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## ABSTRACT

The adoption and use of information technology (IT) innovations within an organization are critical to deriving the benefits of IT, yet many innovations are underused or never used. Theoretical perspectives that have been used to analyze individual behavior regarding IT usage include innovation diffusion theory (IDT) and the theory of planned behavior (TPB). IDT states that adoption of an innovation is influenced by attributes of the innovation. TPB posits that attitudes, subjective norms, and perceived behavioral control will influence an individual's decision to adopt. While most adoption and diffusion research concentrates on why people adopt an innovation, this research will compare how innovation characteristics and TPB components are perceived by both early and late adopters. We then investigate late adopters' perceptions at the time of the innovation introduction and the time of actual adoption to determine which, if any, innovation perceptions have changed.

## Keywords

Innovation Diffusion Theory, Theory of Planned Behavior, innovation characteristics, adopter perceptions.

## INTRODUCTION

Although millions of dollars have been spent on information technology (IT) by organizations, many of these organizations have not realized comparable benefits for the money they have spent. One main problem has been the lack of diffusion of the IT throughout the organization (Raho, Belohlav, and Fiedler, 1987). Better methods for designing, evaluating, and introducing new technology can be developed if practitioners and researchers understand why and when people will accept an IT. Researchers have studied a range of issues related to this topic, on both the individual and organizational aspects of innovation adoption (Dillon and Morris, 1996; Rogers, 1983). While adoption and implementation of innovations at the individual and organizational level should be viewed as separate, they are still intertwined (Topi, 1994). In this paper, the focus is on the individual adoption of a voluntary IT. In particular, our primary objective is to determine both how early and late adopters perceive new innovations at the time of introduction and how late adopters' perceptions change between time of introduction and time of adoption.

## PROPOSED RESEARCH

### Research Questions

Rogers (1983) differentiated adopters into five categories: innovators, early adopters, early majority, late majority, and laggards. Three broad areas that impact the adoption and use of an innovation are (1) socioeconomic status, (2) personality variables, and (3) communication behavior. Early adopters are better educated, more upwardly mobile, of a higher social economic status, greater risk takers, more dogmatic, less fatalistic, more aspiring in careers, more cosmopolite, and more interconnected in the social system (Rogers, 1983). In addition, they have a higher degree of communication with both other individuals and the mass media than late adopters (Rogers, 1983) and are younger in age (Brancheau and Wetherbe, 1990). Although Rogers divides adopters into five categories, this study divides the sample size into early and late adopters (e.g., Brancheau and Wetherbe, 1990; Burkhardt and Brass, 1990). For purposes of this study, early adopters include both innovators and early adopters and late adopters include the late adopter category as defined by Rogers.

What's missing in MIS research is a comparison of the perceived attributes of the innovation by early adopters and by late adopters, and the changing perceptions a late adopter has between time of introduction and time of adoption. Changing

perceptions that late adopters hold toward innovation attributes is within the control of an organization while individual variables, such as age, education, risk-taking, and social status, are not.  Therefore, this study concentrates on both the differences in perceptions between early and late adopters and how perceptions change over time for the late adopter. Research in psychology shows that different individuals base their attitudes and opinions on different sources of information and use different cognitive strategies when evaluating messages about an attitude object (Zanna and Rempel, 1988). Therefore, it is likely that early adopters and late adopters view the same innovation in different ways.

In addition, this study will also examine the importance of attitude, social norms, and perceived behavioral control for early and late adopters to determine if differences in how these components are perceived contribute to the decision of when to adopt, again measuring these variables both BEFORE any adoption has occurred and at the time of adoption.  General support of the above is provided by Ajzen and Fishbein (1980), who suggested that the relative importance of attitudinal and normative components may be influenced by demographic variables, personality traits, and other individual differences. Finally, this study will provide a longitudinal look to determine if perceptions of innovation attributes change over time for late adopters and report which attribute perceptions are most important in changing an individual's adoption decision.  The following research questions will be addressed in this study.

RQ 1: Does the relative importance of innovation attributes differ depending on the adoption period?  Will there be a difference in how late adopters and early adopters perceive innovation characteristics BEFORE adoption?

RQ 2: As time progresses and late adopters begin to adopt, which innovation attribute perceptions change most significantly to move them toward adoption?

RQ 3: Does the relative importance of attitudes, subjective norms, and perceived behavioral control differ depending on the adoption period?  Are early and late adopters affected more strongly by the same or different antecedents?

RQ 4: As time progresses and late adopters begin to adopt, which of the three TPB components (attitudes, social norms, and perceived behavioral control) most significantly influence the late adopter's decision to adopt?

## THEORETICAL MODELS

### Theory of Planned Behavior (TPB)

The theory of planned behavior model descends from the theory of reasoned action (TRA).  TRA (Ajzen and Fishbein, 1980; Fishbein and Ajzen, 1975) posits that behavioral intentions are a function of salient information or beliefs about the likelihood that performing a particular behavior will lead to a specific outcome.  TRA divides beliefs into two conceptually distinct sets: behavioral and normative.  Behavioral beliefs are postulated to be the underlying influence on an individual's attitude toward performing the behavior (Fishbein and Ajzen, 1975), including an individual's beliefs about the consequences of adopting and his/her evaluation of those consequences (Ajzen and Fishbein, 1980).  Normative beliefs are subjective norms that are "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).  Salient referents influencing normative beliefs can include: top management, supervisors, peers, MIS department personnel, local computer experts, and friends (Karahanna, Straub, and Chervany, 1999).  Evidence on the importance of social norms shows that internal, interpersonal communication has a significant role in individual adoption decisions regarding spreadsheet technology (Brancheau and Wetherbe, 1990).  TPB adds a third variable to the antecedents of behavioral intention – perceived behavioral control has both a direct effect on behavior and an indirect effect on behavior through intentions.  When people believe that they have little control over performing a behavior because of a lack of requisite resources, skills, and/or opportunities, their intentions to perform the behavior may be low even if they have favorable attitudes and/or subjective norms concerning performance of the behavior (Madden, Ellen, and Ajzen, 1992).  For example, perceived voluntariness of using the innovation is an important antecedent of adoption of a personal workstation (Moore and Benbasat, 1991).

### Innovation Diffusion Theory (IDT)

The principal theoretical perspective on technology acceptance is innovation diffusion theory.  Rogers (1983) provided one of the first comprehensive views of organizational innovation diffusion.  His IDT is the most widely cited theory applied to the individual level of diffusion and offers a conceptual framework for analyzing the acceptance of an innovation at a global level.  Although it is not concerned with IT exclusively, IDT provides an account of the way in which any technological innovation moves from the stage of invention to widespread use (or non-use).

Rogers (1983) presents five attributes of innovations that influence their adoption: (1) relative advantage ("the degree to which an innovation is perceived as being better than the idea it supersedes" p. 213); (2) compatibility ("the degree to which

an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters", p. 223); (3) complexity ("the degree to which an innovation is perceived as relatively difficult to understand and use", p. 230); (4) trialability ("the degree to which an innovation may be experimented with on a limited basis", p. 231); and (5) observability ("the degree to which the results of an innovation are visible to others", p. 232). Innovations that offer advantages, compatibility, low complexity, trialability, and observability will be diffused more extensively and rapidly than innovations that don't.

Although each attribute alone is not sufficient to predict either the extent or rate of diffusion, Tornatzky and Klein (1982) found that three of these attributes had the greatest influence on adoption: compatibility and relative advantage were positively related to adoption, while complexity was negatively related to adoption. Moore and Benbasat (1991) partially supported Rogers' attributes but added attributes for discretion and ease of use. In their results, the most important attributes to determine innovation adoption are: (1) voluntariness of use, (2) image ("the degree to which use of an innovation is perceived to enhance one's image or status in one's social system," p. 195), (3) relative advantage, (4) compatibility, (5) ease of use, (6) trialability, (7) result demonstrability, and (8) visibility.

Rogers (1983) concluded that the diffusion of innovations in an organization takes place in several distinct stages, and that individual adopters can be categorized into separate groups based on their time of adoption. Individual factors (e.g., education, social status, and attitude toward change) can affect when an individual will adopt an innovation (Rogers, 1983). Rogers divides adopters into five categories based on when the innovation is adopted and plots these categories over a normal distribution, with each major category representing a standard deviation of dispersion. This has been supported in IS research by Brancheau and Wetherbe (1990), who found that adoption of spreadsheets followed a sigmoidal, s-shaped curve, as predicted by IDT.

**Research Model**

The decision to adopt an innovation involves evaluating the innovation based on some criteria, and then forming an attitude toward the innovation. IDT provides a set of innovation attributes that may affect an individual's attitude toward the innovation. TPB provides a theoretical description that combines beliefs about adoption of an innovation (i.e., innovation attributes), communications received by the end-user from his/her "important" others (i.e., social norms), and perceived behavioral control (Karahanna et al., 1999).

The theoretical model for the proposed study combines TPB with aspects of IDT. The basic structure follows the TPB; however, the content of the beliefs variable is derived from IDT and the work by Moore and Benbasat (1991). The model was developed to examine end-users' beliefs, both prior to adoption and after adoption, and to determine how early and late adopters' perceptions change between introduction to the IT and adoption.

**METHODOLOGY**

The adoption and diffusion of the use of electronic student lockers by undergraduate students will be used to collect data to answer the research questions. Electronic student lockers are a form of file storage; students can save their files to their student lockers on a central server, rather than to a disk or hard drive of a PC. Advantages to using the student lockers include: less chance of a "crash," no need to worry about corrupted disks, being able to access their student locker both at home and at school (no need to carry disks from place to place), large amount of memory available in the locker, and backups controlled by the university so chance of loss of data is minimal.

Students, primarily juniors, enrolled in the first semester of their professional program will be surveyed. In a pilot study, approximately 100 students will be surveyed. Eventual rollout of the technology will include approximately 10,000 students. The study will be longitudinal so that changing perceptions about student lockers by late adopters can be measured. Students will be given a brief tutorial on the use of student lockers in an introductory computing class that is required for all students. After that, usage of the lockers is voluntary. After the tutorial, students will be surveyed to determine their perceptions. As students begin to utilize their student lockers, a survey will automatically be sent so that perceptions at adoption can be measured. Then, perceptions between early adopters and late adopters can be measured. Similar to prior work on adoption, we will define the participants in two adoption categories: early adopters and late adopters. Early adopters will be defined as the first 16% of those who adopt; late adopters will be the last 16% who adopt the technology.

**IMPLICATIONS**

Innovation diffusion throughout an organization to all individuals is generally considered the goal of any new IT. This research will identify differences in innovation perceptions that are held by early adopters and late adopters. If there are

differences, organizations will be able to focus attention on changing perceptions held by late adopters about the innovation. This will, in turn, enable a quicker diffusion of new innovations.  This study will also determine if late adopters are more influenced by beliefs, subjective norms, or control issues; and again, organizations may be able to target training programs to influence the late adopters toward earlier adoption of new innovations.

Most innovation diffusion research has focused on the individual's perceptions of innovation characteristics AFTER adoption.  By measuring perceptions both before and after adoption, it will be possible to make comparisons between early and late adopters and to determine which factors most influence the late adopter to eventually adopt.  This study will also provide results from a longitudinal study — a type of study neglected in research on innovation diffusion (Tornatzky and Klein, 1982).

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