DiMaggio and Powell, 1983; Hawley, 1968)."

Appendix H

Factors Affecting Organizational Innovation Diffusion

(Fichman, 2000)

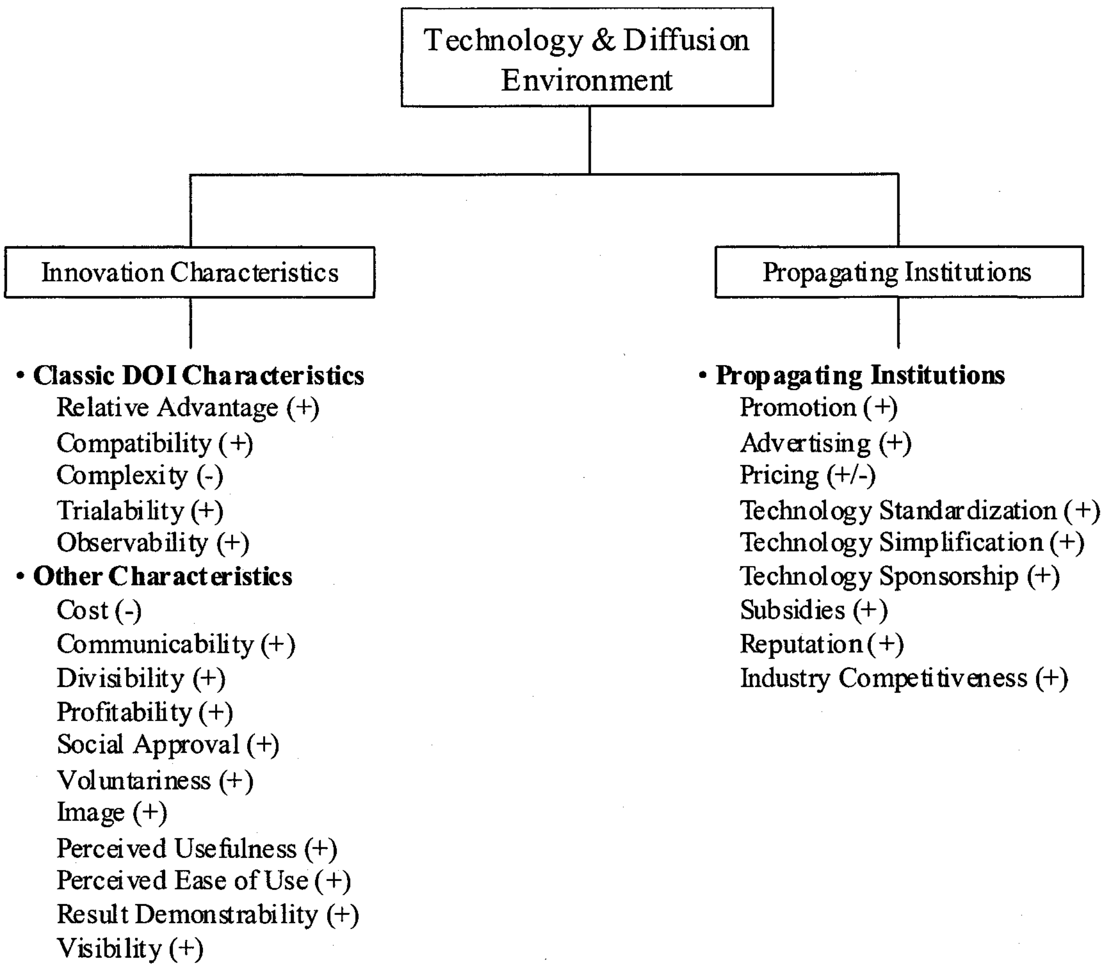

Figure H.1

Innovation-Diffusion Environment Factors Affecting Organizational IT Innovation Diffusion

Appendix H

Factors Affecting Organizational Innovation Diffusion

(Fichman, 2000)

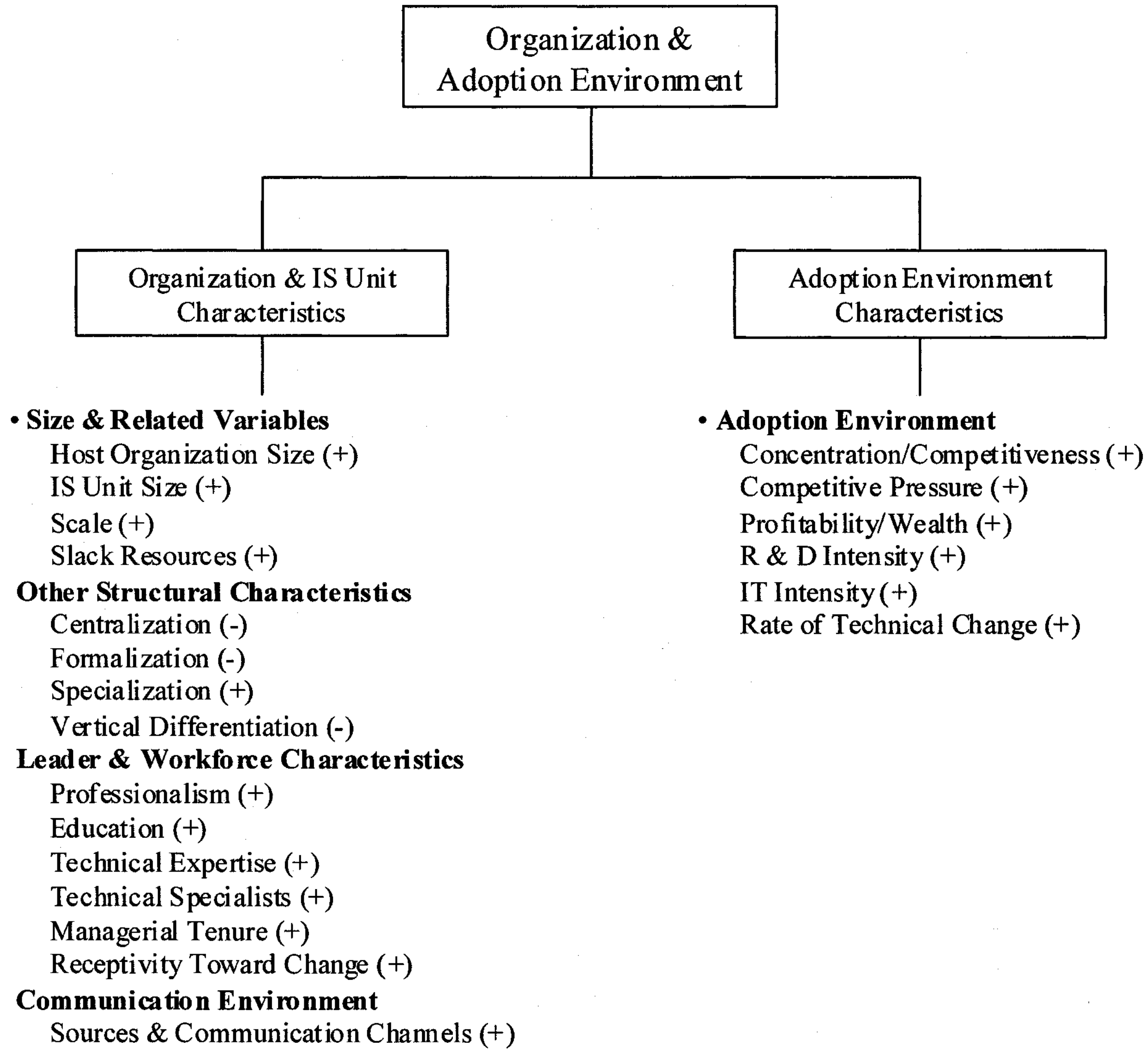

Figure H.2

Organization-Adoption Environment Factors Affecting Organizational IT Innovation Diffusion

Appendix H

Factors Affecting Organizational Innovation Diffusion

(Fichman, 2000)

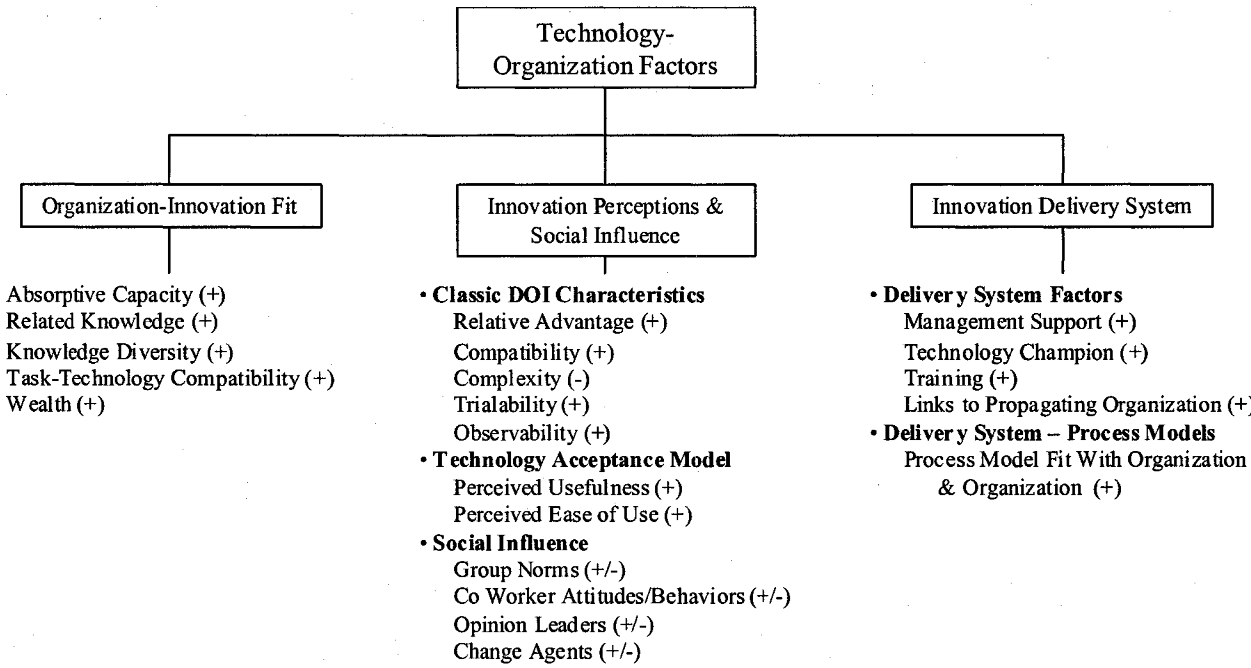

Figure H.3

Technology-Organization Interaction Factors Affecting Organizational IT Innovation Diffusion

Appendix I

Attributes for Describing, Explaining, Predicting Response to Innovation

(Zaltman et al., 1973, p. 33-45)

Attribute	Abbreviated Definition and/or Comment
Cost	"One type of cost is financial, which can be divided into (a) initial cost and (b) continuing cost." "Social cost is another form of expense. Social cost may come in the form of ridicule, ostracism, or even exclusion or expulsion from some relevant reference group."
Returns to Investment	"Of special significance among organizations with particularly scarce resources or short-term investment policy preferences." "Deferral of gratification varies among firms according to industry, and within firms according to type, size of operation, and achievement motivation among management personnel."
Efficiency	"Another potentially important factor is the efficiency of an innovation in terms of (a) overall time saving and (b) the avoidance of bottlenecks in particular."
Risk and Uncertainty	"Followers have a much smaller cost of search. Related, the followers have a reduced risk to late adopters where the innovators have demonstrated the possibility of a new idea." "Relevance of risk varies across social sectors or industries or organizational contexts."
Communicability	"The ease and effectiveness with which the results of the innovation can be disseminated to others constitutes a major force in the diffusion process." "Linked with this is the clarity of results of an innovation."
Compatibility	"Concerns the similarity of the innovation to an existing product it may eventually supplement, complement, or replace." "The pervasiveness or degree to which an innovation relates to and requires changes or adjustments on the part of other elements in the organization influences the speed of adoption by the organization as a whole and by its constituent members." "The greater the pervasiveness"..."the slower its acceptance".
Complexity	"Generally, the more complex an innovation is in terms of operating, the less rapid its acceptance will be." "The innovation may contain complex ideas" or "the actual implementation of the innovation may be complex". "We might say that an innovation which is easy to use but whose essential idea is complex is more likely to be adopted."
Perceived Relative Advantage	"The perceived relative advantage the innovation has over other alternatives, including current practice, is important." "Things the innovation does that other alternatives do not do are its critical attributes."

Appendix I

Attributes for Describing, Explaining, Predicting Response to Innovation

(Zaltman et al., 1973, p. 33-45)

Attribute	Abbreviated Definition and/or Comment
Scientific Status	"New knowledge can be an innovation in which case its reliability, validity, generality, internal consistency, and so on become important sub-attributes." "Not all scientifically sound innovations are adopted, nor are all scientifically unsound innovations rejected."
Point of Origin	"The salient characteristics of innovation may vary according to from whose vantage point it is being perceived and may also vary over time within the viewpoint of any particular observer." "77% of the innovations studied were originated within the firm."
Terminality	"Terminality is an important but relatively unstudied dimension of many innovations. A terminal represents a specific point in time beyond which the adoption of an innovation becomes less rewarding, useless, or even impossible". "The number and spacing of terminals may therefore affect the dif fusion process drastically."
Status Quo Ante	"The degree to which and the ease with which the status quo ante can be reinstated is another factor having a positive relationship with the adoption of an innovation. This characteristic can be termed reversibility." "Divisibility"... "is related to reversibility".
Commitment	Commitment is related to divisibility and reversibility. "Commitment is relevant primarily in situations where there is considerable participation among organizational members in the decision-making process. A decision to adopt an innovation even if made by only one or a few individuals automatically commits other organizational members to the innovation, in a behavioral context."
Interpersonal Relationships	Impact of innovations on organizational interpersonal relationships has been little studied per se. "Innovations may vary along a disruptive-integrative continuum. Related to this is the consideration of whether the innovation is more relevant to the socio-emotional (internal) functioning of a group than to its task and goal (external) function or vice versa."

Appendix I

Attributes for Describing, Explaining, Predicting Response to Innovation

(Zaltman et al., 1973, p. 33-45)

Attribute	Abbreviated Definition and/or Comment
Publicness Versus Privateness	"A public good is one that if it is available to one party in a social system is more or less automatically and simultaneously available to all members of the social system. Fluoridation of a community water system is a public good. Those opposing the concept must accept it." "This suggests a related dimension concerning the size of the decision-making body required to act on the public good. Can only one person make the decision? Does it require the consent of a simple majority or a smaller or larger number?"
Gatekeepers	"Some innovations require going through large number of the approval channels before it can be adopted effectively, whereas others do not. Also, there may be a large number of alternative gatekeepers who can introduce an innovation."
Susceptibility to Successive Modification	"The ability of the innovation"...."to be adapted to improvements in technology as opposed to becoming obsolete because of inflexibility is important." "The ability to refine, elaborate, and modify innovations seems particularly important where financial investment is high and the related technology is a rapidly growing one."
Gateway Capacity	"In addition to the intrinsic value derived from the adoption of an innovation, an additional value can accrue to the extent that the adoption of an innovation can open avenues to the adoption of other innovations".
Gateway Innovations	"Where large-scale social change is desired it is fruitful to think in terms of gateway innovations. What constellation of gateway innovations is most likely to bring that change about? Even small changes in the social structure of an organization can have a dramatic impact in the long run by setting the stage for large-scale innovations."

Appendix J

Most Frequently Researched Innovation Characteristics

(Tornatzky & Klein, 1990, p. 33-39)

Innovation Attribute	Definition/Comment(s)
Compatibility	"The degree to which an innovation is perceived as being consistent with the existing values, past experiences, and needs of the receiver" (Rogers & Shoemaker, 1971). "Compatibility may refer to compatibility with the values or norms of the potential adopters or may represent congruence with the existing practices of the adopters. The first interpretation implies a kind of normative or cognitive compatibility (compatibility with what people feel or think about a technology) while the second suggests a more practical or operational compatibility (compatibility with what people do)."
Relative Advantage	"The degree to which an innovation is perceived as being better than the idea it supersedes." (Rogers and Shoemaker, 1971) "But "being better" is such a general notion that the measurement of relative advantage presents several problems. Relative advantage is perhaps too broad and amorphous a characteristic to be of much use. Typically it is the garbage pail characteristic….into which any of a number of innovation characteristics are dumped. Under these circumstances, relative advantage studies lack conceptual strength, reliability and prescriptive power." (One can hardly help an innovation developer by suggesting that he or she maximize the innovation's relative advantage.")
Complexity	"The complexity of an innovation is "the degree to which an innovation is perceived as relatively difficult to understand and use" (Rogers and Shoemaker, 1971). "Complexity is assumed to be negatively related to innovation adoption and implementation".
Cost	"The cost of an innovation is assumed to be negatively related to the adoption and implementation of the innovation; the less expensive the innovation. The more likely it will be quickly, adopted and implemented."
Communicability	"The degree to which aspects of an innovation may be conveyed to others". (Rothman, 1974. p. 441) "The communicability of an innovation is presumed to be positively related to the adoption and implementation of the innovation."
Divisibility	"The extent to which an innovation can be tried on a small scale prior to adoption". (Fliegel, Kivlin and Sekhon, 1968)

Appendix J

Most Frequently Researched Innovation Characteristics

(Tornatzky & Klein, 1990, p. 33-39)

Innovation Attribute	Definition/Comment(s)
Profitability	"The level of profit to be gained from adoption of the innovation. This characteristic may not be appropriate for all innovations such as consumer products (where the "adopter" is the consumer), or some social innovations".
Social Approval	"Social approval refers to status gained in one's reference group, a non-financial aspect of reward" (Fliegel, Kivlin, and Sekhon, 1968), as a function of adopting a particular
Trialability	"The degree to which an innovation may be experimented with on a limited basis" (Rogers and Shoemaker, 1971). "Theoretically, innovations "that can be tried on the installment plan" (Rogers and Shoemaker, 1971) will be adopted and implemented more often and more quickly than less trialable innovations."
Observability	"The degree to which the results or an innovation are visible to others." (Rogers and Shoemaker 1971) "The more visible the results of an innovation, the more likely the innovation will be quickly adopted and implemented".

Appendix K

Perceived Characteristics of Innovating

(Moore and Benbasat, 1990)

Characteristic	Characteristic Measurement Items
Relative Advantage	1. Using a PWS enables me to accomplish tasks more quickly. * 2. Using a PWS improves the quality of work I do. * 3. Using a PWS makes it easier to do my job. * 4. Using a PWS improves my job performance. 5. Overall, I find using a PWS to be advantageous in my job. 6. Using a PWS enhances my effectiveness on the job. * 7. Using a PWS gives me greater control over my work. * 8. Using a PWS increases my productivity.
Compatibility	1. Using a PWS is compatible with all aspects of my work. * 2. Using a PWS is completely compatible with my current situation. 3. I think that using a PWS fits well with the way 1like to work. * 4. Using a PWS fits into my work style. *
Ease of Use	1. I believe that a PWS is cumbersome to use. 2. My using a PWS requires a lot of mental effort. 3.Using a PWS is often frustrating. 4. Believe that it is easy to get a PWS to do what I want it to do. * 5. Overall, I believe that a PWS is easy to use. * 6. Learning to operate a PWS is easy for me. *
Trialability	1. I've had a great deal of opportunity to try various PWS applications. 2. I know where I can go to satisfactorily try out various uses of a PWS. 3. A PWS was available to me to adequately test run various applications. 4. Before deciding whether to use any PWS applications, I was able to properly try them out. * 5. I was permitted to use a PWS on a trial basis long enough to see what it could do. *
Result Demonstrability	1. I would have no difficulty telling others about the results of using a PWS. * 2. I believe I could communicate to others the consequences of using a PWS. * 3. The results of using a PWS are apparent to me. * 4. I would have difficulty explaining why using PWS may/may not be beneficial. *
Visibility	1. I have seen what others do using their PWS. 2. In my organization, one sees PWS on many desks. 3. PWS are not very visible in my organization. * 4. It is easy for me to observe others using PWS in my firm.
Note: 1. Items with "*" are recommended for use in shortened scale.	

Appendix K

Perceived Characteristics of Innovating

(Moore and Benbasat, 1990)

Characteristic	Characteristic Measurement Items
Image	1. Using a PWS improves my image within the organization. 2. Because of my use of a PWS, others in my organization see me as a more valuable employee. 3. People in my organization who use a PWS have more prestige than those who do not. * 4. People in my organization who use a PWS have a high profile. * 5. Having a PWS is a status symbol in my organization. *
Voluntariness	1. My superiors expect me to use a PWS. 2. My use of a PWS is voluntary (as opposed to required by my superiors or job description). 3. My boss does not require me to use a PWS. * 4. Although it might be helpful, using a PWS is certainly not compulsory in my job. *
Note: 1. Items with "*"are recommended for use in shortened scale.	

Appendix L

Eight IT Acceptance Models and Their Constructs

(Venkatesh et al., 2003)

IT Acceptance Model	Construct	Construct Definition
Theory of Reasoned Action (TRA): Drawn from social psychology, TRA is one of the most fundamental and influential theories of human behavior. TRA has been used to predict a wide range of behaviors (see Sheppard, et al. 1988 for a review.). Davis et al. (1989) applied TRA to individual acceptance of technology and found that the variance explained was largely consistent with studies that had employed TRA in the context of other behaviors.	Attitude Toward Behavior	"An individual's positive or negative feelings (evaluative affect) about performing the target behavior" (Fishbein & Ajzen 1975, p. 216).
	Subjective Norm	"The person's perception that most people who are important to him think he should or should not perform the behavior in question" (Fishbein and Ajzen 1975, p. 302).
Technology Acceptance Model (TAM): TAM is tailored to IS contexts, and was designed to predict information technology acceptance and usage on the job. Unlike TRA the final conceptualization of TAM excludes the attitude construct in order to better explain intention parsimoniously. TAM2 extended Technology Acceptance Model by including subjective norm as an additional predictor of intention in the case of mandatory settings (Venkatesh and Davis 2000). TAM has been widely applied to a diverse set of technologies and users.	Perceived Usefulness	"The degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, p. 320).
	Perceived Ease of Use	"The degree to which a person believes that using a particular system would be free of effort" (Davis 1989, p. 20).
	Subjective Norm	Adapted from TRA/TPB. Included in TAM2 only.
Motivational Model (MM): A significant body of research in psychology has supported general motivation theory as an explanation for behavior. Several studies have examined motivational theory and adapted it for specific contexts. Vallerand (1997) presents an excellent review of the fundamental tenets of this theoretical base. Within the information systems domain, Davis et al. (1 992) applied motivational theory to understand new	Extrinsic Motivation	The perception that users will want to perform an activity because it is perceived to be instrumental in achieving valued outcomes that are distinct from the activity itself, such as improved job performance, pay, or promotions" (Davis et al. 1992, p. 111 2).

Appendix L

Eight IT Acceptance Models and Their Constructs

(Venkatesh et al., 2003)

IT Acceptance Model	Construct	Construct Definition
Motivational Model (MM) (Continued): technology adoption and use (see also Venkatesh and Speier 1999).	Intrinsic Motivation	The perception that users will want to perform an activity "for no apparent reinforcement other than the process of performing the activity per se" (Davis et al. 1992, p. 111 2).
Theory of Planned Behavior (TPB): TPB extended TRA by adding the construct of perceived behavioral control. In TPB, perceived behavioral control is theorized to be an additional determinant of intention and behavior. Ajzen (1991) presented a review of several studies that successfully used TPB to predict intention and behavior in a wide variety of settings. TPB has been successfully applied to the understanding of individual acceptance and usage of many different technologies (Harrison et al. 1997; Mathieson 1991; Taylor & Todd 1995b). A related model is the Decomposed Theory of Planned Behavior (DTPB). In terms of predicting intention, DTPB is identical to TPB. In contrast to TPB but similar to TAM, DTPB "decomposes" attitude, subjective norm, and perceived behavioral control into it's the underlying belief structure within technology adoption contexts.	Attitude Toward Behavior	Adapted from TRA
	Subjective Norm	Adapted from TRA
	Perceived Behavioral Control	"The perceived ease or difficulty of performing the behavior" (Ajzen 1991, p. 1 88). In the context of IS research, "perceptions of internal and external constraints on behavior" (Taylor and Todd 1995b, p. 149).
Combined Technology Acceptance Model and TPB (C-TAM-TPB): This model combines the predictors of TPB with perceived usefulness from TAM to provide a hybrid model (Taylor and Todd 1995a).	Attitude Toward Behavior	Adapted from TRA/TPB.
	Subjective Norm	Adapted from TRA/TPB.
	Perceived Behavioral Control	Adapted from TRA/TPB.
	Perceived Usefulness	Adapted from TAM.

Appendix L

Eight IT Acceptance Models and Their Constructs

(Venkatesh et al., 2003)

IT Acceptance Model	Construct	Construct Definition
Model of PC Utilization (MPCU): Derived largely from Triandis' (1977) theory of human behavior, this model presents a competing perspective to that proposed by TRA and TPB. Thompson et al (1991) adapted and refined Triandis' model for IS contexts and used the model to predict PC utilization. However, the nature of the model makes it particularly suited to predict individual acceptance and use of a range of information technologies. Thompson et al. 1991) sought to predict usage behavior rather than intention; however, in keeping 'A1th the theory's roots, the current research will examine the effect of these determinants on intention. Also, such an examination is important to ensure a fair comparison of the different models.	Job-fit	'The extent to which an individual believes that using a [technology] can enhance the performance of his or her job" (Thompson et at. 1991, p. 129).
	Complexity	Based on Rogers and Shoemaker (1971), "the degree to which an innovation is perceived as relatively difficult to understand and use" (Thompson et at 1991, p. 128).
	Long –term Consequences	"Outcomes that have a pay-off in the future" (Thompson et al. 1991, p. 129).
	Affect Towards Use	Based on Triandis, affect toward use is "feelings of joy, elation, or pleasure, or depression, disgust, displeasure, or hate associated by an individual with a particular act" (Thompson et al 1991, p. 127).
	Social Factors	Derived from Triandis, social factors are "the individual's internalization of the reference group's subjective culture, and specific interpersonal agreements that the individual, has made with others, in specific social situations" (Thompson et al 1991, p. 1.26).

Appendix L

Eight IT Acceptance Models and Their Constructs

(Venkatesh et al., 2003)

IT Acceptance Model	Construct	Construct Definition
	Facilitating Conditions	Objective factors in the environment that observers agree make an act easy to accomplish. For example, returning items purchased online is facilitated when no fee is charged to return the item. In an IS context, "provision of support for users of PCs may be one type of facilitating condition that can influence system utilization" (Thompson et al. 1991, p. 129).
Social Cognitive Theory (SCT): One of the most powerful theories of human behavior is social cognitive theory (see Bandura 1986). Compeau and Higgins (1995b) applied and extended SCT to the context of computer utilization (see also Compeau et al. 1999). While Compeau and Higgins (1995a) also employed SCT, it was to study performance and thus is outside the goal of the current research. Compeau and Higgins' (1995b) model studied computer use but the nature of the model and the underlying theory allow it to be extended to acceptance and use of information technology in general. The original model of Compeau and Higgins (1995b) used usage as a dependent variable but in keeping with the spirit of predicting Individual acceptance, we will examine the predictive validity of the model in the context of intention and I usage to allow a fair comparison of the models.	Outcome Expectations - Performance	The performance-related consequences of the behavior. Specifically, performance expectations deal with job-related outcomes (Compeau and Higgins 1995b).
	Outcome Expectations – Personal	The personal consequences of the behavior. Specifically, personal expectations deal with the individual esteem and sense of accomplishment (Compeau and Higgins 1995b).
	Self-Efficacy	Judgment of one's ability to use a technology (e.g., computer) to accomplish a particular job or task.
	Affect	An individual's liking for a particular behavior (e.g., computer use).
	Anxiety	Evoking anxious or emotional reactions when it comes to performing a behavior (e.g., using a computer).

Appendix L

Eight IT Acceptance Models and Their Constructs

(Venkatesh et al., 2003)

IT Acceptance Model	Construct	Construct Definition
Innovation Diffusion Theory (IDT): Used since the 1960s to study a variety of innovations, ranging from agricultural tools to organizational innovation (Tornatzky and Klein 1982). Within information systems, Moore and Benbasat (1991) adapted the characteristics of innovations presented in Rogers and refined a set of constructs that could be used to study individual technology acceptance. Moore and Benbasat (1996) found support for the predictive validity of these innovation characteristics (see also Agarwal and Prasad 1997, 1998; Karahanna et at 1999; Plouffe et al. 2001).	Relative Advantage	"The degree to which an innovation is perceived as being better than its precursor" (Moore and Benbasat 1991, p. 195).
	Ease of Use	"The degree to which an innovation is perceived as being difficult to use" (Moore and Benbasat 1991, p. 195).
	Image	"The degree to which use of an innovation is perceived to enhance one's image or status in one's social system" (Moore and Benbasat 1991, p. 195).
	Visibility	"The degree to which one can see others using the system in the organization" (adapted from Moore and Benbasat (1991).
	Compatibility	"The degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters" (Moore and Benbasat 1991, p. 195).
	Results Demonstrability	"The tangibility of the results of using the innovation, including their observability and communicability" (Moore and Benbasat 1991, p. 203)
	Voluntariness of Use	"The degree to which use of the innovation is perceived as being voluntary, or of free will (Moore and Benbasat 1991, p. 195)

Appendix M

Comparison of Rationale and Social Influence Model Assumptions (Fulk et al., 1990, p. 125)

Rational Choice Models	Social Influence Model
Media and Task Features	
Fixed	Variable
Objective	Subjective; Socially Constructed
Uniformly Salient	Variably Salient
Choice Making	
Cognitive	Cognitive
Independent	Subject to Social Influence
Prospectively Rational	Can Be Retrospectively Rational
Objectively Rational	Subjectively Rational
Efficiency Motivated	Not Necessarily Efficiency Motivated

Appendix N

A Knowledge Barrier Perspective on the Role of Communications in Innovation Diffusion

Some noted scholars (e.g., Attewell, 1992; Fichman, 1992) advocate a perspective on the role of innovation complexity in diffusion that supports the innovation-adopter symmetry concept of Downs and Mohr (1976). They suggest innovation diffusion be considered in the context of a potential adopter's ability - as well as willingness - to adopt.

Perhaps even more significant, these scholars offer a reconceptualization of innovation diffusion that significantly alters the role of communications. Traditional or "classical" conceptualizations of innovation focus exclusively on the signaling function or role of communications. In such a conceptualization "diffusion is therefore limited by the timing and pattern of communications" (Attewell, 1992, p. 4); i.e., "non-adopters lag behind early adopters because the former have not yet learned of the existence of an innovation, or have not yet been influenced about its desirability by better-informed contacts" (Attewell, 1992, p. 4). Attewell (1992, p. 5) asserts "one may question whether signaling information remains a limiting factor". He notes research "has documented that signaling about new production technology in the US can be very fast and widespread implying that it is not a limiting factor" (Attewell, 1992, p. 5). The more important role of communications in innovation diffusion according to Attewell is in the dissemination of the knowledge and/or know-how necessary for adopters to effectively employ complex new innovations.

Fichman (1992, p. 6) notes "some technologies can not be adopted as a "black-box" solution, but rather, impose a substantial knowledge burden on would be adopters".

Appendix N

A Knowledge Barrier Perspective on the Role of Communications in Innovation Diffusion

Fichman asserts that "an important determinant of adopter innovativeness - for both individuals and organizations - is the level of skills and knowledge gained over the course of the adopter's cumulative history of innovation activities" (Fichman, 1992, p. 7). Making reference to Cohen and Levinthal's (1990) concept of absorptive capacity, Fichman asserts that "an important determinant of adopter innovativeness - for both individuals and organizations - is the level of skills and knowledge gained over the course of the adopter's cumulative history of innovation activities" (Fichman, 1992, p. 7).

Attewell ties innovation diffusion to complexity noting "implementing a complex new technology requires both individual and organizational learning" (Attewell, 1992, p. 6) and "learning and/or communicating the technical knowledge required to use a complex innovation successfully places far greater demands on potential users and on supply-side organizations than does signaling".

Fichman and Kemmerer (1999) identified knowledge barriers and increasing returns to adoption as potential causes of innovation assimilation gaps – situations in which the adoption of an innovation within an organization lags significantly behind its acquisition/provision. They found that "knowledge barriers arise because the technological and managerial knowledge required to successfully deploy complex technologies typically goes far beyond simple awareness of the innovation and its potential benefits" (Fichman & Kemerer, 1999, p. 261). Due to the relative knowledge deficit, diffusion occurs at a slower rate, if at all due to the need for technical knowledge and, or know-how associated with the complex innovation.

Appendix O

Research Survey As Posted

VTC Survey

Thank you for taking the time to participate in this survey of the VTC capability. Your survey responses are very valuable to the Department. They will contribute to a better understanding of the value of video-teleconferencing (VTC) and of how current VTC capabilities can be improved. Please make a conscious effort to answer all the survey items. Survey items that are inadvertently/mistakenly left unanswered significantly detract from the validity of research conclusions. Your completion of the voluntary survey is greatly appreciated.

Please select the most appropriate response for the following three items.

1) I am aware of the video teleconferencing (VTC) capability at my post/location.

- ○ Yes
- ○ No

2) I am authorized to schedule meetings/discussions that make use of the VTC capability at my post/location.

- ○ Yes
- ○ No
- ○ I'm not sure.

3) I have scheduled and/or participated in a meeting/discussion held using the VTC capability at my post/location.

- ○ Yes
- ○ No

For items 4 through 54, please select the response that most accurately reflects your agreement/disagreement with the statement concerning the VTC at your post/location.

4) I intend to use VTC in the next several months.

- ○ Agree Strongly
- ○ Agree

- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

5) I predict I will use VTC in the next several months.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

6) I plan to use VTC in the next several months.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

7) I use VTC a lot to do my work.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat

- Disagree
- Disagree Strongly

8) I use VTC whenever possible to do my work.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

9) I use VTC frequently to do my work.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

10) I use VTC whenever appropriate to do my work.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

Appendix O

Research Survey As Posted

11) VTC use has become a standard part of the way I do my job.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

12) I have developed routines/methods for using VTC in my work.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

13) Since starting to use VTC, I have discovered more and/or different ways of using it.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

14) VTC makes it possible for me to accomplish tasks that would otherwise be infeasible/impractical.

- Agree Strongly
- Agree

- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

15) Using VTC enables me to accomplish tasks more quickly.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

16) Using VTC improves the quality of work I do.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

17) Using VTC makes it easier to do my job.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat

- Disagree
- Disagree Strongly

18) Using VTC enhances my effectiveness on the job.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

19) Using VTC gives me greater control over my work.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

20) I believe it is easy to get VTC to do what I want it to do.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

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Research Survey As Posted

21) Overall, I believe VTC is easy to use.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

22) Learning to operate/use VTC is easy for me.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

23) Using VTC is compatible with all aspects of my work.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

24) I think using VTC fits well with the way I like to work.

- Agree Strongly
- Agree

- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

25) Using VTC fits into my work style.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

26) The top management of my post/location thinks using VTC is valuable for accomplishing our job.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

27) The opinions of the top management of my post/location are important to me.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral

- Disagree Somewhat
- Disagree
- Disagree Strongly

28) My immediate supervisor thinks using VTC is valuable for accomplishing our job.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

29) The opinions of my immediate supervisor are important to me.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

30) My peers think using VTC is valuable for accomplishing our job.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

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Research Survey As Posted

31) The opinions of my peers are important to me.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

32) Using VTC improves my image within my post/location.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

33) People at my post/location who use VTC have more prestige than those who do not.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

34) People at my post/location who use VTC have a high profile.

- Agree Strongly

- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

35) Using the VTC is a status symbol at my post/location.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

36) My post/location is committed to a vision of using VTC.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

37) My post/location is committed to supporting my efforts to use VTC.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral

- Disagree Somewhat
- Disagree
- Disagree Strongly

38) My post/location strongly encourages the use of VTC.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

39) My post/location will recognize my efforts in using VTC.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

40) The use of VTC is important to my post/location.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

Appendix O

Research Survey As Posted

41) I have the resources necessary to use VTC.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

42) I have the knowledge necessary to use VTC.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

43) A specific person (or group) is available for assistance with VTC.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

44) My superiors expect me to use VTC.

- Agree Strongly

- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

45) My use of VTC is voluntary (as opposed to being required by my superiors or my job description).

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

46) My boss does not require me to use VTC.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

47) Although it might be helpful, using VTC is certainly not compulsory in my job.

- Agree Strongly
- Agree
- Agree Somewhat

- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly

48) At this post/location, I feel I am my own boss in most job-related matters.

- Definitely True
- More Often True Than False
- More Often False Than True
- Definitely False

49) At this post/location, a person can usually make his/her own decisions without checking with someone else.

- Definitely True
- More Often True Than False
- More Often False Than True
- Definitely False

50) At this post/location, the way things are done is generally left up to the person doing the work.

- Definitely True
- More Often True Than False
- More Often False Than True
- Definitely False

51) People at this post/location are allowed to do their job almost as they see fit.

- Definitely True
- More Often True Than False
- More Often False Than True
- Definitely False

52) Most people at this post/location can make their own rules on the job.

- Definitely True
- More Often True Than False
- More Often False Than True
- Definitely False

53) Employees at this post/location are constantly being checked on for rule violations.

- Definitely True
- More Often True Than False
- More Often False Than True
- Definitely False

54) Employees at this post/location feel as though they are constantly watched to see that they obey the rules.

- Definitely True
- More Often True Than False
- More Often False Than True
- Definitely False

The following sixteen items address the context and purposes of your use of the VTC at your post/location. Please select the most appropriate response for each item.

55) I use VTC most often to interact with individuals located in

- the same country.
- a different country.
- I don't schedule or participate in VTC meetings/discussions.

Note: If your response to item 55 was 3 (the third choice), indicating you don't schedule or participate in VTC meetings/discussions, please proceed

directly to item 71.

56) I use VTC most often to interact with individuals located

- in the same time zone.
- four time zones or fewer away.
- more than four time zones away.
- in various time zones.
- I don't schedule or participate in VTC meetings/discussions.

57) I use VTC most often to interact with individuals who represent/work for

- the US Department of State.
- another US Government Agency.
- a US Military Service.
- a foreign Government.
- another organization.
- I don't schedule or participate in VTC meetings/discussions.

58) I use VTC most often to interact with individuals I know, and/or have worked with previously

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

59) I use VTC to interact simultaneously with individuals at multiple other posts/locations.

- Agree Strongly

- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

60) I use VTC when I need to share information with individuals at another post/location.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

61) I use VTC when I need to brainstorm (i.e., generate) problem or decision alternatives with individuals at another post/location.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

62) I use VTC when I need to update individuals at another post/location on work/project status.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

63) I use VTC when I need to collaborate electronically (i.e., application sharing) with individuals at another post/location in the creation of a work product (e.g. document or briefing).

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

64) I use VTC when I need to negotiate with individuals at another post/location.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

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Research Survey As Posted

65) I use VTC when I need to influence individuals at another post/location.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

66) I use VTC when I need to make a decision that involves individuals at another post/location.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

67) I use VTC when I need to resolve a dispute that involves individuals at another post/location.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

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Research Survey As Posted

68) I use VTC when I need to form or direct a project or problem-solving team that includes individuals at another post/location.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

69) I use VTC to prepare for, and/or to follow up on face-to-face meetings and/or conferences involving individuals from other post/locations.

- Agree Strongly
- Agree
- Agree Somewhat
- Neutral
- Disagree Somewhat
- Disagree
- Disagree Strongly
- I don't schedule or participate in VTC meetings/discussions.

For the following eleven demographic items, please select the most appropriate response.

70) Please indicate whether you are female or male.

- Female
- Male

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Research Survey As Posted

71) Please indicate your age.

- 25 Years or Under
- 26-35 Years
- 36-45 Years
- 46-55 Years
- 56-65 Years
- Over 65 Years

72) Please indicate the highest level of education you have completed.

- Some High School
- High School Diploma
- Some College
- College Degree
- Some Graduate Work
- Graduate Degree

73) Please indicate your present professional/employment status.

- US Department of State Employee
- Other US Government Agency/Department Employee
- US Military Service Member
- US Firm Contractor Employee
- Non-US Military/Government Agency Employee
- Non-US Firm Contractor Employee
- Other

74) Please indicate the number of months you have been in the professional/employment status indicated in the preceeding item.

- Fewer Than 12 (Less Than a Year)
- 12-35 (1-2 Years)
- 36-59 (3-4 Years)

- 60-83 (5-6 Years)
- 84-119 (7-9 Years)
- 120 Or More (10 Years +)

75) Please indicate the number of months you have been working at this post/location.

- Fewer Than 6
- 6-12
- 13-24
- 25-47
- 48-59
- 60 Or More

76) In my current position at this post/location, I am most accurately described as:

- Someone who is a potential user of the VTC capability at this post/location.
- Someone who is responsible for supporting others' use of this post/location's VTC capability.
- Someone who is both a potential user, and who is responsible for supporting others' use at this post/location.
- Someone who has no involvement with this post/location's VTC capability.

Comments:

77) Please indicate your months of experience using VTC before arriving at this post location.

- None
- Fewer Than 6
- 6-12
- 13-18
- 19-24
- More Than 24

78) Please indicate your months of experience using VTC at this post/location.

- ○ I don't schedule or participate in VTC meetings/discussions.
- ○ Fewer Than 6
- ○ 6-12
- ○ 13-18
- ○ 19-24
- ○ More Than 24

79) Please indicate the number of people who report to you either directly, or indirectly through a subordinate.

- ○ None
- ○ 10 Or Fewer
- ○ 11-50
- ○ 51-100
- ○ More Than 100

80) What post are you with?

Select Post

81) What Bureau are you with?

Select Bureau

Your personal comments would be a great value to the goals of this survey. Please enter them in the appropriate text box below. (Note: Each text box has a 5000 character (about 750 word) limit.)

82) Please tell us what you think could be done to make the VTC capability at your post/location more useful to you in doing your job, more compatible with your needs, and/or easier for you to use.

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Research Survey As Posted

83) Please identify/describe any changes to the working environment and/or the way your post/location operates that would likely result in your using VTC more.

84) Please provide any additional comments concerning the VTC capabilities of your post/location.

Thank You. Your completion of this survey is very valuable to the Department and is greatly appreciated. Please take a moment to ensure that you have not left any survey items unanswered - unintentionally. (Note: Items 56 - 69 may remain unanswered if your response to item 55 indicates that you do not schedule or participate in meetings/discussions conducted using the VTC at your post/location.

Appendix P

Research Construct Score Scatter and Frequency Plots

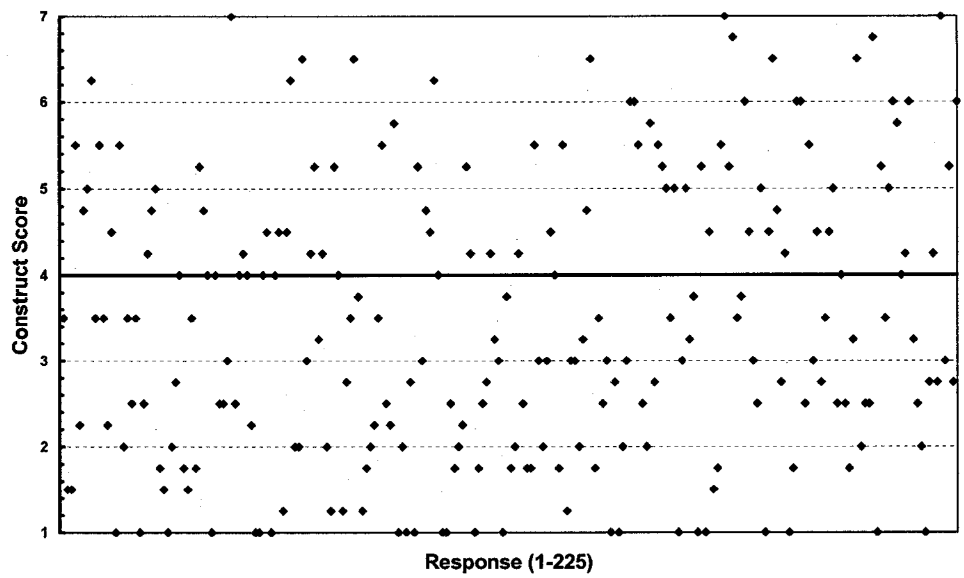


Figure P.1

Innovation Usage Construct Score Scatter Plot

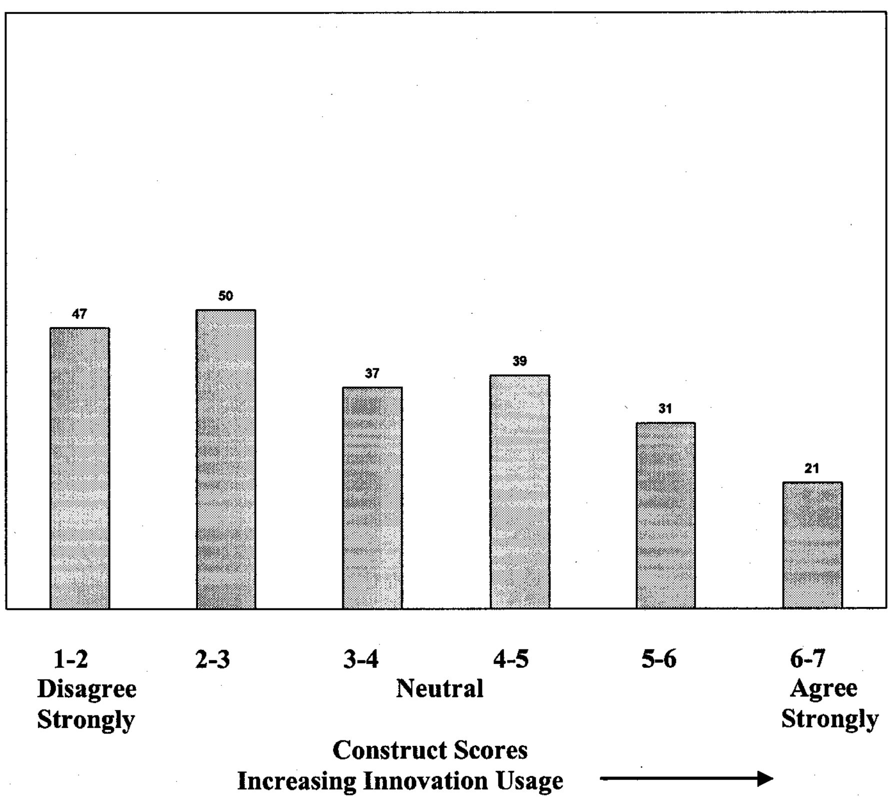


Figure P.2

Innovation Usage Frequency Plots

Appendix P

Research Construct Score Scatter and Frequency Plots

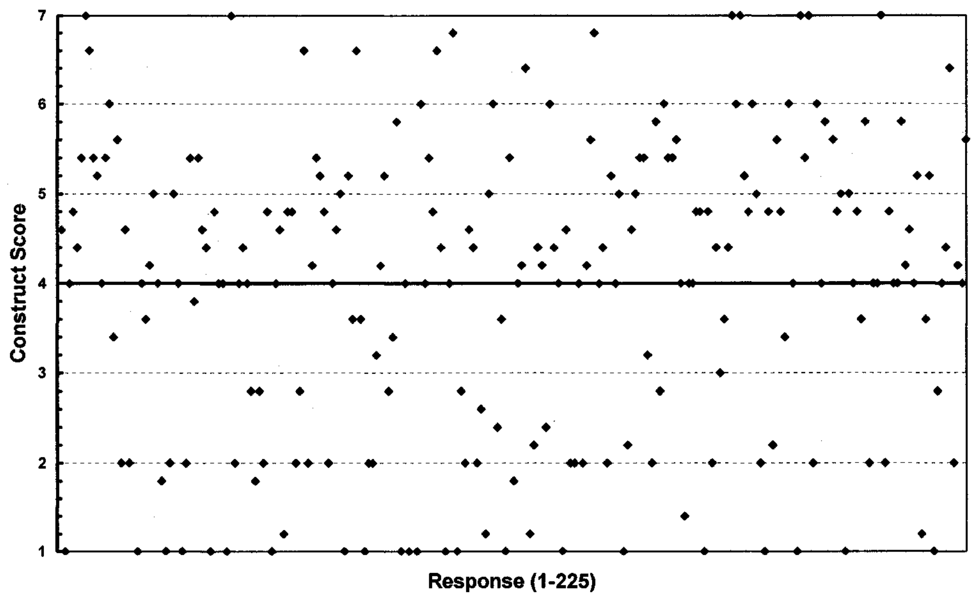


Figure P.3

Perceived Relative Advantage Construct Score Scatter Plot

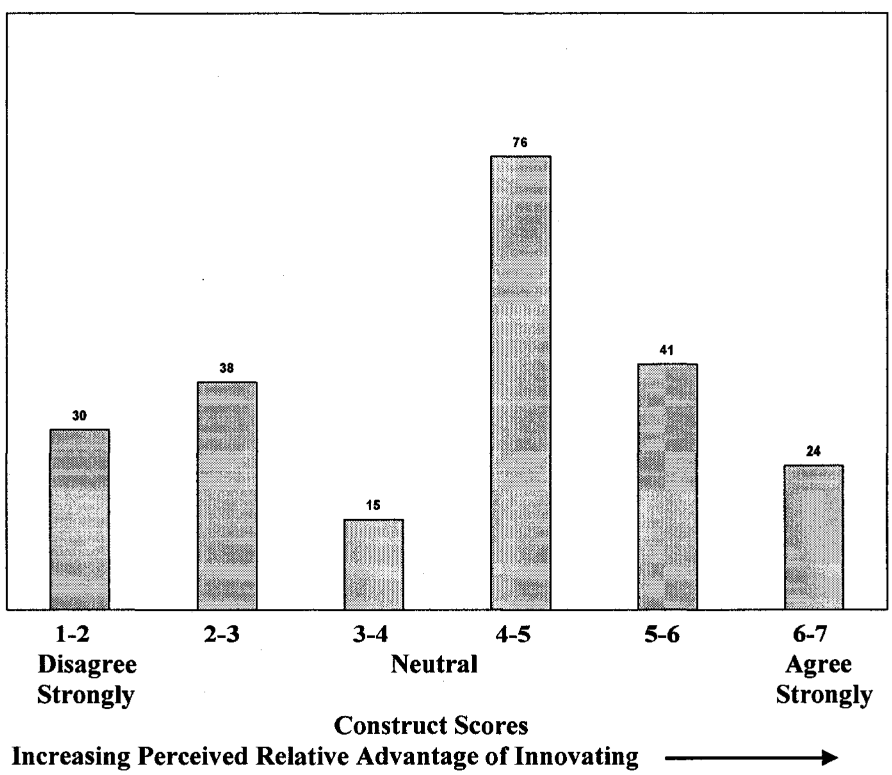


Figure P.4

Perceived Relative Advantage Score Frequency Plot

Appendix P

Research Construct Score Scatter and Frequency Plots

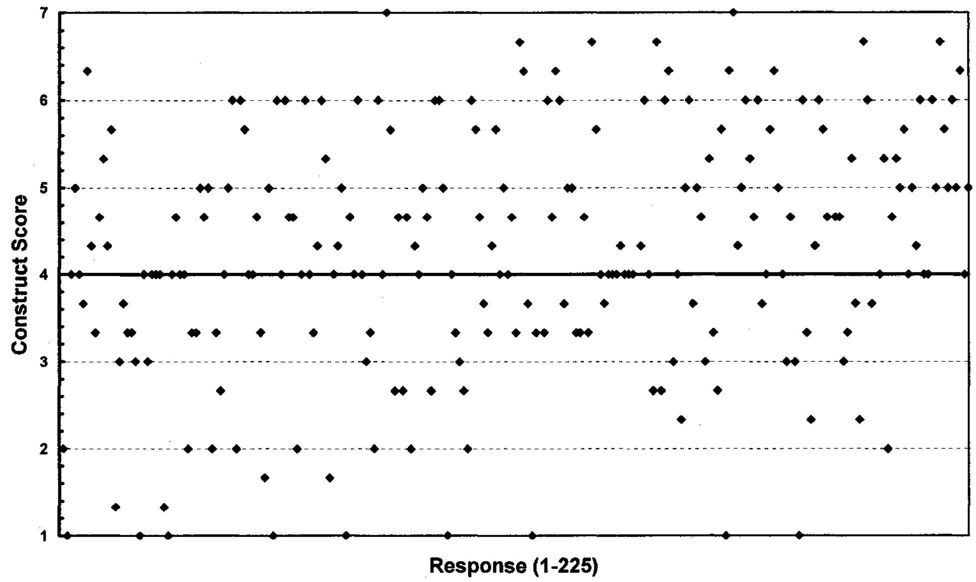


Figure P.5

Perceived Ease Construct Score Scatter Plot

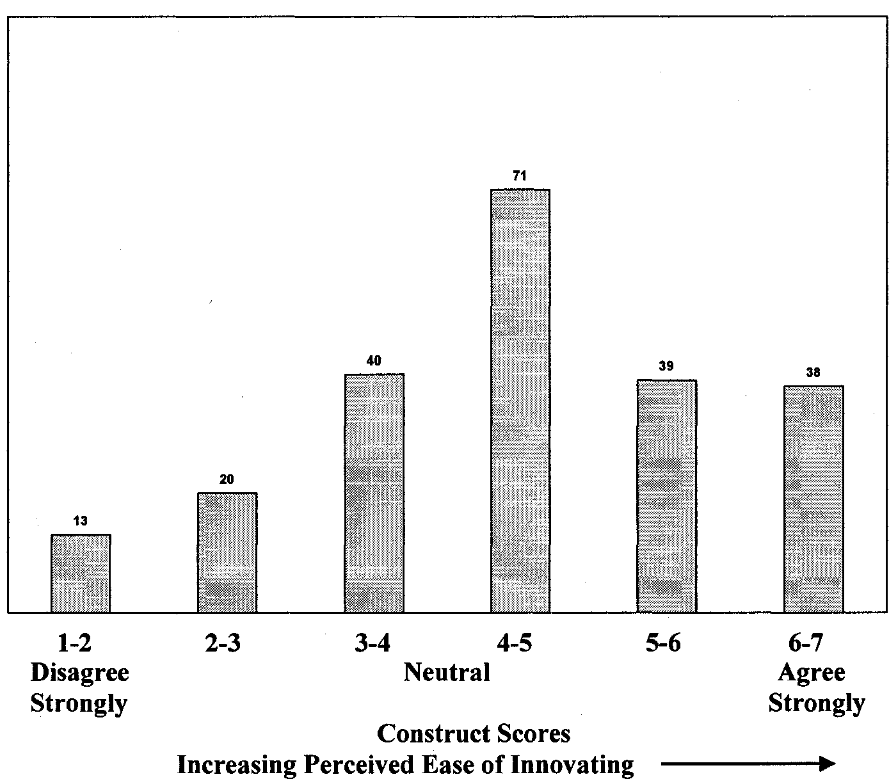


Figure P.6

Perceived Ease Score Frequency Plot

Appendix P

Research Construct Score Scatter and Frequency Plots

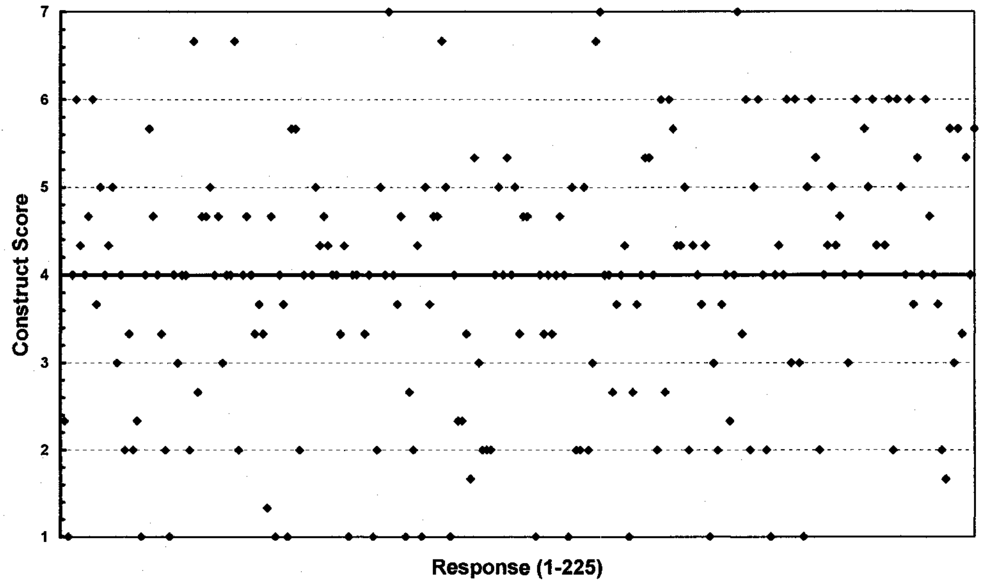


Figure P.7

Perceived Compatibility Construct Score Scatter Plot

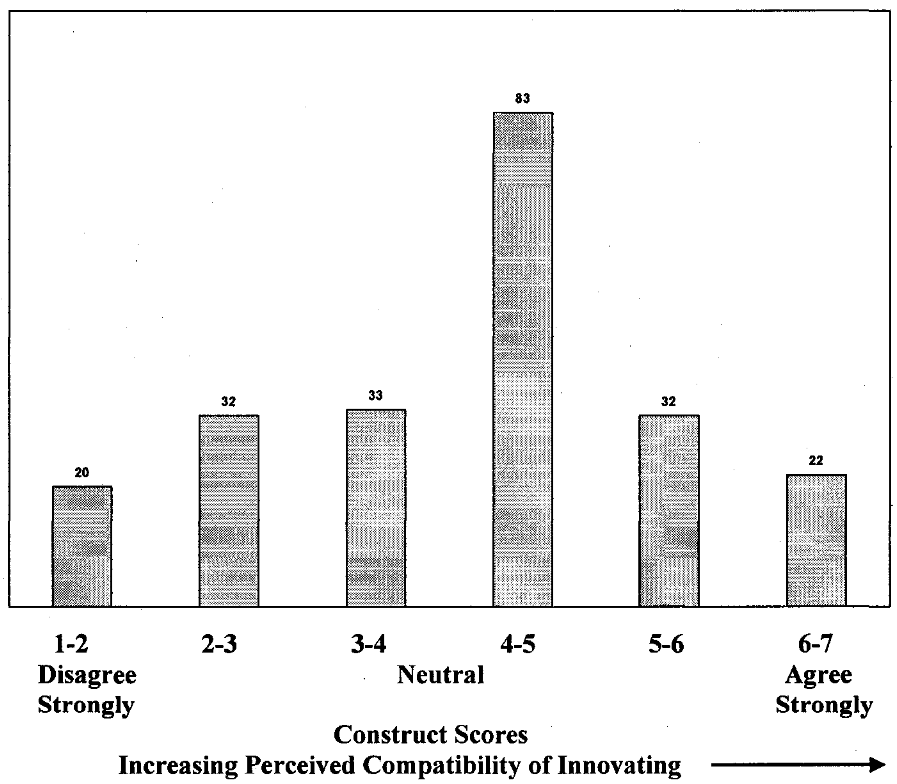


Figure P.8

Perceived Compatibility Score Frequency Plot

Appendix P

Research Construct Score Scatter and Frequency Plots

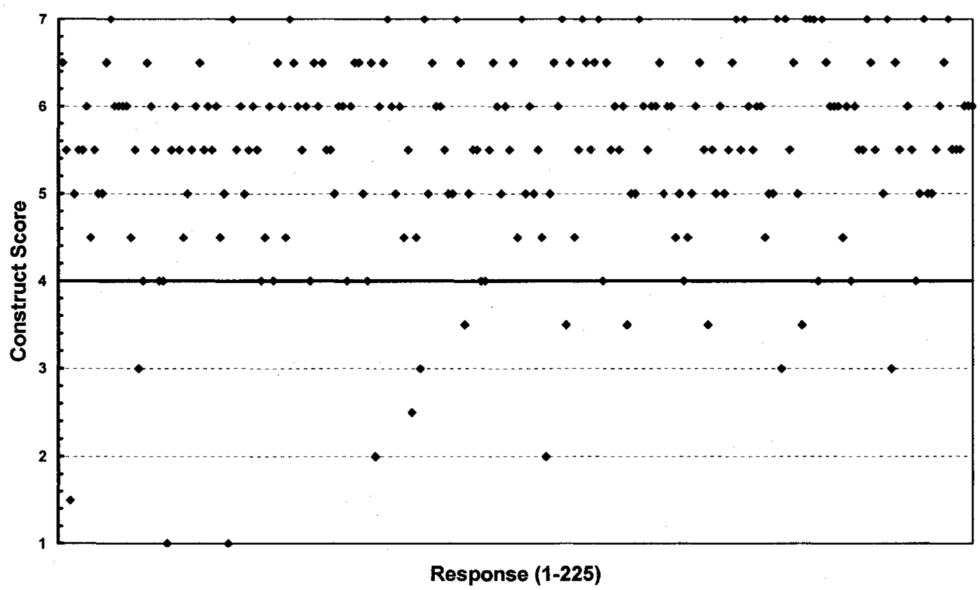


Figure P.9

Top Management Subjective Norm Construct Score Scatter Plot

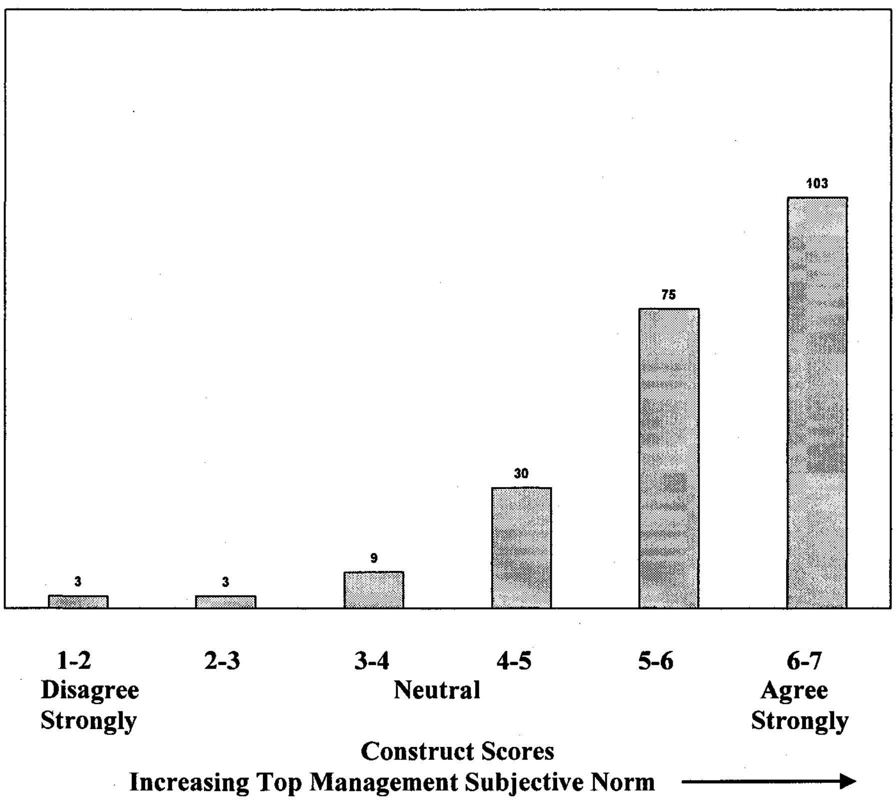


Figure P.10

Top Management Subjective Norm Score Frequency Plot

Appendix P

Research Construct Score Scatter and Frequency Plots

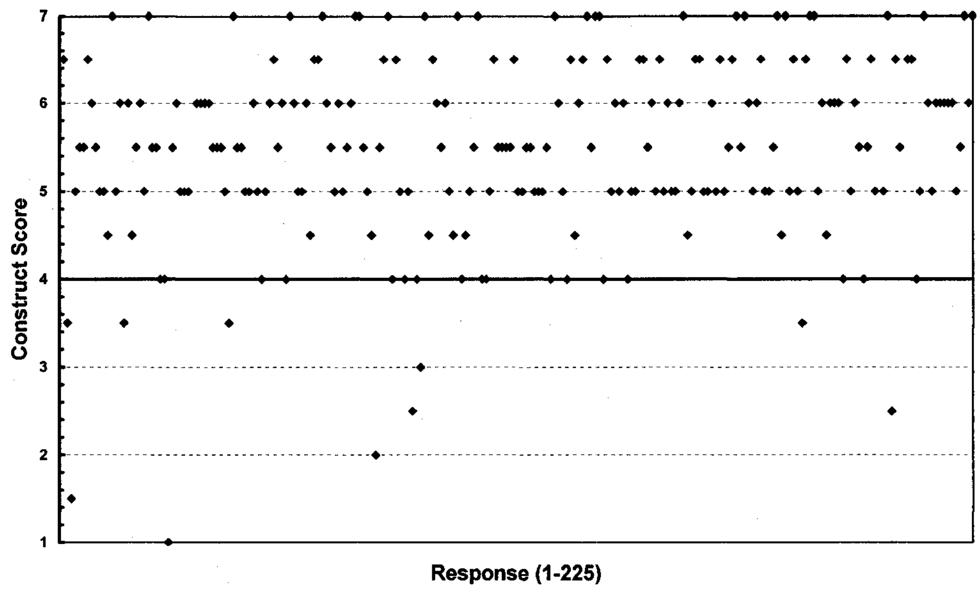


Figure P.11

Supervisor Subjective Norm Construct Score Scatter Plot

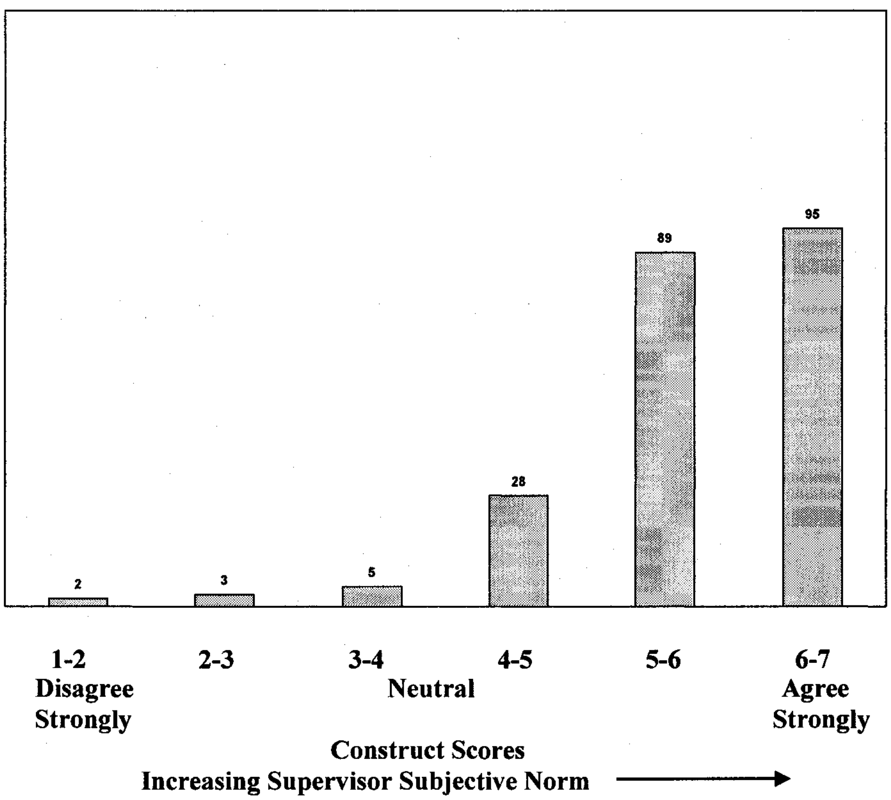


Figure P.12

Supervisor Subjective Norm Score Frequency Plot

Appendix P

Research Construct Score Scatter and Frequency Plots

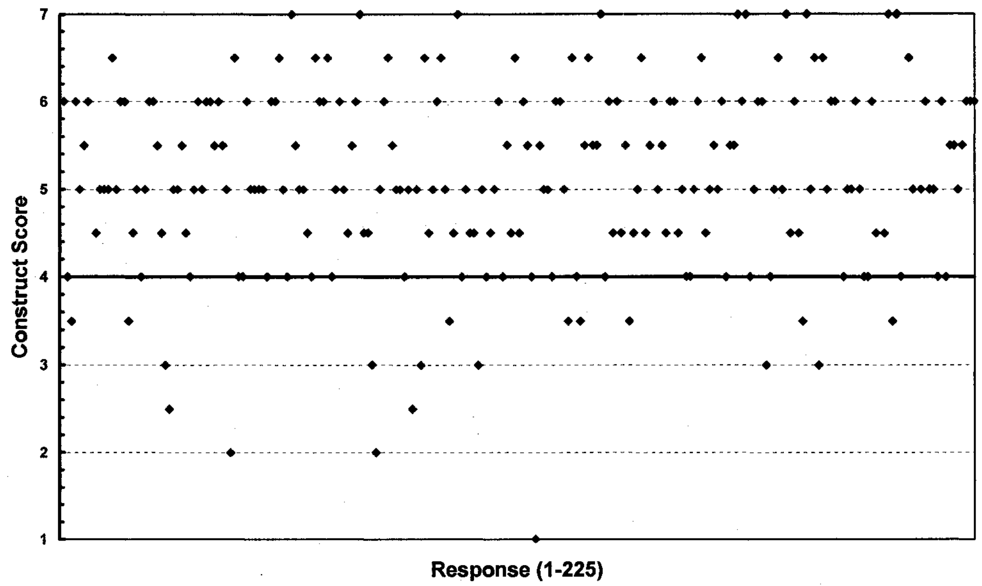


Figure P.13

Peer Subjective Norm Construct Score Scatter Plot

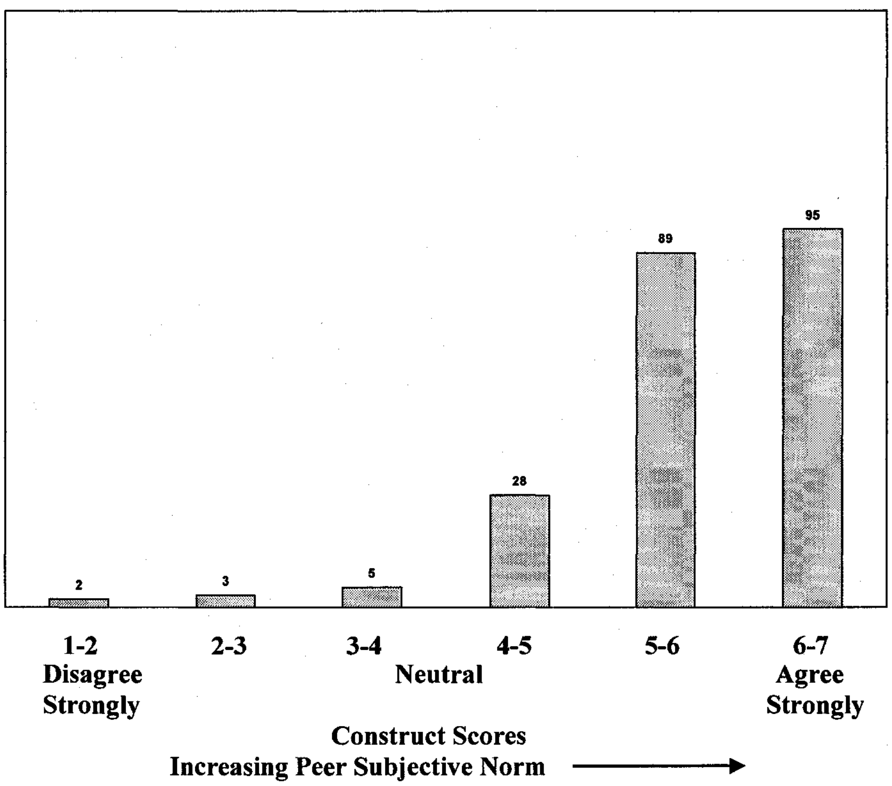


Figure P.14

Peer Subjective Norm Score Frequency Plot

Appendix P

Research Construct Score Scatter and Frequency Plots

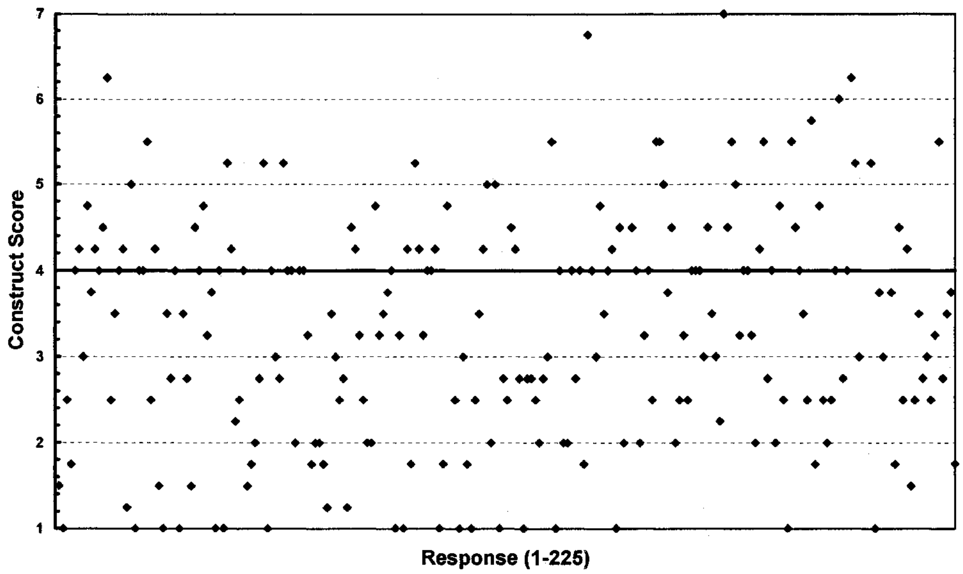
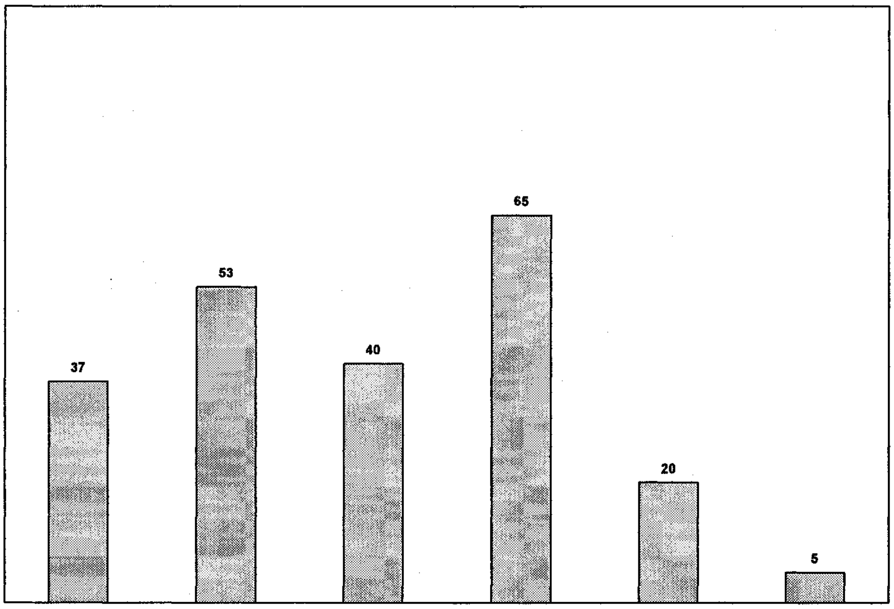


Figure P.15

Perceived Image Construct Score Scatter Plot



1-2 Disagree Strongly | **2-3** | **3-4** | **4-5 Neutral** | **5-6** | **6-7 Agree Strongly**

Construct Scores

Increasing Perceived Image of Innovating →

Figure P.16

Perceived Image Construct Score Frequency Plot

Appendix P

Research Construct Score Scatter and Frequency Plots

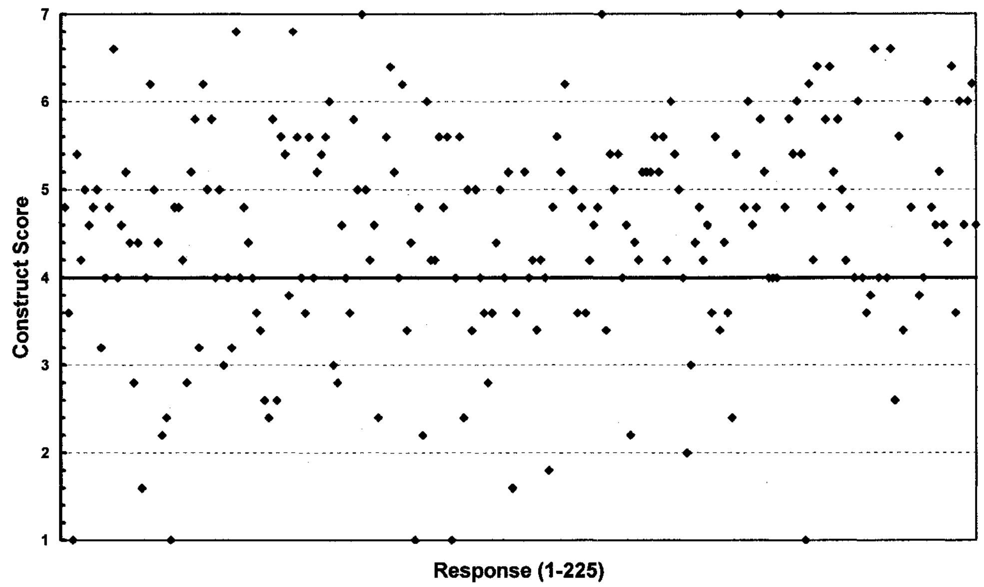


Figure P.17

Organizational Commitment Construct Score Scatter Plot

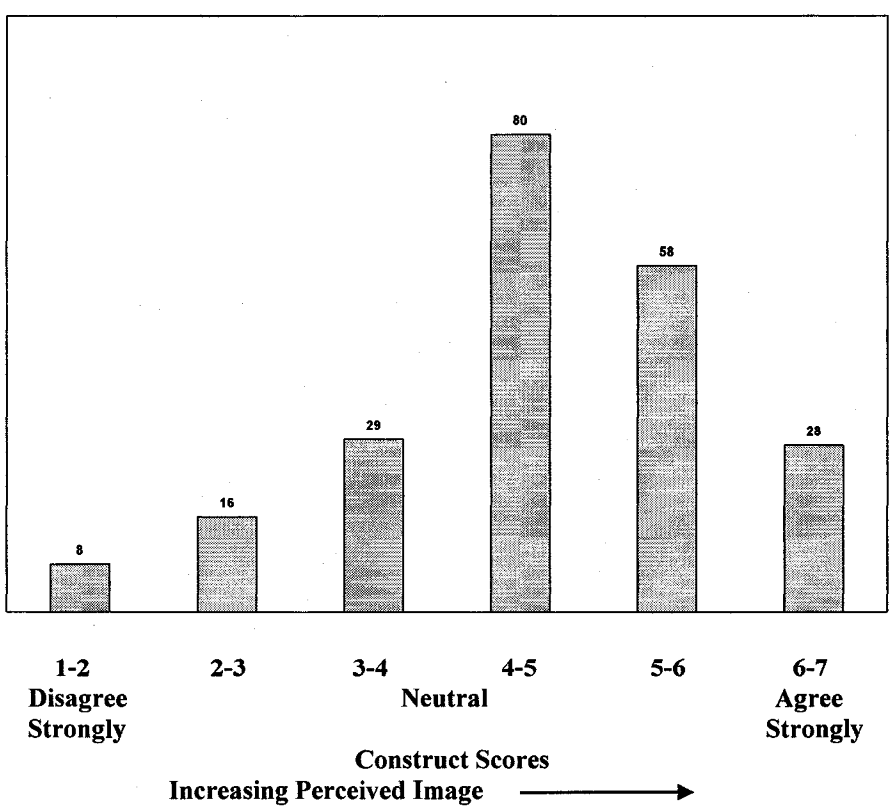


Figure P.18

Organizational Commitment Construct Score Frequency Plot

Appendix P

Research Construct Score Scatter and Frequency Plots

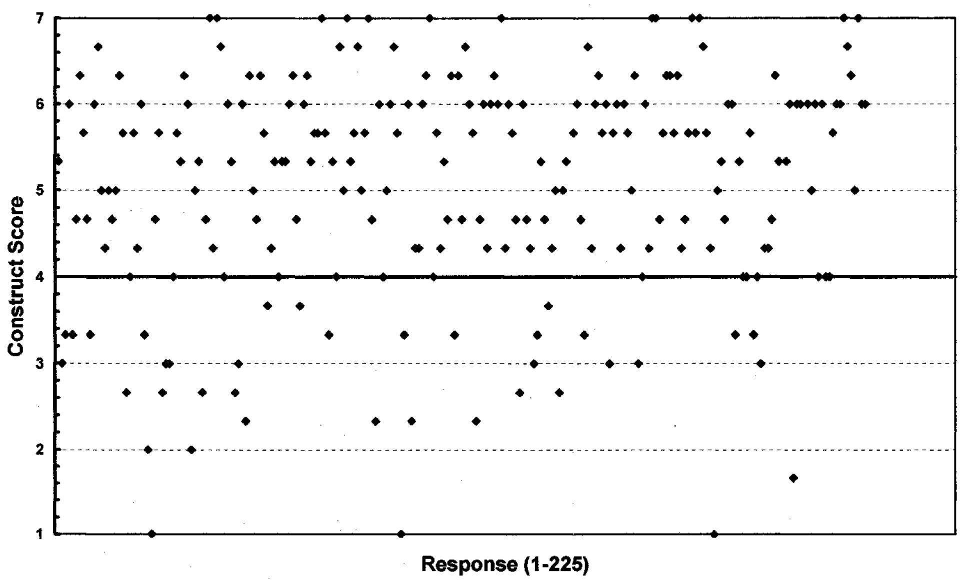


Figure P.19

Facilitating Conditions Construct Score Scatter Plot

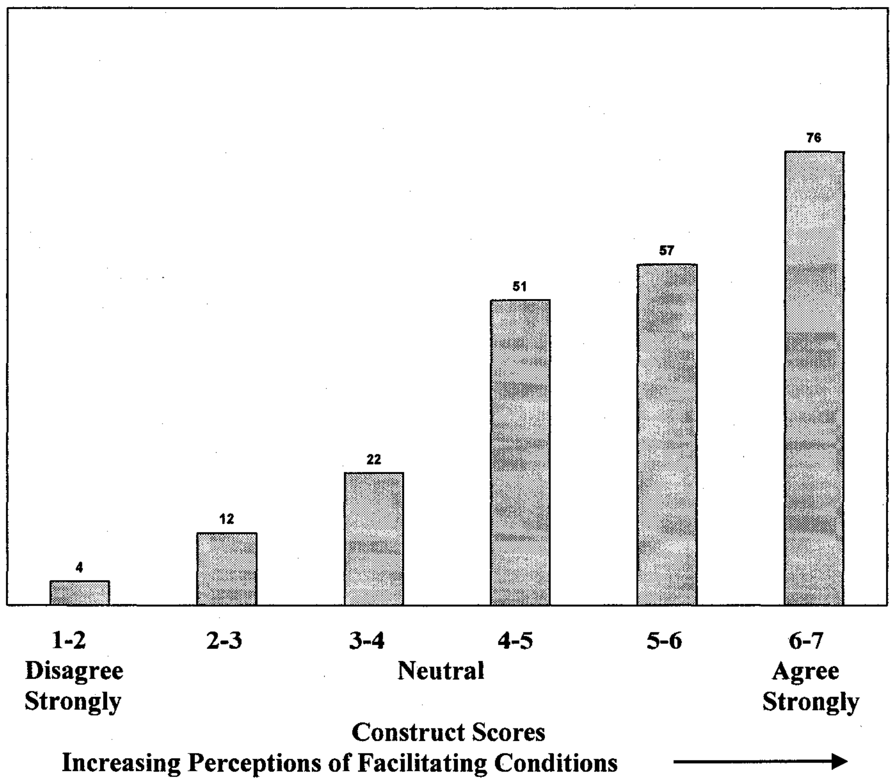


Figure P.20

Facilitating Conditions Construct Score Frequency Distribution

Appendix P

Research Construct Score Scatter and Frequency Plots

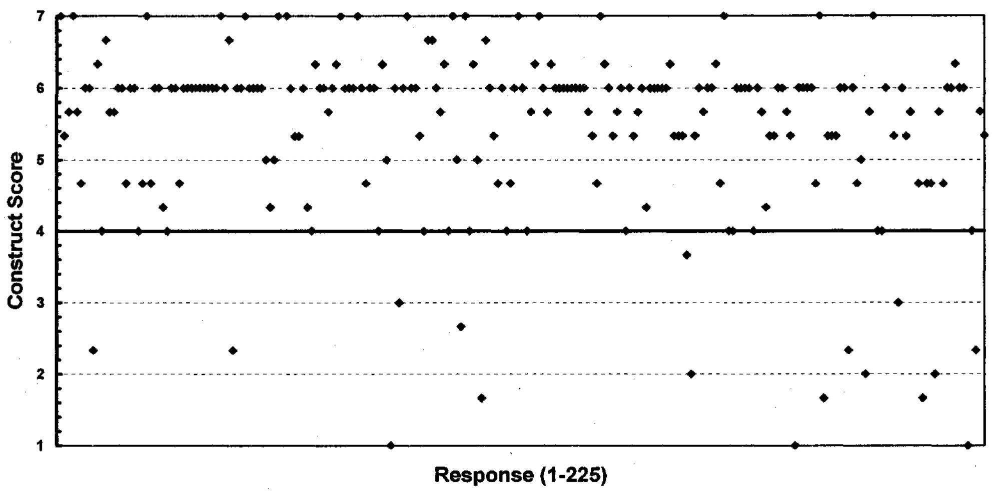


Figure P.21

Perceived Voluntariness Construct Score Scatter Plot

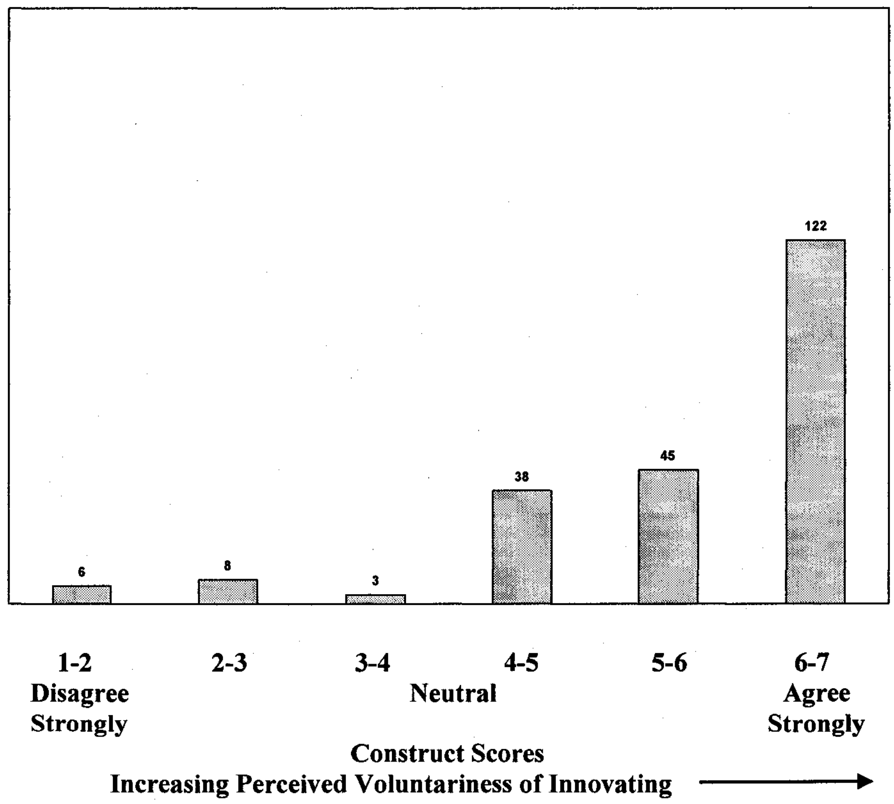


Figure P.22

Perceived Voluntariness Construct Score Frequency Distribution

Appendix P

Research Construct Score Scatter and Frequency Plots

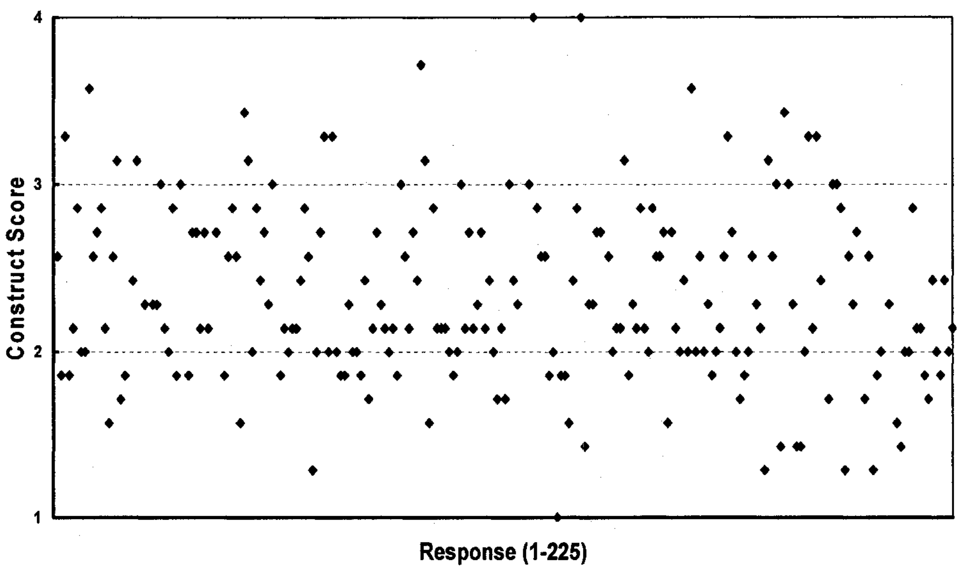
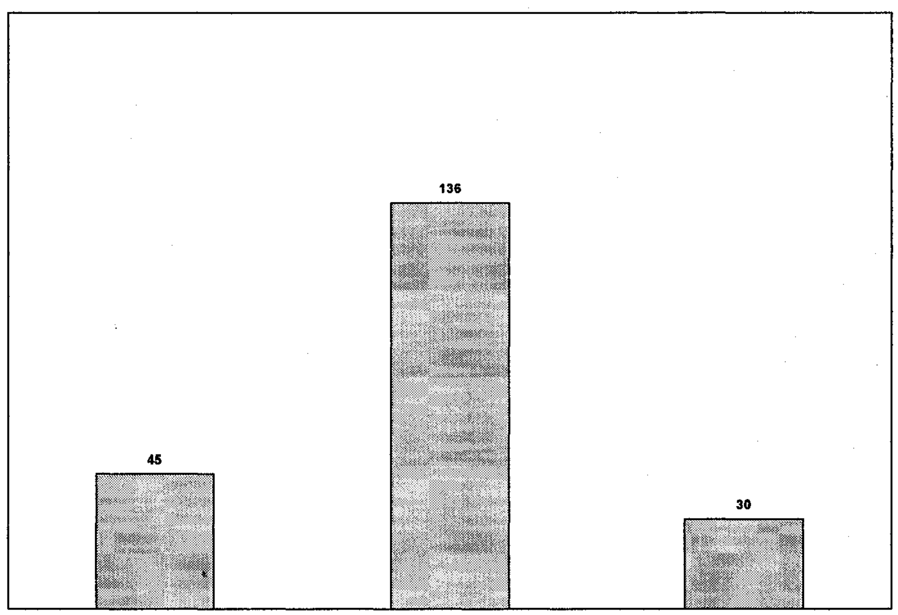


Figure P.23

Formalization Construct Score Scatter Plot



1-2 Definitely True | **2-3** | **3-4 Definitely False**

Construct Scores

Decreasing Organizational → Formalization

Figure P.24

Formalization Construct Score Frequency Distribution

Appendix P

Research Construct Score Scatter and Frequency Plots

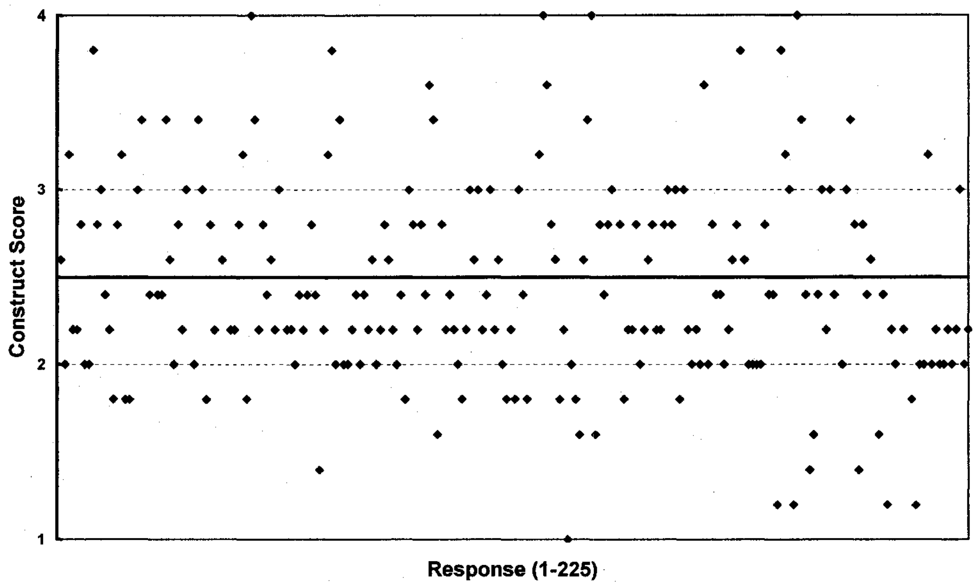


Figure P.25

Formalization Job Structure Sub-Construct Score Scatter Plot

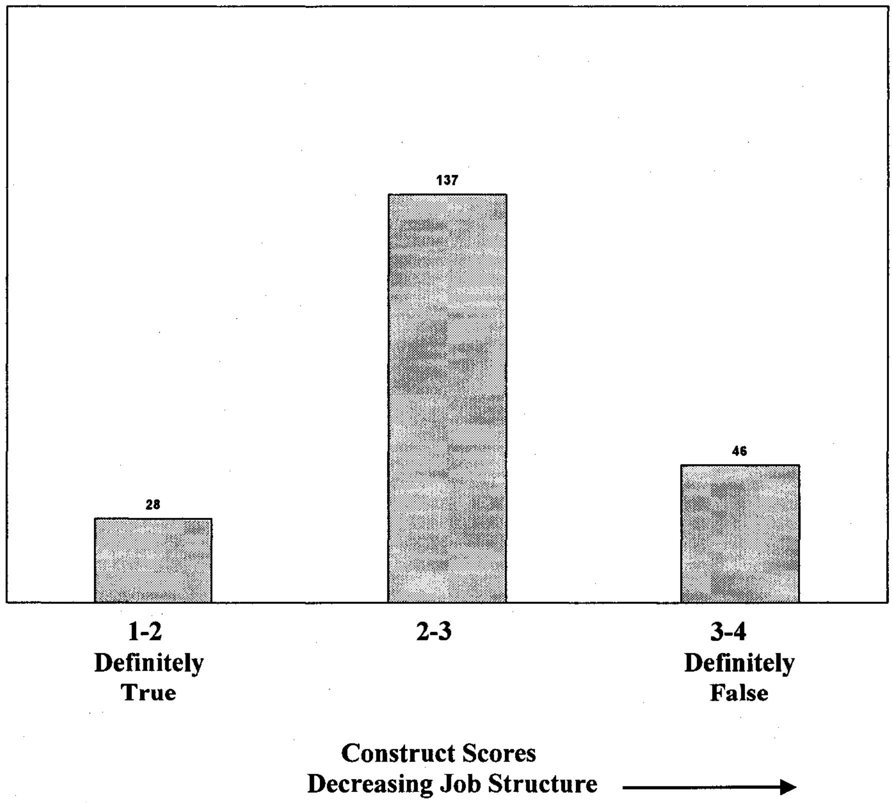


Figure P.26

Formalization Job Structure Sub-Construct Score Frequency Distribution

Appendix P

Research Construct Score Scatter and Frequency Plots

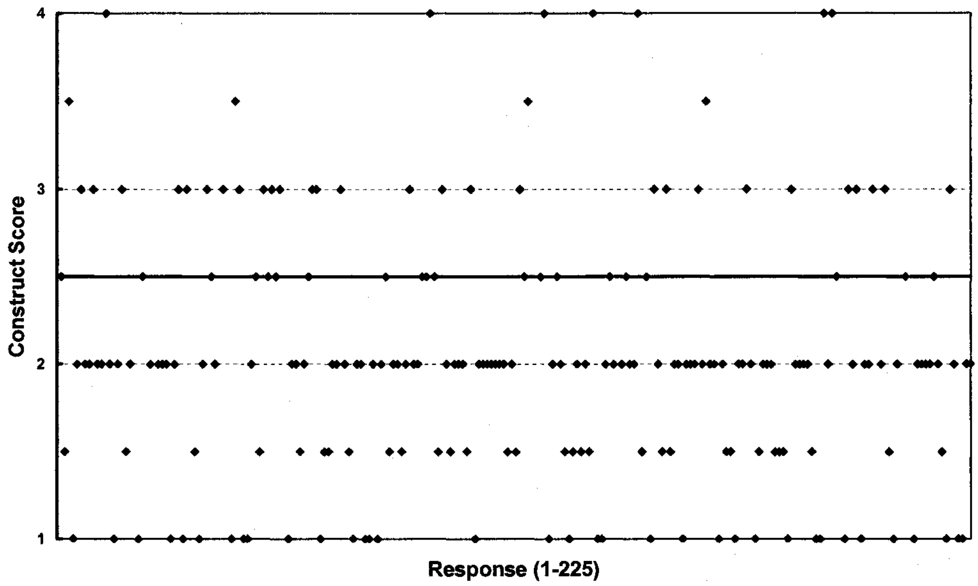
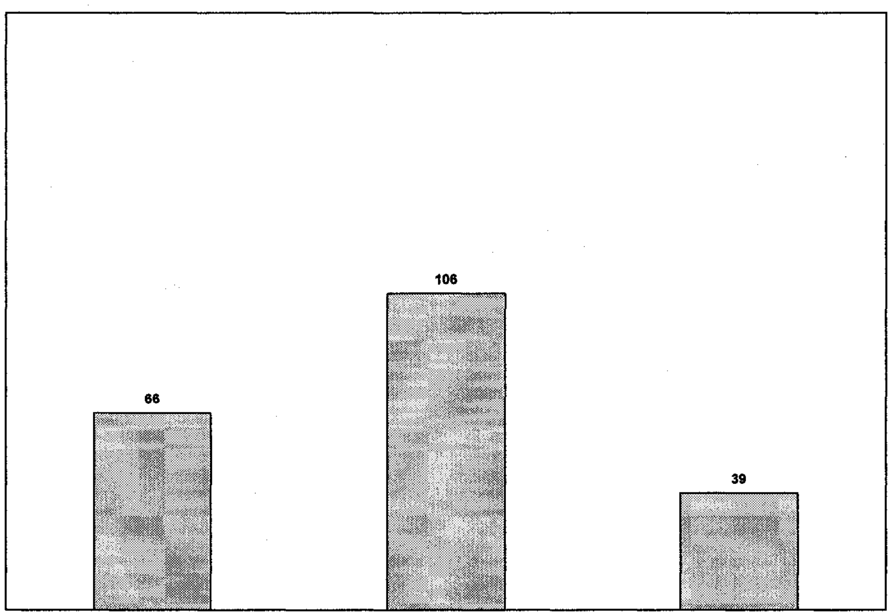


Figure P.27

Formalization Rule Enforcement Sub-Construct Score Scatter Plot



1-2 Definitely True | **2-3** | **3-4 Definitely False**

Construct Scores

Decreasing Rule ⟶ Enforcement

Figure P.28

Formalization Rule Enforcement Sub-Construct Score Frequency Distribution

Appendix Q

Survey Demographic Data

Demographic Item	Response Data (N)
70) Please indicate whether you are female or male.	**Number/ Percent (202)**
1. Female	58/29%
2. Male	144/71%
71) Please indicate your age.	**Number/ Percent (219)**
1. 25 or Under	1/.5%
2. 26-35	24/11%
3. 36-45	71/32%
4. 46-55	88/40%
5. 56-65	34/16%
6. 65+	1/.5%
72) Please indicate the highest level of education you have completed.	**Number/ Percent (220)**
1. Some High School	1/.5%
2. High School Degree	3/1%
3. Some College	27/12%
4. College Degree	57/26%
5. Some Graduate	31/14%
6. Graduate Degree	101/46%
73) Please indicate your present professional/employment status.	**Number/ Percent (221)**
1. US Department of State	200/91%
2. Other US Government Agency/Department	12/5%
3. US Military	7/3%
4. US Contractor	0
5. Non-US Military/Government	1/.5%
6. Non-US Contractor	0
7. Other	1/.5%

Appendix Q

Survey Demographic Data

Demographic Item	Response Data (N)
74) Please indicate the number of months you have been in the professional/employment status indicated in the preceding item.	**Number/ Percent (221)**
1. Fewer Than 12	8/4%
2. 12-35	10/5%
3. 36-59	16/7%
4. 60-83	9/4%
5. 84-119	26/12%
6. 120 or More	152/69%
75) Please indicate the number of months you have been working at this post/location.	**Number/ Percent (221)**
1. Fewer Than 6	44/20%
2. 6-12	15/7%
3. 13-24	77/35%
4. 25-47	69/31%
5. 48-59	4/2%
6. 60 or More	12/5%
76) In my current position at this post/location, I am most accurately described as:	**Number/ Percent (221)**
1. Potential VTC user	80/36%
2. Provider of support to others' VTC use	33/15%
3. Both potential user and supporter of other's VTC use	85/38%
4. Having no involvement with VTC	23/10%
77) Please indicate your months of experience using VTC before arriving at this post location.	**Number/ Percent (219)**
1. None	90/41%
2. Fewer Than 6	41/19%
3. 6-12	21/10%
4. 13-18	10/5%
5. 19-24	7/3%
6. More Than 24	50/23%

Appendix Q

Survey Demographic Data

Demographic Item	Response Data (N)
78) Please indicate your months of experience using VTC at this post/location.	**Number/ Percent (220)**
1. None	61/28%
2. Fewer Than 6	66/30%
3. 6-12	23/10%
4. 13-18	34//15%
5. 19-24	14/6%
6. More Than 24	22/10%
79) Please indicate the number of people who report to you either directly or indirectly through a subordinate.	**Number/ Percent (222)**
1. None	28/13%
2. 10 or Fewer	97/44%
3. 11-50	53/24%
4. 51-100	14/6%
5. More Than 100	30/14%

Construct/Item	N	Mean	Standard Deviation	1. Disagree Strongly	2. Disagree	3. Disagree Somewhat	4. Neutral	5. Agree Somewhat	6. Agree	7. Strongly Agree
Innovation Usage	**225**	**3.42**	**1.65**							
I use VTC a lot to do my work.	225	3.05	1.88	58	59	22	30	22	23	11
I use VTC whenever possible to do my work.	225	3.27	1.84	47	56	19	38	31	25	9
I use VTC frequently to do my work.	225	2.87	1.74	59	66	21	35	20	17	7
I use VTC whenever appropriate to do my work.	225	4.48	1.92	27	25	3	45	35	63	27
Perceived Relative Advantage of Innovating	**222**	**3.91**	**1.68**							
Using VTC enables me to accomplish tasks more quickly.	223	3.84	1.80	30	42	2	66	39	30	14
Using VTC improves the quality of work I do.	223	3.99	1.80	30	32	5	65	39	38	14
Using VTC makes it easier to do my job.	224	4.00	1.82	28	38	3	62	38	40	15
Using VTC enhances my effectiveness on the job.	224	4.11	1.83	27	35	2	59	41	43	17
Using VTC gives me greater control over my work.	224	3.58	1.67	30	43	14	81	26	19	11
Perceived Ease of Innovating	**221**	**4.24**	**1.41**							
I believe it is easy to get VTC to do what I want it to do.	224	3.94	1.59	20	31	22	67	45	31	8

Appendix R
Survey Item Response Data

Construct/Item	N	Mean	Standard Deviation	1. Disagree Strongly	2. Disagree	3. Disagree Somewhat	4. Neutral	5. Agree Somewhat	6. Agree	7. Strongly Agree
Overall, I believe VTC is easy to use.	222	4.46	1.62	17	14	17	61	44	52	17
Learning to operate/use VTC is easy for me.	223	4.33	1.53	11	21	19	78	33	48	13
Perceived Compatibility of Innovating	**220**	**3.86**	**1.45**							
Using VTC is compatible with all aspects of my work.	222	3.58	1.65	27	45	24	63	30	27	6
Perceived Compatibility of Innovating (Continued)										
I think using VTC fits well with the way I like to work.	223	3.97	1.54	19	29	14	84	39	31	7
Using VTC fits into my work style.	222	4.02	1.60	18	32	16	71	38	40	7
Top Management/Supervisor/Peer Subjective Norm	**223**	**15.15**	**5.88**							
The top management of my post/location thinks using VTC is valuable for accomplishing our job.	223	4.92	1.56	11	11	6	58	36	72	29
The opinions of the top management of my post/location are important to me.	223	6.01	1.14	2	4	1	17	17	99	83
Supervisor Subjective Norm	**222**	**15.07**	**5.83**							
My immediate supervisor thinks using VTC is valuable for accomplishing our job.	223	4.81	1.55	10	13	4	72	35	61	28
The opinions of my immediate supervisor are important to me.	222	6.15	1.01	1	3	0	13	14	100	91
Peer Subjective Norm	**220**	**13.09**	**5.55**							

Appendix R
Survey Item Response Data

Construct/Item	N	Mean	Standard Deviation	1. Disagree Strongly	2. Disagree	3. Disagree Somewhat	4. Neutral	5. Agree Somewhat	6. Agree	7. Strongly Agree
My peers think using VTC is valuable for accomplishing our job.	221	4.52	1.52	12	17	5	80	37	56	14
The opinions of my peers are important to me.	221	5.67	1.07	1	1	2	34	36	102	45
Perceived Image of Innovating	**220**	**3.28**	**1.34**							
People in my post/location who use VTC have more prestige than those who do not.	222	3.85	1.58	22	32	11	95	29	21	12
Perceived Image of Innovating (Continued)										
People in my post/location who use VTC have a high profile.	223	2.88	1.48	48	63	16	73	13	7	3
Using the VTC is a status symbol in my post/location.	222	3.58	1.71	31	46	18	60	32	28	7
Using the VTC is a status symbol in my post/location.	222	2.82	1.44	52	57	22	70	15	4	2
Organizational Commitment	**219**	**4.51**	**1.25**							
My post/location is committed to a vision of using VTC.	222	4.38	1.51	11	19	17	74	43	44	14
My post/location is committed to supporting my efforts to use VTC.	223	4.87	1.34	6	8	7	69	50	65	18
My post/location strongly encourages the use of VTC.	222	4.46	1.57	13	19	15	61	50	48	16
My post/location will recognize my efforts in using VTC.	223	4.23	1.41	10	21	17	85	49	31	10
The use of VTC is important to my post/location.	220	4.58	1.64	15	17	12	53	47	56	20

Appendix R
Survey Item Response Data

Construct/Item	N	Mean	Standard Deviation	1. Disagree Strongly	2. Disagree	3. Disagree Somewhat	4. Neutral	5. Agree Somewhat	6. Agree	7. Strongly Agree
Facilitating Conditions	**222**	**5.03**	**1.33**							
I have the resources necessary to use VTC.	222	4.88	1.75	18	13	15	24	42	82	28
I have the knowledge necessary to use VTC.	223	4.61	1.75	14	23	21	34	44	60	27
A specific person (or group) is available for assistance with VTC.	223	5.63	1.46	8	5	6	19	29	94	62
Voluntariness	**221**	**5.14**	**1.17**							
My superiors expect me to use VTC.[1]	223	4.31	1.74	15	23	27	69	18	44	27
My use of VTC is voluntary (as opposed to being required by my superiors or my job description).	223	5.27	1.39	6	6	9	42	25	107	28
My boss does not require me to use VTC.	222	5.51	1.46	8	7	7	23	14	122	41
Although it might be helpful, using VTC is certainly not compulsory in my job.	221	5.50	1.46	9	3	10	26	16	113	44

Note:
1. Item deleted due to questionable validity.

Appendix R
Survey Item Response Data

Construct/Item	N	Mean	Standard Deviation	1. Definitely False	2. More Often False Than True	3. More Often True Than False	4. Definitely True
Organizational Formalization	218	2.31	.555				
At this post/location, I feel I am my own boss in most job-related matters.	217	2.05	.789	50	118	37	12
At this post/location, a person can usually make his/her own decisions without checking with someone else.	217	2.52	.758	11	106	76	24
At this post/location, the way things are done is generally left up to the person doing the work.	216	2.34	.649	10	133	62	11
People at this post/location are allowed to do their job almost as they see fit.	216	2.45	.745	12	116	67	21
Most people at this post/location can make their own rules on the job.	215	2.90	.751	4	60	104	47
Employees at this post/location are constantly being checked on for rule violations.	216	2.10	.768	43	120	42	11
Employees at this post/location feel as though they are constantly watched to see that they obey the rules.	216	1.98	.821	66	98	43	9

Appendix R
Survey Item Response Data

Appendix S

Individual Survey Item Factor Loading Analysis

Construct[1]	Survey Item	Item Factor Loading	Communalit y Estimate
Intention to Use Innovation	4. I intend to use VTC in the next several months.	.97	.950
	5. I predict I will use VTC in the next several months.	.97	.948
	6. I plan to use VTC in the next several months.	.97	.936
Innovation Usage	7. I use VTC a lot to do my work.	.93	.869
	8. I use VTC whenever possible to do my work.	.85	.718
	9. I use VTC frequently to do my work.	.91	.833
	10. I use VTC whenever appropriate to do my work.	.72	.524
Perceived Relative Advantage of Innovating	15. Using VTC enables me to accomplish tasks more quickly.	.90	.813
	16. Using VTC improves the quality of work I do.	.93	.869
	17. Using VTC makes it easier to do my job	.96	.924
	18. Using VTC enhances my effectiveness on the job.	.92	.847
	19. Using VTC gives me greater control over my work.	.88	.780
Perceived Ease of Innovating	20. I believe it is easy to get VTC to do what I want it to do.	.75	.560
	21. Overall, I believe VTC is easy to use.	.88	.781
	22. Learning to operate/use VTC is easy for me	.80	.640
Perceived Compatibility of Innovating	23. Using VTC is compatible with all aspects of my work.	.73	.537
	24. I think using VTC fits well with the way I like to work.	.91	.822
	25. Using VTC fits into my work style.	.91	.829
Image Effect of Innovating	32. Using VTC improves my image within my post/location.	.68	.464
	33. People in my post/location who use VTC have more prestige than those who do not.	.88	.766
	34. People in my post/location who use VTC have a high profile.	.80	.633
	35. Using the VTC is a status symbol in my post/location.	.85	.721

Note:
1. Subjective norm constructs not included due to expectancy value structure.

Appendix S

Individual Survey Item Factor Loading Analysis

Construct[1]	Survey Item	Item Factor Loading	Communality Estimate
Organizational Commitment	36. My post/location is committed to a vision of using VTC.	.76	.585
	37. My post/location is committed to supporting my efforts to use VTC.	.71	.507
	38. My post/location strongly encourages the use of VTC.	.87	.754
	39. My post/location will recognize my efforts in using VTC.	.68	.463
	40. The use of VTC is important to my post/location.	.87	.765
Facilitating Conditions	41. I have the resources necessary to use VTC.	.71	.497
	42. I have the knowledge necessary to use VTC.	.57	.320
	43. A specific person (or group) is available for assistance with VTC.	.65	.427
Voluntariness of Innovating	44. My superiors expect me to use VTC.[2, 3]	.52	.262
	45. My use of VTC is voluntary (as opposed to being required by my superiors or my job description).	.62	.384
	46. My boss does not require me to use VTC.	.84	.711
	47. Although it might be helpful, using VTC is certainly not compulsory in my job.	.72	.517
Formalization (Job Structure)	48. At this post/location, I feel I am my own boss in most job-related matters.	.65	.424
	49. At this post/location, a person can usually make his/her own decisions without checking with someone else.	.78	.607
	50. At this post/location, the way things are done is generally left up to the person doing the work.	.85	.716
	51. People at this post/location are allowed to do their job almost as they see fit.	.84	.709
	52. Most people at this post/location can make their own rules on the job.	.62	.390
Formalization (Rule Enforcement)	53. Employees at this post/location are constantly being checked on for rule violations.	.76	.582
	54. Employees at this post/location feel as though they are constantly watched to see that they obey the rules.	.76	.582

Notes:
1. Subjective norm constructs not included due to expectancy value structure.
2. Item reverse coded.
3. Item deleted from analysis due to questionable validity.

Appendix T

Subjective Norm/Organizational Commitment Regression Analysis

Regression	Dependent Variable	Independent Variable	Coefficient of Determination (R^2)	R^2 p-Value	Beta Coefficient	Beta p-value
1	USGE	TMSN	.256	<.0001	.507	<.0001
2	COMT	TMSN	.525	<.0001	.724	<.0001
3	USGE	TMSN	.385	<.0001	.125	.107
		COMT			.524	<.0001
4	USGE	TMSN	.256	<.0001	.507	<.0001
5	SUSN	TMSN	.508	<.0001	.711	<.0001
6	USGE	TMSN	.356	<.0001	.184	.019
		SUSN			.453	<.0001
7	USGE	TMSN	.446	<.0001	-.081	.343
		SUSN			.357	<.0001
		COMT			.460	<.0001
8	USGE	COMT	.444	<.0001	.423	<.0001
		SUSN			.322	<.0001

Top Management Subjective Norm, Supervisor Subjective Norm, Organizational Commitment Investigation Regression Results

Discussion: Regressions one, two, and three illustrate mediating role of organizational commitment (COMT) in the relationship between top management subjective norm (TMSN) and innovation acceptance/use (USGE). Thus, when the effects of organizational commitment are removed from the relationship between top management subjective norm and innovation acceptance/use, no significant relationship remains.

Regressions three, four, and five illustrate the mediating role of supervisor subjective norm on the relationship between top management subjective norm and innovation acceptance/use. Although supervisor subjective norm is not as powerful a mediator of the top management subjective norm-innovation acceptance/use relationship as organizational commitment, the observed reduction in statistical

Appendix T

Subjective Norm/Organizational Commitment Regression Analysis

significance and of regression coefficient magnitude in the multiple regression (6) are evidence of mediation. (Baron & Kenny, 1986)

Regressions seven and eight provide additional persuasive evidence of the nature of the relationship among these three predictors and innovation acceptance/use. In regression seven, top management subjective norm is not statistically significant when the effects of organizational commitment and supervisor subjective norm are controlled in the three predictor multiple regression.

Regression eight results show that removal of top management subjective norm has a negligible effect on explanatory value (R2 reduced .2% from the three predictor model) and that organizational commitment and supervisor subjective norm explain more than 44% of the variance in innovation acceptance/use behavior.