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INFORMATION TECHNOLOGY ADOPTION ACROSS TIME: A CROSS-SECTIONAL COMPARISON OF PRE-ADOPTION AND POST-ADOPTION BELIEFS[1]

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Abstract

The process of information technology adoption and use is critical to deriving the benefits of information technology. Yet from a conceptual standpoint, few empirical studies have made a distinction between individuals' pre-adoption and post-adoption (continued use) beliefs and attitudes. This distinction is crucial in understanding and managing this process over time. The current study combines innovation diffusion and attitude theories in a theoretical framework to examine differences in pre-adoption and post-adoption beliefs and attitudes. The examination of Windows technology in a single organization indicates that users and potential adopters of information technology differ on their determinants of behavioral intention, attitude, and subjective norm. Potential adopter intention to adopt is solely determined by normative pressures, whereas user intention is solely determined by attitude. In addition, potential adopters base their attitude on a richer set of innovation characteristics than users. Whereas pre-adoption attitude is based on perceptions of usefulness, ease-of-use, result demonstrability, visibility, and trialability, post-adoption attitude is only based on instrumentality beliefs of usefulness and perceptions of image enhancements.

Keywords: MIS implementation, innovation diffusion, innovativeness, adoption, Theory of Reasoned Action, IS use, user attitudes, user behavior

ISRL Categories: AA0102, AA03, EI0208, EL05, GB02, GB03

[1]Robert Zmud was the accepting senior editor for this paper.

Introduction

Information technology (IT) usage is a key dependent variable in MIS research (DeLone and McLean 1992) and many studies have empirically examined its determinants (e.g., Adams et al. 1992; Christensen 1987; Davis 1989, 1993; Mathieson 1991; Moore and Benbasat 1996; Pavri 1988; Taylor and Todd 1995; Thompson et al. 1991). However, the temporal dimension of the adoption process—i.e., the sequence of activities that lead to the initial adoption and subsequent continued usage of an IT innovation at the individual adopter level—has been ignored in most empirical studies investigating user beliefs and attitudes. Do the antecedents of user adoption of IT change over time as individuals start using the IT? Are the antecedents of adoption the same as the antecedents of usage? A prior conclusion (Kwon and Zmud 1987) is that research should explore the impact of contextual factors, such as the characteristics of the technology and their interaction with organizational and task characteristics, on *multiple* implementation stages. These factors may well have divergent impacts on the various stages of the innovation decision process.

Some studies in the general information systems (IS) implementation/diffusion area have articulated and/or tested differences across stages of the innovation decision process (e.g., Brancheau and Wetherbe 1990, Cale and Eriksen 1994, Cooper and Zmud 1990; for reviews see Kwon and Zmud 1987 and Prescott and Conger 1995). For example, Cooper and Zmud have investigated the impact of compatibility and complexity on adoption and infusion of material requirements planning (MRP) practices at the organizational level. Brancheau and Wetherbe have studied the influence of IT departments and internal communication channels during adoption and implementation of spreadsheets at the individual level.

However, with two exceptions (Davis et al. 1989; Thompson et al. 1994), individual-level empirical studies in the general Theory of Reasoned Action (TRA)/Planned Behavior (TPB) tradition (e.g., Adams et al. 1992; Agarwal and Prasad 1997; Christensen 1987; Davis 1989, 1993; Mathieson 1991; Moore and Benbasat 1996; Pavri 1988; Taylor and Todd 1995; Thompson et al. 1991) have not articulated or tested for differences in the determinants of attitude or behavior prior to and post-adoption. Further, even though 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 (Rogers 1983).

Consequently, the theoretical contributions of the study are threefold. First, this is the first study that we are aware of to empirically examine the differential influence of a *comprehensive* set of innovation attributes on both adoption and usage behaviors. Second, a theoretical rationale is provided for differences across adoption and usage based on theories of attitude formation. Third, a distinction is made between adoption and usage behaviors. Prior comparative studies in this vein compare antecedents of initial usage behavior soon after adoption with antecedents of usage for more experienced users. Therefore, the dependent variables examined are intention to use or current level of usage for both initial and continued usage. This paper differs in approach. For adoption, end-user perceptions are captured *prior* to adoption, and the dependent variable is intention to adopt rather than intention to use. This is an important distinction since, according to TRA, studies need to be specific as to the target behavior of interest. If adoption is of interest, then the dependent variable should be intention to adopt or adoption behavior.

In this vein, the current study attempts to contribute to a better theoretical understanding of the antecedents of user acceptance and user resistance to adoption and usage of information technology. Specifically, the study investigates whether differences exist between the determinants of (1) adoption and usage of IT, (2) attitude toward adopting and attitude toward continuing to use IT, and (3) subjective norm toward adopting and subjective norm toward continuing to use IT.

From a theoretical perspective, identifying antecedents of user adoption and usage of IT and determining how they differ extends our current

state of knowledge. According to Melone (1991, p. 77), "for the most part, the IS literature is silent on how users *form initial attitudes* about technologies and how these *attitudes are modified over time*" (emphasis added).

From a practical perspective, knowing which criteria are important for adoption and which for usage enables systems developers and IT champions to employ more targeted implementation efforts at each phase of the adoption process. By emphasizing only *relevant* criteria at each phase, the change agents can greatly enhance their efficiency and effectiveness. This is becoming increasingly important as organizational investments in IT continue to rise and since IT adoption and usage are critical prerequisites for obtaining the productivity benefits that IT has been touted to provide.

The paper proceeds as follows. The next section discusses the general research question guiding the study. The research model and ensuing hypotheses are presented next, followed by a description of the field study conducted. The data analysis methods used to validate the scales and test the research model are then presented, and the results of the study are described and discussed. The study concludes with a discussion of the theoretical and practical implications of the findings.

General Research Question

The innovation decision process leading to institutionalization of usage may be conceptualized as a temporal sequence of steps through which an individual passes from initial knowledge of an innovation, to forming a favorable or unfavorable attitude toward it, to a decision to adopt or reject it, to putting the innovation to use, and to finally seeking reinforcement of the adoption decision made (Rogers 1983).[2] Key constructs in this innovation-decision process are the innovation's perceived attributes, the individual's attitude and beliefs, and communications received by the individual from his/her social environment about the innovation. *The general research question this paper examines is whether these key constructs differentially influence pre-adoption and post-adoption behaviors.*

Most of the research studying end-user beliefs and attitudes (e.g., Christensen 1987; Davis 1989; Mathieson 1991; Moore and Benbasat 1996; Pavri 1988; Taylor and Todd 1995; Thompson et al. 1991) has examined users' beliefs about specific IT *after* they have already adopted and are using the IT. Consequently, results of the above studies identify beliefs that users hold for continued use of IT. These may not be the beliefs that lead to initial adoption. Even though adoption is a prerequisite for usage, factors that affect adoption may have the opposite effect on the later decisions to continue using the innovation (Tornatzky et al. 1983). Identification of these pre-adoption criteria and their comparison to post-adoption criteria remains an important unanswered question in IS research.

Support for such differences between adoption and usage has been provided by consumer behavior research (e.g., Howard and Sheth 1969) and cognitive dissonance theory (Cummings and Venkatesan 1976; Festinger 1957). According to these theories, use of a product may change one's perceptions, attitudes, and needs with respect to use of the product. As a result, beliefs after use of the product may not be the same as the set of beliefs that have led to initial adoption. In innovation diffusion literature, Klonglan and Coward (1970) corroborate this notion by suggesting that sociological variables may be more important in explaining mental acceptance of innovations, whereas economic variables may be more important in explaining use. In addition, Triandis (1971) suggests that social norms and affect will have a more pronounced effect in determining behavior when the behavior is new (as in adoption). Their influence on behavior will decrease as users become more experienced.

The IS implementation literature also provides some evidence for differences in the antecedents of adoption and usage. For instance, Davis et al. (1989) found that while ease of use is a significant determinant of use after one hour of use of IT, it has a non-significant effect on use after 14

[2]In this paper, the stages leading to the adoption decision will be collectively referred to as pre-adoption stages (where the target behavior is adoption), and the stages following the adoption decision will be collectively referred to as post-adoption stages (where the target behavior is continued usage).

weeks of usage. In addition, Thompson et al. (1994) found that the influence of social norms and affect on usage were greater for inexperienced than for experienced users. Further, ease of use had a greater influence on utilization for inexperienced users, corroborating the results of Davis et al. Note, however, that in both studies the focus was usage behavior for both experienced and inexperienced users, rather than adoption behavior. Further, Cooper and Zmud (1990) and Laudon (1985) argue that adoption is better explained by "rational" task-technology fit, and that later implementation stages such as infusion are better explained by more socio-political and "learning" approaches such as bureaucratic self-interest.

The Research Model

The theoretical model for the study combines aspects of the Theory of Reasoned Action (Fishbein and Ajzen 1975) with aspects of Innovation Diffusion Theory (Rogers 1983) in a complimentary manner (see Figure 1). As described above, the innovation decision process involves the evaluation of an innovation by the individual and, based upon this evaluation, the formation of an attitude toward the innovation. Yet Innovation Diffusion Theory (IDT) is silent concerning how this attitude is formed, how it leads to the eventual adoption or rejection decision, and how innovation characteristics fit into this process. The attitudes literature provides the theoretical framework needed at this level to define the linkages between beliefs about adopting (and using) the innovation (i.e., the innovation characteristics), communications received by the end-user about adopting the innovation, attitude, and the eventual adoption/rejection, and use of the innovation (Moore 1989). Toward this end, TRA provides the underlying structure for the theoretical model of the study as well as a theoretical description of how the different components of the innovation decision process fit together. The content of the beliefs derives from IDT. It should be noted that the objective of this research is *not* to test TRA. Rather, TRA is used to inform the relationships among the different constructs of the study[3] to investigate the following research questions:

R1: Is the relative importance of attitude and subjective norm in determining behavioral intention the same for potential adopters and users of IT?

R2: Do potential adopters and users of IT hold the same behavioral and normative beliefs?

Triandis (1980) provides a theoretical explanation as to how pre-adoption beliefs change once the IT innovation is adopted and used. By explicitly linking initial beliefs with beliefs one holds subsequent to behavior,[4] his theoretical framework helps us conceptualize the transition between the different stages in the process. Triandis suggests that actual consequences of one's behavior are interpreted and internalized and, in turn, change one's behavioral beliefs about the behavior in two ways. First, they change one's perceived probability that the behavior will have the particular consequences. Second, they change one's evaluations of these consequences. In turn, these new probabilities and evaluations become antecedents to behavioral intention. Thus, the Triandis model explicitly models feedback loops that provide a theoretical explanation as to how pre-adoption beliefs change once the IT innovation is adopted and used.

TRA suggests that the best predictor of adoption (or continued use) behavior is intention to adopt (or continue to use) the IT (*behavioral intention*).[5]

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[3]However, since TRA is used to define the causal linkages among beliefs, attitude, norms, and intention, in a strict sense, the study is testing the causal relationships postulated in TRA.

[4]Triandis (1980), however, does not propose a causal path between behavioral beliefs (perceived consequences) and affect. Rather, both affect and perceived consequences directly influence behavioral intention.

[5]The role of behavioral intention as a mediating variable declines in cases of non-volitional or habitual behaviors or when a long period of time lapses between measurement of intention and behavior. In such cases, attitude emerges as a strong predictor of behavior (Breckler and Speckart 1979). In cases of habitual behavior, past behavior becomes a powerful predictor of behavior. In fact, Triandis (1980) models habit as a direct antecedent to behavior. The behavioral intention-behavior link is stable over time if behavioral intention is linked to a person's identity, it is more well-formed, and/or when people are committed to the behavior.

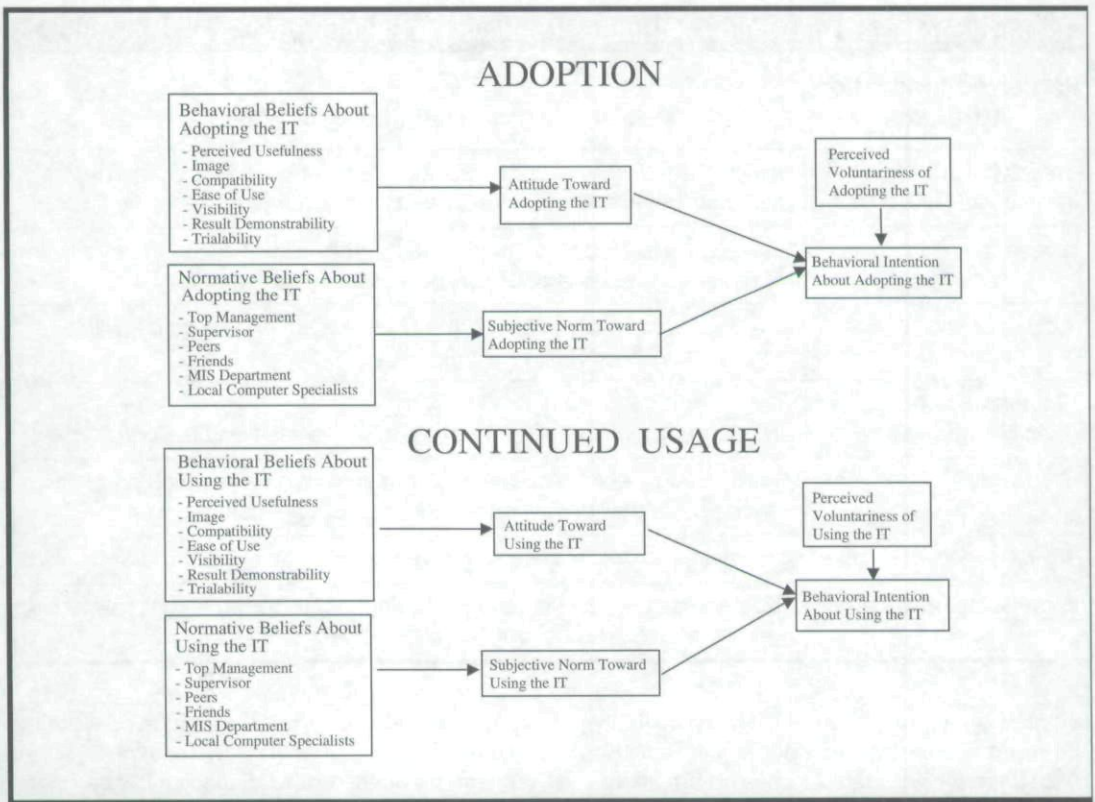

Figure 1. Theoretical Models

An individual's intention to adopt (or continue to use) the IT is determined by two basic factors: one reflecting personal interests and one reflecting social influence. The personal factor, *attitude toward adopting* (or continuing to use) the IT, reflects the individual's positive and negative evaluations of performing the behavior. The social influence factor, *subjective norm,* refers to the individual's perceptions of the social pressures to adopt or not adopt (continue using or stop using) the IT.

Determinants of Attitude

Attitude toward adopting (or continuing to use) an IT is generated by the individual's salient beliefs about the consequences of adopting (continuing to use) the IT (*behavioral beliefs*) and *evaluation of these consequences.* Thus, attitude is derived by the strength of the person's beliefs that adopting (or continuing to use) the IT will lead to certain consequences, each weighted by the evaluation of each belief's behavioral consequences (Ajzen and Fishbein 1980).

The innovation diffusion literature provides a set of innovation characteristics that may affect an individual's opinion of the innovation prior to adoption and may affect the rate at which innovations are adopted. These attributes provide a theoretically based set of behavioral beliefs for the study.[6] They include relative advantage (or perceived usefulness), image, compatibility,

[6]A distinction is made between perceptions of the innovation itself and perceptions of *adopting/using* the innovation (Moore 1987, 1989). Since it is *adoption/use* of an innovation that is key to diffusion, then the perceived characteristics of innovation as defined by Rogers (1983) should be redefined in terms of adopting/using the innovation. This convention is used in the current research. This distinction is consistent with TRA where attitude toward an object may be different than attitude toward a behavior with respect to the object.

Table 1. Perceived Innovation Attributes (Behavioral Beliefs)

Perceived Innovation Attributes	Definition
Relative Advantage (Perceived Usefulness)	the degree to which adopting/using the IT innovation is perceived as being better than using the practice it supersedes
Image	the degree to which adoption/usage of the innovation is perceived to enhance one's image or status in one's social system
Compatibility	the degree to which adopting the IT innovation is compatible with what people do
Complexity (Ease of Use)	the degree to which using a particular system is free of effort
Trialability	the degree to which one can experiment with an innovation on a limited basis before making an adoption or rejection decision
Visibility	the degree to which the innovation is visible in the organization
Result Demonstrability	the degree to which the results of adopting/using the IT innovation are observable and communicable to others

complexity (or ease of use), trialability, visibility, and result demonstrability (Moore and Benbasat 1996; Rogers 1983). Table 1 presents brief definitions for these attributes. Tornatzky and Klein's (1982) meta-analysis indicates that, of these seven attributes, only relative advantage, compatibility, and complexity were consistently related to adoption and/or utilization decisions.

A number of IS studies have examined the effect of perceived usefulness and perceived ease of use on usage and have found these to be important determinants of self-reported system use (e.g., Adams et al. 1992; Davis 1989, 1993; Davis et al. 1989; Mathieson 1991; Taylor and Todd 1995). Only Moore and Benbasat (1996) and Agarwal and Prasad (1997) examined the effect on usage of *all* innovation characteristics *simultaneously*. Moore and Benbasat's results showed compatibility, perceived usefulness, and ease of use to be most influential for continued *usage* decisions. Result demonstrability, visibility, image, and trialability were not significant in determining usage of personal workstations. Agarwal and Prasad examined current usage behavior and continued usage intentions for the Web. They found that while current level of usage is influenced by perceptions of visibility, compatibility, and trialability, continued usage intentions were only influenced by perceived usefulness and result demonstrability. None of these studies examined the effect of these innovation attributes on adoption behavior.

Differences between pre-adoption and post-adoption attitude: Attitude may be formed based on three general classes of information: information concerning past behavior, affective information, and cognitive information (Zanna and Rempel 1988). It is reasonable to assume that pre-adoption beliefs are formed primarily based on indirect experience (affect or cognition) with IT while post-adoption usage beliefs are formed based on past experience. The question is, then, whether "the underlying attitudes of two individuals with identical attitude scale scores differ in their predictive validity if one person's attitude is based on prior behavior and the other person's attitude is not so based" (Fazio and Zanna 1981, pp. 165-166).

Empirical evidence suggests that attitudes based on direct experience with an attitude object predict behavior better than attitudes formed based

on indirect experience (Fazio and Zanna 1981; Fazio et al. 1982). There are three explanations for this. First, more information about the attitude object may be available through direct experience than indirect experience. Information derived through direct experience with the attitude object is likely to result in the individual being more able to evaluate the object clearly and confidently. Second, since direct experience involves actual behavior toward the attitude object, then the behavior itself is more salient to an individual. In contrast, indirect behavior, which involves some medium describing the attitude object, may result in the medium or description (and not behavior) being salient. Therefore, direct experience may lead an individual to be more attentive to incoming *behavioral* information, which in turn facilitates the ease with which one forms one's attitude. Finally, direct experience leads to the formation of an attitude, which is more readily *accessible* in memory, which in turn results in a stronger attitude-behavior relationship. The last two factors are based on the theoretical assumption (Bem's [1972] self-perception theory) that "people consider behavioral experiences to be reliable information that is highly reflective of their attitudes toward the given object. As a result, individuals form relatively strong attitudes when they can employ such information as the basis of their attitudes" (Fazio and Zanna 1981, p. 193).

In the context of this research then, it is expected that the attitude-behavior link for users of an IT will be stronger than for potential adopters of the IT. This contradicts Triandis (1971), who suggests that the affect-behavior link weakens as individuals become more experienced. In addition, since more and richer information is available, in general, through direct rather than indirect experience, one would expect users to have a richer, more complex set of behavioral beliefs underlying their attitude toward continuing to use an IT than do potential adopters of an IT.

H1: The relationship between attitude and behavioral intention will be stronger for users than for potential adopters of an IT.

H2: There will be more behavioral beliefs underlying attitude for users than for potential adopters of an IT.

Determinants of Subjective Norm

Subjective norm, the second component of the model, is generated by the *normative beliefs* that the person attributes to what relevant others (salient referents) expect her to do with respect to adopting (or continuing to use) the IT as well as her *motivation to comply* with those beliefs.

The subjective norm component is closely related to the communication network aspects of IDT which lie at the heart of the diffusion process. Despite the importance of the communication network in innovation diffusion, most diffusion research has ignored the effects of social influence (Rogers 1976). There are two types of social influence: (1) informational influence, which occurs when individuals accept information as evidence of reality, and (2) normative influence, which occurs when individuals conform to the expectations of others (Bearden et al. 1986; Burnkrant and Cousineau 1975). Social influence is hypothesized to operate through three processes: internalization, identification, and compliance (Kelman 1961). Internalization results from accepting information from expert sources and integrating this information into one's cognitive system. Identification results from feeling some bond with a likable source and persists for as long as the likable source is still salient. Finally, compliance is produced by a powerful source having control over the message recipient in the form of rewards and punishments. Internalization is a form of informational influence while identification and compliance are forms of normative influence. The social normative component of the model captures the collective effect of these influences on behavioral intention.

The possible salient referents for the social normative component with respect to individuals' adoption/continuous usage of IT in organizations have been derived through a review of the MIS and organizational communication literature. They are top management, supervisors, peers, the organization's MIS department, local computer technology experts, and friends (e.g., Brancheau 1987; Cale and Eriksen 1994; Leonard-Barton 1987; Moore 1989; Salancik and Pfeffer 1978; Schmitz 1987; Schmitz and Fulk 1991; Wynekoop 1992).

Differences between pre-adoption and post-adoption subjective norm: An innovation creates uncertainty about its expected consequences for potential adopters (Rogers 1983). Individuals are in general uncomfortable with uncertainty and will tend to increase communication (Katz and Tushman 1979; Van de Ven et al. 1976) to interpret the innovation and its implications (Burkhardt and Brass 1990; Katz 1980). These increased interactions with the social network may influence one's adoption decision via informational and normative influence. Informational influence occurs when near-peers of the potential adopter inform the potential adopter of their own personal experience and evaluation of the innovation or when the potential adopter can observe peers using the innovation. Use by peers, termed psychological or vicarious trial, can be a very effective source of evaluative information (Bandura 1977). In addition to informational influence, normative pressure from supervisors and peers to adopt the innovation reduces the risk of adoption and uncertainty since it provides strong evidence indicating the legitimacy and appropriateness of the adoption decision. Since the level of uncertainty declines as individuals move through the stages of the adoption process, we would expect more uncertainty coping activities (and thus more reliance on the social network) at the pre-adoption stages than at the post-adoption stages. As a result, we may expect the impact of the social network to vary across adoption and usage behaviors.

H3: The relationship between subjective norm and behavioral intention will be stronger for potential adopters than for users of an IT.

Perceived Voluntariness

An underlying assumption of TRA is that behavior is under volitional control. Consequently, a question arises concerning the degree of volitional control that end users have over their computing activities and specifically over adoption and usage. One study found, for instance, that perceived voluntariness of usage of personal workstations is not a dichotomous variable (voluntary versus compulsory), but, rather, it is distributed normally (Moore 1989). Specifically, the results of that study show that degree of perceived voluntariness of use affects attitudes toward usage as well as the extent to which attitudes toward usage predict use. The less voluntary the behavior, the less one's attitude toward usage predicts use. Similarly, another study (Hartwick and Barki 1994) found that the relative impacts of attitude and subjective norm in the Theory of Reasoned Action differed depending on whether usage was mandatory or voluntary. As a result, perceived voluntariness was added to the model to account for the fact that adoption and usage of many IT innovations may not be entirely voluntary.[7]

Methodology

A cross-sectional field study was conducted at a large financial institution headquartered in the Midwest in 1993. Questionnaires and interviews were used to collect the data. The choice of a single organization controls for the effect which organizational level variables, such as institutional constraints and infrastructure arrangements, can have on individual adoption (Brown 1981) making it more likely that micro level effects will be detected.

The information technology being introduced in the organization was Microsoft's Windows 3.1 software package to replace the MS DOS operating system. Adoption of Windows at this site constituted a "contingent" decision (Rogers 1983, pp. 347-348). This implies that the organization had made the decision to adopt Windows, but individuals and departments had discretion as to when they would adopt. Individuals and departments were encouraged to adopt Windows, but there was no overt pressure to adopt within a certain timeframe. Making the decision to adopt Windows was costless to the user, but was charged back to the user's department. At the

[7]This is consistent with the Theory of Planned Behavior (TPB), which has added a perceived behavioral control component to TRA to reflect the fact that "successful performance of the intended behavior is contingent on the person's control over the many factors that may prevent [or facilitate] it" (Ajzen 1988, p. 132). The contribution of this component to prediction of a behavior is inversely related to the amount of control the individual has over the behavior (Madden et al. 1992).

time of the study, just over half of the PC users in the organization had adopted Windows.

To ensure that beliefs included in the study were salient to the respondents, a belief elicitation process was followed as suggested by Ajzen and Fishbein (1980). This made it unlikely that any salient beliefs were excluded from the set of innovation characteristics. The full procedure is described below.

Potential adopters were defined as individuals who had knowledge of Windows but who had not yet started using Windows. Therefore, potential adopters were screened by having them classify their knowledge of Windows on a scale of 1 (know nothing) to 5 (I am an expert). Only individuals who were knowledgeable about Windows were asked to complete the questionnaires.

Questionnaire Development

Two questionnaires were developed, one for adoption and one for continued use of Windows following the scale guidelines of the Theory of Reasoned Action (Ajzen and Fishbein 1980). Thus, the questions were specific and consistent with respect to action (adoption or continued use), target (Windows software package), context (an individual's job), and time (in the next six months).

Behavioral beliefs in the pilot study were measured using Moore and Benbasat's (1991) validated 34-item survey instrument. However, further validation of the instrument in the context of the study and using the pilot study data necessitated changes in the final instrument used. Appendix A includes the resulting questionnaire items for the study. Identical questions were asked on both the potential adopter and user questionnaires; the wording was modified to reflect either adoption or continued use behavior.

Ajzen and Fishbein (1980) suggest that for each new context, population, and behavior, new sets of beliefs and salient referents must be elicited. To identify these salient beliefs, they suggest using the free-response format where an individual is asked about the consequences of the behavior in question *without* any prompting or probing by the interviewer. To apply this procedure to the site in the study, 10 potential adopters of Windows and 10 users of Windows were interviewed. The results of this procedure and testing for criterion validity confirm that the respondents' salient beliefs are captured by the constructs included in the study.

Furthermore, as Ajzen and Fishbein recommend, it is critical that sources of social norms included in the study are salient to the respondents. The respondents identified the following groups as referents: everybody, boss, people in our department (peers), technical support staff, and senior management. These groups were exactly the groups identified through the literature review.

Pre-Test and Pilot Test

Both a pre-test and a pilot test were conducted to validate the instrument. For the pre-test, the questionnaire was administered in face-to-face interviews to 21 randomly selected end users (11 potential Windows adopters and 10 Windows users) at the research site. Feedback was obtained about the length of the instrument, the format of the scales, construct validity, and question ambiguity. In addition, respondents were asked to identify any factors not on the questionnaire that they considered important in their adoption or usage of Windows. In this way the content validity of the instrument was assessed. The respondents also provided the terminology they use in their organization for various processes and functions. These terms were then used to tailor the questionnaire to this particular organization.

To pilot test the instruments and administration procedures, questionnaires were mailed to 300 individuals randomly selected from the population of end users in the organization. The data obtained from the pilot study was examined for completeness of responses, reliability, and construct validity. Subsequently some changes were made to the questionnaires. For example, Moore and Benbasat's (1991) scales were modified to the version found in Appendix A.

Data Analysis

The revised questionnaires were mailed to all 977 PC users in the organization. Both the user

and potential adopter questionnaires were mailed to all users since there was no way to a priori identify who had already adopted Windows. Instructions were included that informed individuals which questionnaire to complete. Individuals who were using Windows either at work or at home were asked to fill out the usage questionnaire.

Of the 977 questionnaires, 26 were returned because the respondents were no longer employed at the organization. Of the remaining 951 questionnaires, 268 were returned for a response rate of 28.2%. Of these, 107 were from potential adopters of Windows and 161 were from users of Windows. Nineteen of the 107 potential adopters had no knowledge of Windows and they were, therefore, dropped. The final sample for potential adopters was 77 and for users 153, a number of observations having been dropped because of missing data. Demographic data about the respondents in the final sample are shown in Table 2.

Non-response bias was assessed by treating responses received after the deadline given

Table 2. Sample Demographics

	Potential Adopters		Users	
	Mean	**Std. Deviation**	**Mean**	**Std. Deviation**
Age	37.7	8.5	36.7	7.5
Tenure*	10.1	6.6	9.1	6.3
	Potential Adopters		**Users**	
Gender				
Female	69.8%		59.4%	
Male	30.2%		40.6%	
Education				
High School	32%		25.9%	
Associate	22.3%		10.8%	
Bachelor	30.1%		37.3%	
Master/MBA	10%		24.1%	
Doctorate	5%		1.9%	
Position				
Admin./Clerical	37.7%		29.6%	
Technical	21.7%		25.8%	
Supervisory	8.5%		6.3%	
Managerial	20.8%		28.3%	
Executive	3.8%		1.3%	
Other	7.5%		8.7%	

* Refers to the number of years the respondent has been employed at the site.

(three weeks after the questionnaire was mailed to the respondents) as being representative of non-respondents. T-tests on demographics and key constructs of the study showed no significant differences between respondents and non-respondents for both users and potential adopters. Even though this is a commonly used method to assess non-response bias, the possibility of bias is not entirely eliminated and results should be interpreted accordingly.

The data were then analyzed to determine the reliability and discriminant validity of the final scales. Table 3 and Appendices B and C present the reliability and factor analysis results for the study. Most scales showed good reliability with alphas greater than .80 (Nunnaly 1978). The only scales with alphas below .80 are voluntariness and intention. For intention (in the user questionnaire), the low alpha is a result of the scale not having enough variability.[8]

Results of the confirmatory factor analysis presented in Appendices B and C show that the behavioral beliefs, attitude, behavioral intention, and voluntariness scales exhibit good discriminant validity. Results support the factor structure proposed with one exception: compatibility and perceived usefulness load on the same factor. As a result, compatibility was omitted from the testing of the research model.

A plausible explanation for why perceived usefulness and compatibility load on the same factor is the following: Compatibility is a multidimensional construct defined as the degree to which using an innovation is consistent with the existing sociocultural values and beliefs, past and present experiences, and needs of potential adopters (Rogers 1983). This definition implies two types of compatibility: normative or cognitive compatibility, referring to compatibility with what people feel or think about an innovation, and practical or operational compatibility, referring to compatibility with what people do (Tornatzky and Klein 1982). The compatibility items on the Moore and Benbasat scales measure operational compatibility. As a result, in an organizational context and for a personal infrastructure technology such as Windows, task-centered beliefs that focus on the ability of the technology to facilitate one's job (i.e., perceived usefulness and operational compatibility beliefs) may be inextricably linked in the user's mind. Consequently, it is unlikely that individuals would view an innovation as useful if it is not compatible with their work style (Moore and Benbasat 1991).

Descriptive Statistics

Table 4 presents the means and standard deviations of the main constructs in the study for both potential adopters and users. This table also provides the results of the Mann-Whitney U-test, which tested differences between the potential adopter and user populations on these constructs.

With the exception of image, users and potential adopters differ significantly on their scores on all constructs of the study. Even though, overall, both groups view adoption/usage of Windows positively, the mean scores indicate that, with the exception of image and trialability, users of Windows have significantly more positive behavioral beliefs[9] and attitude than potential adopters.

Further, normative beliefs x motivation to comply (NBMC) for potential adopters, while generally positive, are closer to neutral than the beliefs of users. In addition, subjective norm for potential

[8]Almost all responses for the two questions of the scale were 6 and 7. Since 6 and 7 are adjacent and close to each other on a 7-point scale (as compared to other scale points, e.g., 2), responses of 7 on one question and 6 on the other would not be considered as unreliable. If, however, responses range only between 6 and 7, then 7 and 6 represent opposite ends of the scale (i.e., the 7-point scale is replaced by a 2-point scale). As a result, a response of 6 on one question and 7 on the other would be considered as unreliable since an individual chooses *opposite* ends of the scale. The intention scale shows high reliability in the potential adopters case, since there is a larger variability in responses.

[9]The evaluation component was omitted since Ajzen and Fishbein acknowledge that if the evaluation terms are either all negative or all positive, then the sum of beliefs alone will tend to be highly correlated with attitude. Since in this study evaluation terms for most beliefs were positive, then there is no reason for the evaluation component. The analysis was actually performed with and without the evaluation terms without significant changes in results.

Table 3. Scale Reliabilities

Construct[a]	Cronbach's Alpha		
	— Present Study —		
	Users	Potential Adopters	Moore & Benbasat (1991)
Attitude (3)	.90	.94	
Intention (2)	.50[b]	.90	
Voluntariness (2)	.71	.74	.82 (2)
Behavioral Beliefs			
Perceived Usefulness (4)	.88	.90	.90 (5)
Result Demonstrability (3)	.82	.76	.79 (4)
Image (3)	.84	.83	.79 (3)
Trialability (3)	.95	.92	.71 (2)
Compatibility (3)	.88	.93	.86 (3)
Ease of Use (3)	.87	.90	.84 (4)
Visibility (2)	.90	.98	.83 (2)

[a] The numbers in parentheses indicate the number of items in the scale.
[b] The low reliability is attributed to the low variance in the scores of the scale.

adopters is neutral (slightly negative). Taken together, these results suggest that potential adopters do not perceive any strong normative pressures to adopt Windows.

Scores for degree of voluntariness show that potential adopters view adoption of Windows as being voluntary (mean = 5.03). This suggests that the organizational level decision to adopt is not a confounding factor. On the other hand, users are less sure that continued use of Windows is voluntary (mean = 3.27). Interviews with users revealed that this response is a function of organizational norms. Once someone in the organization has adopted a software or hardware product, it is generally frowned upon if usage is discontinued. Often, the local computer support personnel will remove the previously used software from the individual's computer to encourage use of the new software product. These norms highlight the importance of managing initial adoption as key to diffusion of software innovations in this particular organization.

Finally, scores on behavioral intention show that overall users will continue using Windows (mean = 6.78). The potential adopter scores for behavioral intention (mean = 4.44) are significantly lower than user scores, but are still above the neutral point on the scale.

Model Testing

Partial Least Squares (PLS) approach was used to analyze the effect of the behavioral and normative components on intentions to adopt and use Windows. PLS, a latent structural equation modeling technique, uses a component-based approach to estimation. Because of this, it places minimal demands on sample size and residual distributions (Fornell and Bookstein 1982; Lohmoller 1989). Loadings of measures of each

Table 4. Descriptive Statistics

Variable	Potential Adopters		Users		Mann-Whitney U-Test	
	Mean	Std. Dev.	Mean	Std. Dev.	Z-Score	Significance
Intention	4.44	2.12	6.78	0.54	-9.71	.0000
Attitude	1.60	0.95	2.13	0.92	-4.46	.0000
Subjective Norm	-.18	1.45	0.71	1.37	-4.47	.0000
Voluntariness	5.03	1.44	3.27	1.69	-7.07	.0000
Behavioral Beliefs						
Perceived Usefulness	4.90	1.16	5.63	1.02	-4.82	.0000
Image	3.10	1.41	3.01	1.27	-0.34	.7324
Trialability	4.21	1.62	2.24	1.58	-7.69	.0000
Compatibility	5.01	1.11	5.74	0.95	-4.85	.0000
Ease of Use	5.16	1.08	5.59	1.13	-3.28	.0010
Visibility	4.67	1.68	5.62	1.21	-4.22	.0000
Result Demonstrability	4.38	1.32	5.08	1.00	-4.00	.0001
Normative Belief x Motivation to Comply						
Top Management	0.81	4.04	4.09	3.63	-5.82	.0000
Friends	0.16	1.88	0.87	1.94	-2.32	.0202
Supervisor	0.83	4.31	4.73	3.70	-6.46	.0000
Peers	1.01	3.21	2.71	2.89	-3.99	.0001
MIS Department	0.56	2.11	1.56	2.21	-3.18	.0015
Local Computer Specialists	1.10	2.79	2.52	2.65	-3.64	.0003

Note: Scales for behavioral beliefs, intention, and voluntariness are 1 (low value for construct) to 7 (high value for construct); scales for attitude and subjective norm range from -3 (strongly disagree) to +3 (strongly agree); scales for Normative Belief x Motivation to Comply range from -9 (low) to +9 (high).

construct can be interpreted as loadings in a principal components factor analysis. Paths can be interpreted as standardized beta weights in a regression analysis. The path coefficients and explained variances for the model are shown in Figures 2 and 3 for potential adopters and users, respectively.

The models presented and tested in Figures 2 and 3 do not include direct measures of attitude and subjective norm. Instead, attitude and subjective

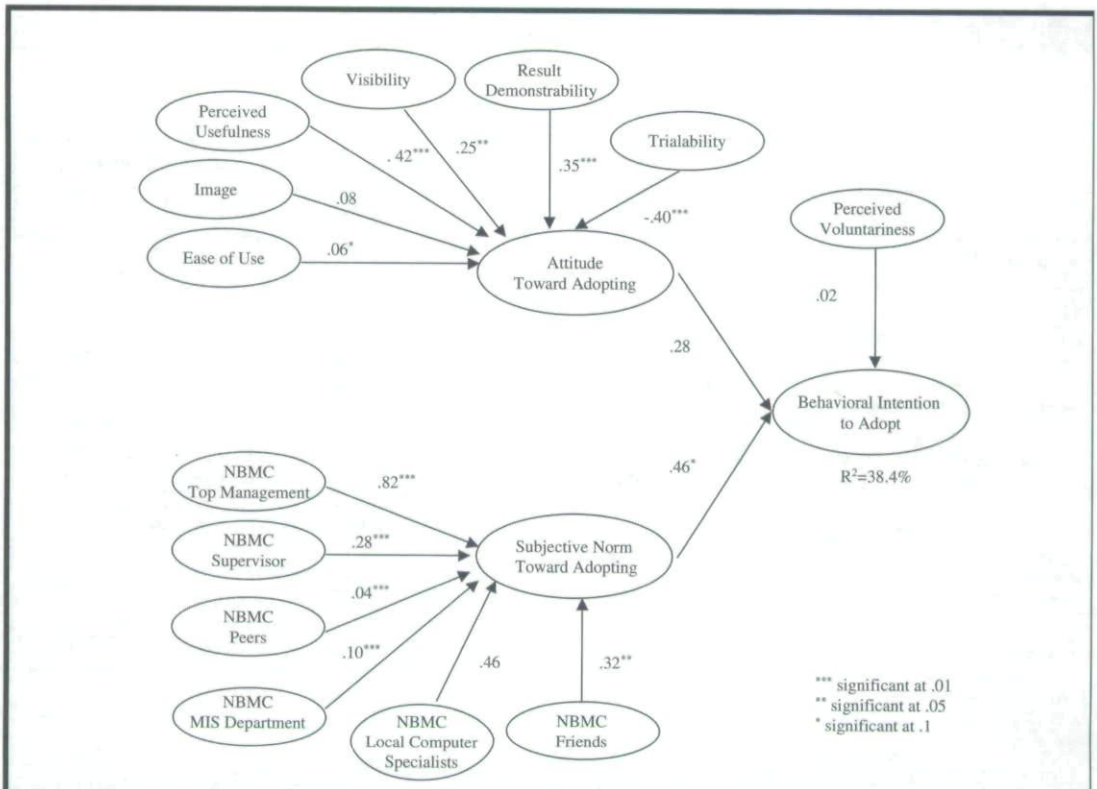

Figure 2. PLS Results for Potential Adopters

norm are synthesized by their respective behavioral and normative beliefs. As a result, the innovation attributes become the observed indicators of attitude and the NBMC items the observed indicators of subjective norm. This approach overcomes potential aggregation biases inherent in summing up individual beliefs and helps in better understanding the etiology of attitudes (Baggozi 1988).[10]

In following this approach of representing attitude and subjective norm as second order factors, a choice has to be made between a molar (i.e., one containing formative indicators) and molecular (i.e., one containing reflective indicators) approach to analysis. The choice depends primarily on whether the first order factors (i.e., the beliefs in this case) are viewed as causes or as indicators of the second order factors (Chin 1998; Chin and Gopal 1995). If a change in one of the beliefs necessarily results in similar changes in the other beliefs, then a molecular model is appropriate. Otherwise, a molar model is appropriate. In the current research, it can be argued that a molar model is more appropriate since a change in one belief does not necessarily imply changes in other beliefs.

RESULTS

PLS results for potential adopters and users are presented in Figures 2 and 3 respectively, and a summary is presented in Table 5. The discussion below will be structured around the study's two

[10]However, due to sample size limitations, summated scales were used to represent each individual belief (i.e., PU in the model is the summated scale of its four items).

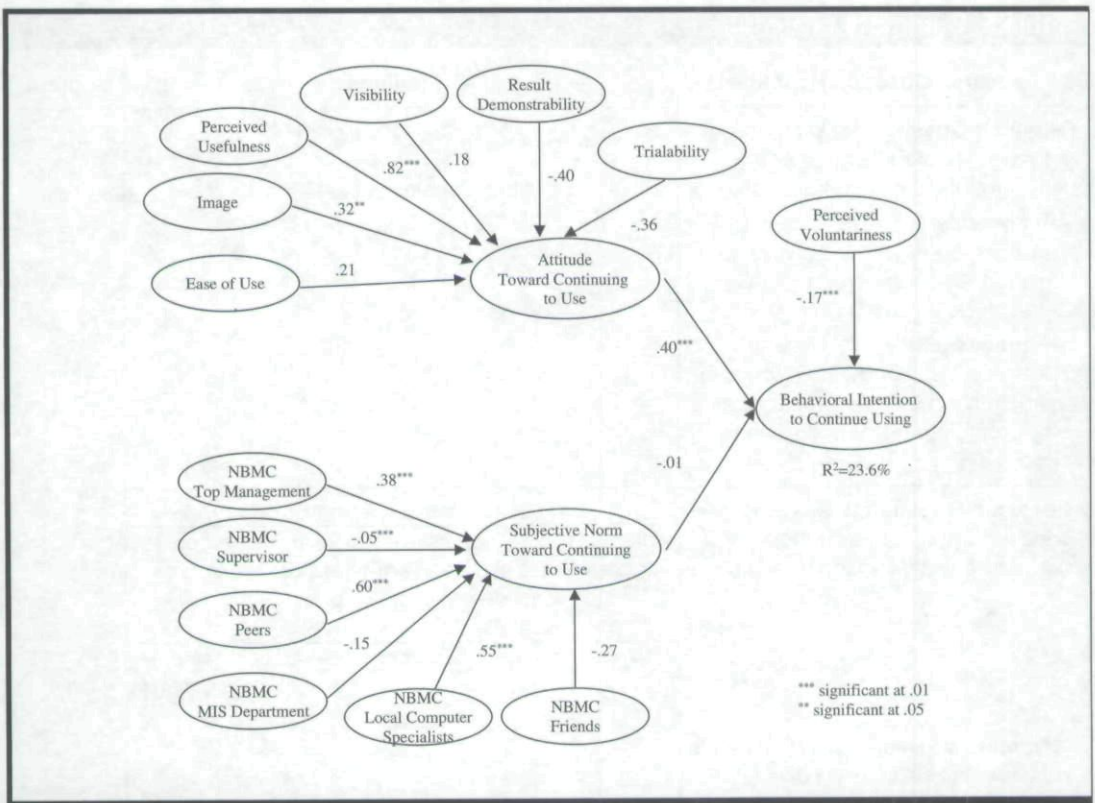

Figure 3. PLS Results for Users

research questions. Implications of the results are discussed in the next section.

Research Question 1: The first research question examined whether the relative importance of attitude and subjective norm in determining behavioral intention differed between potential adopters and users. As can be seen from Figure 2, behavioral intention to adopt Windows is solely determined by normative considerations from the social environment concerning adoption of Windows (T-statistic adjusted = 1.90), while intention to continue using Windows (Figure 3) is determined by the user attitude toward continuing to use Windows (T-statistic adjusted = 2.99) and the degree of voluntariness of use (T-statistic adjusted = -2.07). This lends support to both hypotheses 1 and 3, which respectively state that the relationship between attitude and behavioral intention will be stronger for users than for potential adopters and that the relationship between subjective norm and behavioral intention will be stronger for potential adopters than for users.

Research Question 2: The second research question examined whether pre-adoption behavioral and normative beliefs differ from post-adoption behavioral and normative beliefs. Figures 2 and 3 show both similarities and differences between the two groups. In terms of behavioral beliefs, perceived usefulness is the only belief underlying both attitude toward adopting and attitude toward continuing to use. In addition, image is significant for users while visibility, result demonstrability, ease of use, and trialability are significant for potential adopters. These results contradict the expectation (hypothesis H2) that users will have a richer set of beliefs underlying their attitude than potential adopters. In fact results indicate the opposite. Whereas two beliefs significantly form user attitude, five beliefs underlie adoption attitude.

Table 5. Summary of Results

Research Question/Hypothesis	Findings			Support
Research Question 1: Differences in determinants of Behavioral Intention between potential adopters and users	$BI_{potential\ adopters} = f$ (Subjective Norm) $BI_{users} = f$ (Attitude, Voluntariness)			
Hypothesis 1: The relationship between behavioral intention and attitude will be stronger for users than for potential adopters of IT				Yes
Hypothesis 3: The relationship between behavioral intention and subjective norm will be stronger for potential adopters than for users of IT				Yes
Research Question 2: Differences in behavioral and normative beliefs between potential adopters and users		*Behavioral Beliefs*	*Normative Beliefs*	
	Potential Adopters	perceived usefulness, ease of use, visibility, result demonstrability, trialability	Top mgmt., supervisor, friends, MIS dept., peers	
	Users	perceived usefulness, image	Peers, local computer specialists, top mgmt., supervisor	
Hypothesis 2: More behavioral beliefs underlie attitude for users than for potential adopters				No

In terms of normative beliefs, top management, supervisors, and peers significantly underlie subjective norm for both groups. The MIS department and friends are also significant for potential adopters, and local computer specialists are significant for users. Despite the similarities, important differences emerge when one examines the relative importance of the referent groups. For potential adopters, top management, friends, and one's supervisor are the top three determinants of subjective norm. For users, however, the top three determinants are peers, local computer specialists, and top management.

Discussion

Limitations

As with all research, the current study has certain limitations. The study's sample is limited to end users in a specific financial institution using a particular type of technological innovation. As such, the research needs to be replicated to examine the robustness of the findings across a wide range of technologies and samples. Further, while an effort was made to examine non-response bias, there is always the lingering possibility that the data are somehow systematically biased. In addition, the variability in intentions for users is restricted and, even though it does not invalidate the results of the study, it may explain the lower explained variance in the user data. Clearly, the methodology adopted for the study also presents certain constraints. Future efforts at examining the determinants of IT adoption should attempt to both broaden the sample and technology base and to utilize variant methodologies to uncover research artifacts and triangulate on the phenomenon.

Further, beliefs, attitudes, and decisions are dynamic and not static. As a result, cross-sectional

studies such as this may not fully capture the complexity or periodicity of the adoption and usage processes. Therefore, the results of this study should be viewed as only preliminary evidence with respect to the varying criteria that predominate different phases of the innovation decision process. Longitudinal studies that examine how beliefs and attitudes of the same user evolve temporally would provide a more rigorous test of how the determinants of behavioral intention, attitude, and subjective norm are modified over time.

In addition, according to Adaptive Structuration Theory (DeSanctis and Poole 1994), there is an interplay between technology and the social process of technology use resulting in the same technology being used in multiple ways (Robey 1995). As a result, different users of the same technology, be it Windows or spreadsheets or workstations, will each "appropriate" and "reinvent" the technology in the process of using it. Since people generate social constructions of technology based on norms and interpretive schemes embedded in the organizational context (Orlikowski 1992), it is impossible to determine whether Windows adoption and use had the same meaning for all respondents in the organization (Orlikowski and Robey 1991) or whether Windows as a technology had relatively stable perceived characteristics across adoption and continued usage. This is important when investigating how much relationships and data loadings in a fixed set of constructs change across stages of the innovation-decision process.

Discussion of Findings

There were two major research questions in this study. First, the study attempted to determine whether the importance of the attitudinal and normative components in determining behavioral intention is the same across the adoption and usage stages of the innovation-decision process. Second, the study examined whether potential adopters and users of Windows hold the same behavioral and normative beliefs. Descriptive statistics and results of the data analysis above provide preliminary evidence of important differences in four areas.

Differences in the Determinants of Behavioral Intention

One important finding of the study concerns the determinants of behavioral intention. Pre-adoption and post-adoption antecedents of behavioral intention differ significantly. Whereas the normative component dominates prediction of behavioral intention to adopt, the attitudinal component predominates for behavioral intention to continue using the IT. For users in this particular organizational setting, subjective norm does not have a significant relationship with intention to continue using Windows and for potential adopters attitude does not have a significant effect on intention to adopt Windows.

This may suggest that social pressures from the organizational environment may be an effective mechanism to overcome adopter initial inertia in adopting IT. Even though this effect vanishes following adoption, use of social norms may be important in inducing initial use and the subsequent development of perceptions (Agarwal and Prasad 1997). As evidenced in the current study, these perceptions become important in sustaining and institutionalizing usage of IT.

These results both support and contradict evidence in the literature. For example, results contradict earlier findings (Cooper and Zmud 1990; Laudon 1985) that pre-adoption is better explained by "rational" task-technology fit, and post-adoption by more socio-political and "learning" approaches. However, Cooper and Zmud were focusing on the infusion stage of the innovation process and their post-adoption results may not be directly comparable to the present study.

These results also support findings in prior literature. That user attitude has a closer relationship with intention than potential adopter attitude is consistent with Fazio and Zanna's (1981) distinction between attitudes formed based on direct and indirect experience. Initially, this contradicts Triandis (1971), who expects affect to be more related to adoption than to usage intentions. A closer examination, however, reveals that while Fazio and Zanna consider attitude to be cognitively based, Triandis' expectations deal solely with the affective component of attitude ("affect"). In Figures 2 and 3, attitude is synthe-

sized from behavioral beliefs and is thus cognitively based.

Because of this, another PLS model was run where affect was added as an additional antecedent of behavioral intention in addition to the paths already shown in Figures 2 and 3. This is consistent with the Triandis (1980) model, which poses both perceived consequences (i.e., attitude in this study) and affect as antecedents of behavioral intention. Results show that for potential adopters, affect (T-statistic adjusted = 2.33, path coefficient = .33) and subjective norm (T-statistic adjusted = 2.41, path coefficient = .44) were the only significant determinants of intention to adopt. For users, however, attitude (T-statistic adjusted = 2.51, path coefficient = .35) and voluntariness (T-statistic adjusted = -1.89, path coefficient = -.19) were the only significant determinants of behavioral intention. This latter analysis provides further evidence supporting the proposition that the antecedents of adoption and usage are indeed different.

Differences in the Determinants of Attitude

Another important finding of the study is that users and potential adopters differ in the set of behavioral beliefs underlying attitude. Contrary to expectations, potential adopters have a richer set of behavioral beliefs than users. Whereas potential adopter attitude is composed of trialability, perceived usefulness, result demonstrability, visibility, and ease of use, user attitude is composed of perceived usefulness and image. Therefore, it appears as if trialability, result demonstrability, ease of use, and visibility cease to be important after individuals adopt Windows.

The richer set of behavioral beliefs for adopters may be attributed to the higher uncertainty surrounding the adoption decision as compared to the continuous usage decision. To reduce this higher uncertainty, it is possible that potential adopters focus on a wider set of technology characteristics. After adoption, what may become salient are more rational considerations such as the ability of the technology to facilitate one's job and advancement in the organization. Therefore, even though users may have a richer understanding and more concrete knowledge of the technology than potential adopters, many of the non-task centered attributes may become irrelevant in deciding whether to not continue using the technology.

For example, it is logical to assume that trialability will only be relevant to adoption decisions. Trialability of an innovation is important in reducing risk and uncertainty about the expected consequences of using the innovation. It provides adopters a risk-free way to explore and experiment with the technology, to increase their comfort level and consequently the likelihood of adoption. Once an innovation is already in use by an individual, the relevance of trialability in determining an individual's decision to continue using the innovation vanishes.

Similarly, visibility of IT provides the opportunity to observe others use the technology. Such psychological or vicarious trial can be a very effective source of evaluative information (Bandura 1977) for potential adopters. Following adoption, however, individuals acquire personal experience with the IT and consequently their own source of evaluative information. As a result, the relevance of visibility in usage decisions declines.

In terms of result demonstrability, it is possible that, in their attempt to better evaluate the innovation, potential adopters try to articulate pros and cons of adopting or rejecting the technology. Users, on the other hand, in order to reduce cognitive dissonance, try to rationalize their usage behavior by looking for positive information to reinforce their past adoption decision. This is captured by the perceived usefulness belief.

Finally, ease of use considerations are important for potential adopters, possibly reflecting perceptions of their own computer self-efficacy with respect to learning how to use the system (Davis et al. 1989). After adoption, and as users gain experience with the system, ease of use concerns seem to be resolved and displaced by more instrumental considerations involving the efficacy of the innovation to increase one's job performance (i.e., perceived usefulness).

Tornatzky and Klein's (1982) meta-analysis of research on innovation characteristics found that relative advantage, complexity (ease of use), and compatibility were the only innovation characteristics that were consistently related to adoption

and/or utilization decisions. In the current study, only relative advantage (and compatibility) was consistently important for both adopters and users of Windows. Since, in Tornatzky and Klein's meta-analysis, no distinction was drawn between adoption and utilization decisions, it is possible that their results reflect innovation characteristics that significantly affect *both* adoption and utilization decisions, but not characteristics that affect only one adoption stage.

Differences in Normative Beliefs

Results show that, for both users and potential adopters, work networks are important determinants of subjective norm. In both cases, top management, peers, and one's supervisor were important referent groups. The relative importance of these referents in determining subjective norm in each group, however, revealed important differences. For potential adopters, the significant referent groups in order of importance are top management, friends, supervisor, peers, and the MIS department. This highlights the importance of management support in adoption decisions. It is possible that these strong signals from management to adopt reduce risk and uncertainty of adoption since they provide strong evidence as to the legitimacy of the behavior.

Interpersonal networks also appear to be very important in the case of potential adopters as indicated by the fact that friends' opinions significantly affected one's felt pressures toward adopting Windows.

For users, the significant referent groups in order of importance are peers, local computer specialists, top management, and supervisors. It is important to note here that in addition to the work network, formal change agents are an important referent group. This may reflect the fact that local computer experts are a valuable source of assistance with potential problems and questions with the technology. One's sustained use intentions may hinge on the efficacy of this group in providing such support. Further, the salience of one's peer group for users may reflect norms in the workplace to utilize compatible IT to facilitate workflow and the exchange of information.

Differences in Values of the Constructs

In general, users have significantly more positive beliefs about the consequences of using Windows, feel significantly more normative pressure toward continuing to use Windows, have significantly more positive attitude toward using Windows, and have higher scores for intention than potential adopters. Longitudinal studies are required to answer the question whether users have already adopted Windows as a result of their more positive beliefs, attitudes, normative pressures, and intentions, or whether adoption and subsequent use of Windows have resulted in users' perceptions becoming more positive. Triandis' (1980) theoretical framework, self-perception theory (Bem 1982), and cognitive dissonance theory (Festinger 1957) may provide some theoretical insights into the temporal dimension of the adoption process.

Implications for Theory and Practice

Implications for Theory

The current study provides preliminary evidence suggesting that adoption and continued usage behaviors are determined by different factors. While adoption is solely influenced by normative considerations, continued usage is determined by attitudinal factors and the extent to which usage is mandated. Furthermore, with the exception of image, all other innovation attribute beliefs underlie pre-adoption attitude, whereas only perceived usefulness and image underlie post-adoption attitude. These conclusions are drawn from a cross sectional study of potential adopters and users. Longitudinal studies would provide more conclusive evidence as to the process through which beliefs, attitudes, norms, and intentions are formed and temporally evolve.

The findings of this study also indicate that the interplay between innovation attributes and social norms should be further explored in future research. In the present study, visibility and image were more highly correlated with subjective norm than with attitude for potential adopters. This may suggest that these two beliefs

influence behavior via the normative rather than via the attitudinal component.

In addition, the relationship between voluntariness and subjective norm should be more closely investigated. According to TRA, voluntariness is not part of the subjective normative component. However, clearly voluntariness is a form of social influence. It is possible that subjective norm and voluntariness operate through different social influence processes: subjective norm via internalization and identification processes (Kelman 1958) and voluntariness via compliance processes. Future research should attempt to better conceptualize social influence and disentangle these effects.

Further, a more sophisticated conceptualization of usage, rather than a simple scale of extent of use, may be useful in technology acceptance research. Saga and Zmud's (1994) three dimensions of extended use, integrative use, and emergent use and Thompson et al.'s (1991) diversity and intensity of use constitute important steps in this direction. Enriching our understanding of use may position us to better understand organizational outcomes of technology use.

The study combines aspects of the Theory of Reasoned Action with Innovation Diffusion Theory to derive the theoretical model for the study. Future research may instead use the Theory of Planned Behavior (Ajzen 1988), which extends TRA. The Theory of Planned Behavior adds a perceived behavioral control component to TRA. This component reflects the fact that "successful performance of the intended behavior is contingent on the person's control over the many factors that may prevent it" (Ajzen 1988, p. 132), and it thus takes into account realistic constraints that may exist. Addition of the perceived behavioral control component may provide further insights into the process and increase the explained variance of the theoretical model.

The distinction between pre-adoption and post-adoption beliefs and attitudes may also suggest future directions in attitude change studies. Attitude structures formed based on direct experience with the attitude object (as in continued use) are likely influenced by different persuasive methods than attitude structures that have primarily a cognitive basis (prior to initial trial) (Fazio and Zanna 1981). There exist a number of approaches to persuasion such as conditioning and modeling (e.g., classical conditioning and observational learning), message learning, judgmental (e.g., social judgment-involvement), motivational (e.g., balance theory, congruity theory, impression management theory, psychological reactance theory), self-persuasion, and the Elaboration-Likelihood Model (Petty and Cacioppo 1981). Future research, capitalizing on different sources of attitude formation, should conceptualize and investigate the efficacy of these different persuasion methods on pre-adoption and post-adoption attitudes and beliefs.

Implications for Practice

The findings of the research also have important practical implications for IT implementation. The study has provided some preliminary evidence concerning the criteria that potential adopters utilize to evaluate IT innovations. This is important in the design of information systems and the associated implementation plans that will lead to acceptance of information systems. Change agents may tailor IT demonstrations, marketing efforts, training programs, and other implementation interventions to emphasize criteria that end users actually employ to make their adoption and usage decisions. This, in turn, should increase the likely effectiveness and efficiency of managerial interventions. For example, to encourage adoption, emphasis may be given to mobilizing such social networks as one's occupational and departmental social worlds (Aydin and Rice 1991). The literature on social influence provides more specific information on the various mechanisms by which social influence may be exerted (Aydin and Rice 1991; Compeau and Higgins 1991; Fulk et al. 1987, 1990; Rice and Aydin 1991; Rice et al. 1990; Salancik and Pfeffer 1978).

A similar observation can be made about managerial interventions regarding users. Implementation change agency should stress rational elements of the innovation rather than social elements. Users seem to be more responsive to arguments based on task/technology fit (Goodhue and Thompson 1995) and perceived usefulness. They also seem to be influenced by its compatibility with their work habits. In addi-

tion, the role of mandating use should be examined and its effect over time on adoption, usage, and performance should be explored.

Conclusion

The current study argues that using a unitary set of beliefs to explain different stages of the innovation decision process may lead to important relationships being obfuscated. Toward this end, the study makes an important theoretical contribution toward articulating differences in the determinants of adoption and usage. The majority of MIS research in the belief/attitude tradition to date has focused on beliefs and attitudes related to usage of IT. Consequently, our understanding of beliefs, attitudes, and norms leading to IT adoption and how these are modified over time is limited. Preliminary evidence from the current study suggests that social norms alone induce initial adoption while sustained usage decisions, when non-mandated, are based solely on attitudinal considerations. Further, in the absence of concrete knowledge of the technology prior to adoption, both instrumentality and non-instrumentality beliefs influence attitude toward adoption. Post-adoption, however, when users through experience have concrete knowledge of the technology, only instrumentality beliefs of usefulness and perceptions of image enhancements influence attitude. These results represent an important first step toward a deeper understanding of the temporal evolution of beliefs, attitudes, norms, and behavior across different phases of the innovation process.

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APPENDIX A

Questionnaire Items (Adoption)

Note: Items designated with an asterisk adopted from Moore and Benbasat (1991).

Behavioral Beliefs

Relative Advantage (PU)

1. If I were to adopt Windows, it would enable me to accomplish my tasks more quickly.*
2. If I were to adopt Windows, the quality of my work would improve.*
3. If I were to adopt Windows, it would enhance my effectiveness on the job.*
4. If I were to adopt Windows, it would make my job easier.*

Trialability (TR)

1. Before deciding on whether or not to adopt Windows, I would be able to use it on a trial basis.
2. Before deciding on whether or not to adopt Windows, I would be able to properly try it out.*
3. I would be permitted to use Windows on a trial basis long enough to see what it can do.*

Ease of Use (EOU)

1. Learning to operate Windows would be easy for me.*
2. If I were to adopt Windows, it would be easy to use.*
3. If I were to adopt Windows, it would be difficult to use.

Compatibility (COM)

1. If I were to adopt Windows, it would be compatible with most[11] aspects of my work.*
2. If I were to adopt Windows, it would fit my work style.*
3. If I were to adopt Windows, it would fit well with the way I like to work.*

Result Demonstrability (RD)

1. I have difficulty explaining why adopting Windows may or may not be beneficial.*
2. I could communicate to others the pros and cons[12] of adopting Windows.*
3. I have no difficulty telling others about the results of adopting Windows.*

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[11]Moore and Benbasat used the phrase "all aspects."

[12]Moore and Benbasat used the word "consequences" rather than pros and cons. The pretest indicated that respondents were not exactly sure what this word meant. It was, therefore, changed to "pros and cons."

Image (IM)

1. If I were to adopt Windows, it would give me high status in the organization.
2. If I were to adopt Windows, I would have more prestige in the organization than people who have not yet adopted it.*
3. Having Windows is a status symbol in my organization.*

Visibility (VIS)

1. In my organization, one sees Windows on many computers.*
2. In my organization, I have seen many people with Windows on their computers.

Attitude

All things considered, adopting Windows in my job within the next six months would be

a. extremely negative . . . extremely positive

b. extremely good . . . extremely bad

c. extremely harmful . . . extremely beneficial

Normative Beliefs

1. Top management thinks I should adopt Windows.
2. My close friends think I should adopt Windows.
3. My immediate supervisor thinks I should adopt Windows.
4. My peers think I should adopt Windows.
5. The [name of the MIS department] thinks I should adopt Windows.
6. Other computer technical specialists in the organization think I should adopt Windows.

Subjective Norm

Most people who are important to me think I should adopt Windows.

Voluntariness (VOL)

1. My boss does not require me to adopt Windows. *
2. Although it might be helpful, adopting Windows is certainly not compulsory in my job. *

Behavioral Intention

1. I intend to adopt Windows in my job within the next six months.
2. During the next six months, I plan to experiment with or regularly use Windows in my work.

APPENDIX B

Potential Adopters: Item Factor Loadings for Constructs

	Attit	BI	SN	Volunt	PU	EOU	RD	Trial	Vis	Image	Compat	NBMC Top Mgt	NBMC Super	NBMC Peers	NBMC MIS Dpt	NBMC Local Spc	NBMC Friends
Att1	.97	.47	.28	.27	.63	.37	.41	.08	.16	-.14	.56	.13	.22	.28	.13	.15	.26
Att2	.96	.52	.28	.32	.63	.39	.37	.11	.17	-.11	.57	.22	.27	.34	.19	.20	.30
Att3	.93	.45	.36	.28	.73	.31	.49	.13	.14	-.09	.67	.20	.42	.35	.23	.18	.33
BI1	.43	.97	.30	.36	.36	.30	.34	.29	.23	.02	.31	.48	.43	.33	.33	.23	.23
BI2	.44	.97	.38	.40	.30	.20	.33	.36	.25	.05	.33	.50	.48	.34	.34	.27	.34
SN1	.32	.32	1.00	.43	.27	.55	.36	.28	.38	.25	.35	.45	.62	.67	.49	.46	.68
Vol1	.31	.42	.41	.71	.24	.44	.12	.23	.25	.28	.18	.59	.54	.40	.39	.42	.32
Vol2	.17	.17	.32	.96	.28	.49	.31	.15	.44	.01	.23	.27	.43	.29	.01	.25	.17
PU1	.58	.58	.33	.17	.79	.52	.58	.16	.23	-.07	.11	.09	.29	.34	.18	.15	.27
PU2	.61	.61	.26	.25	.82	.43	.33	.10	-.01	-.03	.12	.01	.17	.22	.14	.02	.24
PU3	.59	.30	.21	.34	.92	.41	.46	.17	.09	-.03	.67	.13	.31	.26	.15	.17	.25
PU4	.59	.25	.12	.21	.89	.44	.41	.08	.21	-.10	.68	.03	.26	.22	.03	.14	.17
EOU1	.29	.25	.12	.14	.44	.88	.47	.13	.10	-.09	.40	.06	.13	.31	.05	.20	.11
EOU2	.40	.21	.07	.11	.58	.95	.49	.06	.03	-.13	.56	-.00	.10	.25	.09	.17	.15
EOU3	.15	.18	-.08	-.10	.09	.55	.17	.02	-.21	-.12	.18	.08	.02	.09	.01	-.08	.05
RD1	.38	.29	.25	.14	.53	.45	.79	.19	.08	-.11	.47	.10	.16	.18	.08	.08	.30
RD2	.39	.28	.40	.20	.40	.39	.86	.14	.19	-.09	.50	.25	.30	.33	.16	.33	.30
RD3	.32	.29	.24	.15	.34	.41	.83	.27	.21	-.01	.42	.25	.21	.27	.16	.13	.11

APPENDIX B (CONTINUED)

	Attit	BI	SN	Volunt	PU	EOU	RD	Trial	Vis	Image	Compat	NBMC Top Mgt	NBMC Super	NBMC Peers	NBMC MIS Dpt	NBMC Local Spc	NBMC Friends
TR1	.06	.33	.27	.25	.11	.11	.26	.95	.31	.16	.16	.41	.31	.37	.35	.33	.15
TR2	.15	.37	.25	.28	.17	.09	.22	.99	.36	.12	.20	.41	.32	.36	.31	.33	.12
TR3	.06	.15	.31	.23	.11	.08	.18	.86	.307	.19	.13	.26	.14	.32	.21	.22	.07
VIS1	.16	.25	.38	.36	.14	.02	.19	.35	.99	.09	.32	.47	.45	.43	.22	.41	.09
VIS2	.16	.23	.37	.31	.15	.01	.19	.35	.99	.09	.33	.46	.45	.42	.24	.42	.07
IM1	-.02	.13	.23	.28	.12	-.09	.04	.14	.13	.71	.00	.24	.25	.19	.08	.27	.20
IM2	-.02	.08	.35	.27	.14	-.07	.06	.08	.17	.70	.02	.14	.23	.23	.01	.20	.27
IM3	-.13	.02	.23	.21	-.08	-.14	-.11	.15	.08	.99	-.19	.09	.10	.16	.18	.12	.26
COM1	.50	.27	.30	.16	.59	.46	.45	.16	.40	-.20	.89	.19	.40	.39	.30	.38	.24
COM2	.59	.26	.31	.16	.66	.45	.57	.15	.30	-.12	.92	.19	.33	.38	.21	.27	.17
COM3	.63	.37	.34	.27	.79	.51	.51	.19	.23	-.17	.94	.23	.39	.38	.20	.27	.28
NBMC Top Mgt	.10	.00	.45	.56	.08	.05	.24	.40	.47	.10	.23	1.00	.76	.58	.56	.63	.22
NBMC Supvs	.01	.00	.62	.58	.30	.11	.27	.29	.46	.12	.41	.76	1.00	.77	.57	.66	.44
NBMC Peers	.00	.00	.67	.41	.30	.29	.31	.37	.43	.17	.42	.58	.77	1.00	.60	.68	.42
NBMC MIS Dpt	.10	.00	.49	.32	.15	.07	.16	.31	.23	.17	.24	.56	.57	.60	1.00	.64	.43
NBMC Lcl Spc	.11	.03	.46	.41	.14	.16	.22	.32	.42	.14	.33	.63	.66	.68	.64	1.00	.38
NBMC Friends	.01	.01	.68	.32	.27	.14	.29	.12	.08	.27	.25	.22	.44	.42	.43	.38	1.00

Note: PLS does not directly support CFA. The procedure followed to derive the factor scores is the following: (1) The measurement model was run and and the resulting PLS weights of the indicators were used to create factor scores. (2) This score was correlated with all other indicators to calculate the cross loadings.

APPENDIX C

Users: Item Factor Loadings for Constructs

	Attit	BI	SN	Volunt	PU	EOU	RD	Trial	Vis	Image	Compat	NBMC Top Mgt	NBMC Super	NBMC Peers	NBMC MIS Dpt	NBMC Local Spc	NBMC Friends
Att1	.94	.32	.29	.11	.59	.33	.17	-.01	.19	.19	.62	.15	.23	.33	.14	.27	.19
Att2	.96	.27	.29	.14	.61	.28	.17	-.02	.25	.18	.62	.16	.25	.34	.15	.29	.17
Att3	.84	.30	.28	.20	.72	.37	.28	.04	.28	.19	.68	.12	.20	.34	.13	.22	.16
BI1	.41	.70	.10	.27	.46	.18	.04	-.15	.20	.05	.46	.15	.15	.23	.07	.13	.07
BI2	.22	.95	.09	.29	.27	.16	.04	-.07	.12	.17	.28	.15	.16	.16	.07	.19	.02
SN1	.31	.11	1.00	.40	.34	.16	.18	.06	.21	.25	.33	.39	.43	.49	.16	.32	.54
Vol1	.22	.28	.35	.89	.33	.21	.14	-.25	.25	.13	.29	.58	.72	.48	.15	.35	.12
Vol2	.05	.30	.35	.87	.17	.04	.04	-.15	.33	.13	.15	.51	.48	.37	.16	.31	.15
PU1	.73	.47	.34	.28	.83	.40	.47	.06	.20	.20	.73	.13	.22	.37	.07	.22	.20
PU2	.62	.30	.32	.21	.83	.37	.33	.12	.22	.23	.72	.10	.24	.26	.12	.30	.10
PU3	.52	.26	.25	.23	.89	.48	.35	.09	.17	.27	.79	.13	.18	.28	.05	.22	.12
PU4	.62	.29	.31	.26	.85	.41	.40	.05	.19	.18	.75	.13	.24	.34	.07	.23	.14
EOU1	.28	.17	.09	.11	.42	.86	.37	.07	.09	-.02	.51	.12	.08	.18	.11	.26	.04
EOU2	.35	.20	.20	.15	.53	.91	.47	.04	.09	.02	.59	.11	.13	.19	.14	.19	.06
EOU3	.27	.13	.13	.13	.34	.87	.42	-.02	-.02	-.02	.37	.11	.07	.13	.11	.14	-.04
RD1	.14	-.03	.22	.10	.32	.35	.84	.11	-.01	.12	.31	.15	.11	.04	.11	.11	.02
RD2	.29	.10	.07	.07	.48	.50	.86	.16	.05	.20	.50	.01	.07	.11	.15	.14	-.07

APPENDIX C (CONTINUED)

	Attit	BI	SN	Volunt	PU	EOU	RD	Trial	Vis	Image	Compat	NBMC Top Mgt	NBMC Super	NBMC Peers	NBMC MIS Dpt	NBMC Local Spc	NBMC Friends
RD3	.16	.07	.17	.09	.43	.39	.87	.19	.02	.21	.42	.05	.05	.13	.11	.18	.05
TR1	-.02	-.10	.04	-.23	.08	.05	.15	.95	-.01	.22	.103	-.24	-.14	.06	.01	.03	.18
TR2	-.01	-.10	.08	-.18	.10	.02	.17	.97	.04	.30	.11	-.18	-.09	.06	.09	.07	.24
TR3	.01	-.13	.06	-.23	.09	.03	.17	.95	.02	.28	.12	-.19	-.11	.05	.04	-.00	.22
VIS1	.20	.14	.18	.31	.16	.02	.03	-.00	.96	-.01	.15	.27	.27	.30	.27	.19	.19
VIS2	.29	.18	.22	.31	.28	.08	.02	.03	.95	-.00	.28	.28	.28	.32	.21	.26	.17
IM1	.24	.16	.25	.16	.25	.09	.24	.29	.01	.81	.26	.14	.20	.21	.19	.29	.25
IM2	.20	.17	.26	.17	.32	-.00	.23	.20	-.01	.82	.24	.09	.23	.23	.15	.24	.26
IM3	.15	.12	.20	.10	.18	-.05	.14	.25	-.00	.94	.15	.02	.12	.12	.23	.25	.26
COM1	.53	.34	.32	.27	.69	.57	.47	.06	.21	.15	.86	.20	.29	.36	.14	.26	.15
COM2	.67	.31	.31	.23	.79	.44	.41	.13	.19	.20	.92	.13	.22	.40	.05	.26	.18
COM3	.65	.39	.28	.20	.87	.50	.41	.12	.21	.23	.93	.08	.16	.28	.07	.24	.08
NBMC Top Mgt	.16	.17	.39	.48	.14	.13	.10	-.21	.29	.07	.14	1.00	.70	.40	.22	.34	.19
NBMC Supvs	.25	.18	.43	.68	.26	.10	.09	-.12	.28	.18	.24	.70	1.00	.68	.20	.34	.26
NBMC Peers	.37	.27	.49	.62	.37	.19	.09	.06	.32	.20	.38	.40	.68	1.00	.28	.44	.42
NBMC MIS Dpt	.16	.08	.16	.18	.09	.16	.17	.05	.25	.23	.09	.22	.20	.28	1.00	.50	.24
NBMC Lcl Spc	.28	.20	.32	.37	.28	.22	.17	.04	.23	.29	.28	.33	.33	.44	.50	1.00	.32
NBMC Friends	.19	.05	.54	.15	.16	.02	.01	.22	.19	.29	.14	.19	.26	.42	.24	.32	1.00