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Technology Acceptance Model 3 and a Research Agenda on Interventions

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ABSTRACT

Prior research has provided valuable insights into how and why employees make a decision about the adoption and use of information technologies (ITs) in the workplace. From an organizational point of view, however, the more important issue is how managers make informed decisions about interventions that can lead to greater acceptance and effective utilization of IT. There is limited research in the IT implementation literature that deals with the role of interventions to aid such managerial decision making. Particularly, there is a need to understand how various interventions can influence the known determinants of IT adoption and use. To address this gap in the literature, we draw from the vast body of research on the technology acceptance model (TAM), particularly the work on the determinants of perceived usefulness and perceived ease of use, and: (i) develop a comprehensive nomological network (integrated model) of the determinants of individual level (IT) adoption and use; (ii) empirically test the proposed integrated model; and (iii) present a research agenda focused on potential pre- and postimplementation interventions that can enhance employees' adoption and use of IT. Our findings and research agenda have important implications for managerial decision making on IT implementation in organizations.

Subject Areas: Design Characteristics, Interventions, Management Support, Organizational Support, Peer Support, Technology Acceptance Model (TAM), Technology Adoption, Training, User Acceptance, User Involvement, and User Participation.

INTRODUCTION

While great progress has been made in understanding the determinants of employees' information technology (IT) adoption and use (Venkatesh, Morris, Davis, & Davis, 2003), trade press still suggests that low adoption and use of IT by employees are still major barriers to successful IT implementations in organizations (Overby, 2002; Gross, 2005). As ITs are becoming increasingly complex and central

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to organizational operations and managerial decision making (e.g., enterprise resource planning, supply chain management, customer relationship management systems), this issue has become even more severe. There are numerous examples of IT implementation failures in organizations leading to huge financial losses. Two high-profile examples of IT implementation failures are Hewlett-Packard's (HP) failure in 2004 that had a financial impact of \$160 million (Koch, 2004a) and Nike's failure in 2000 that cost \$100 million in sales and resulted in a 20% drop in stock price (Koch, 2004b). Low adoption and underutilization of ITs have been suggested to be key reasons for "productivity paradox"-that is, a contradictory relationship between IT investment and firm performance (Landauer, 1995; Sichel, 1997; Devaraj & Kohli, 2003). This issue is particularly important given that recent reports suggest that worldwide investment in IT will increase at a rate of 7.7% a year from 2004 to 2008 compared to 5.1% from 2000 to 2004 (World Information Technology and Service Alliance, 2004). It has been suggested in both the academic and trade press that managers need to develop and implement effective interventions in order to maximize employees' IT adoption and use (Cohen, 2005; Jasperson, Carter, & Zmud, 2005). Therefore, identifying interventions that could influence adoption and use of new ITs can aid managerial decision making on successful IT implementation strategies (Jasperson et al., 2005).

The theme of interventions as an important direction for future research is documented in recent research. For instance, Venkatesh (2006) reviewed prior research on IT adoption and suggested three avenues for future research that are pertinent to the editorial mission of *Decision Sciences*: (i) business process change and process standards; (ii) supply-chain technologies; and (iii) services. Within each of these three avenues, he noted interventions as a critical direction for future research that had significant managerial implications and the potential to enhance IT implementation success. More recently, other researchers have provided new directions in individual-level IT adoption research with a particular focus on interventions that can potentially lead to greater acceptance and effective utilization of IT (Benbasat & Barki, 2007; Goodhue, 2007; Venkatesh, Davis, & Morris, 2007). Our objective is to present a brief literature review, propose an integrated model of employee decision making about new ITs, empirically validate the model, and present a research agenda that identifies a set of interventions for researchers and practitioners to investigate to further our understanding of IT implementation.

The research on individual-level IT adoption and use is mature and has provided rich theories and explanations of the determinants of adoption and use decisions (e.g., Venkatesh et al., 2003; Sarker, Valacich, & Sarker, 2005 for group-level IT adoption research). Notwithstanding the plethora of IT adoption studies, there has been limited research on the interventions that can potentially lead to greater acceptance and use of IT (Venkatesh, 1999). The most widely employed model of IT adoption and use is the technology acceptance model (TAM) that has been shown to be highly predictive of IT adoption and use (Davis, Bagozzi, & Warshaw, 1989; Adams, Nelson, & Todd, 1992; Venkatesh & Davis, 2000; Venkatesh & Morris, 2000). One of the most common criticisms of TAM has been the *lack of actionable guidance* to practitioners (Lee, Kozar, & Larsen, 2003). Many leading researchers have noted this limitation in interviews reported in Lee et al. (2003). For example, Alan Dennis, a leading scholar in the field of information systems,

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commented, "imagine talking to a manager and saying that to be adopted technology must be useful and easy to use. I imagine the reaction would be 'Duh!' The more important questions are what [sic] makes technology useful and easy to use" (Lee et al., 2003, p. 766). Some work has been done to address this limitation by identifying determinants of key predictors in TAM, namely, perceived usefulness and perceived ease of use. Some researchers have developed context-specific determinants to the two TAM constructs-for instance, Karahanna and Straub (1999) for electronic communication systems (i.e., e-mail systems), Koufaris (2002) for e-commerce, Hong and Tam (2006) for multipurpose information appliances, Rai and Patnayakuni (1996) for CASE tools, and Rai and Bajwa (1997) for executive information systems-that have immense value in theorizing richly about the specific IT artifact (type of system) in question and identifying determinants that are specific to the type of technology being studied. Others have developed general and context-independent determinants that span across a broad range of systems (e.g., Venkatesh, 2000; Venkatesh & Davis, 2000). While each of these approaches has merits, and it is not our goal to debate generality versus context specificity in theorizing (Bacharach, 1989; Johns, 2006), in this article, we are choosing the general set of determinants of TAM as a basis for the identification of broadly applicable interventions that can fuel future research.

Venkatesh and Davis (2000) identified general determinants of perceived usefulness and Venkatesh (2000) identified general determinants of perceived ease of use. These two models were developed separately and not much is known about possible crossover effects-that is, could determinants of perceived usefulness influence perceived ease of use and/or could determinants of perceived ease of use influence perceived usefulness? Investigating and theorizing about potential crossover effects or ruling out the possibility of these effects is an important step in developing a more comprehensive nomological network around TAM. Further, interventions, based on the determinants of perceived usefulness and perceived ease of use, hold the key to helping managers make effective decisions about applying specific interventions to influence the known determinants of IT adoption and, consequently, the success of new ITs (Rai, Lang, & Welker, 2002; DeLone & McLean, 2003; Sabherwal, Jeyaraj, & Chowa, 2006). Given this backdrop, this article presents an integrated model of determinants of perceived usefulness and perceived ease of use, empirically validates the model, and uses the integrated model as a springboard to propose future directions for research on interventions.

BACKGROUND

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TAM was developed to predict individual adoption and use of new ITs. It posits that individuals' behavioral intention to use an IT is determined by two beliefs: *perceived usefulness*, defined as the extent to which a person believes that using an IT will enhance his or her job performance and *perceived ease of use*, defined as the degree to which a person believes that using an IT will be free of effort. It further theorizes that the effect of external variables (e.g., design characteristics) on behavioral intention will be mediated by perceived usefulness and perceived ease of use. Over the last two decades, there has been substantial empirical support in favor of TAM (e.g., Adams et al., 1992; Agarwal & Karahanna, 2000; Karahanna,

Agarwal, & Angst, 2006; Venkatesh et al., 2003, 2007). TAM consistently explains about 40% of the variance in individuals' intention to use an IT and actual usage. As of December 2007, the *Social Science Citation Index* listed over 1,700 citations and *Google Scholars* listed over 5,000 citations to the two journal articles that introduced TAM (Davis, 1989; Davis et al., 1989).

Theoretical Framework

Prior research employing TAM has focused on three broad areas. First, some studies replicated TAM and focused on the psychometric aspects of TAM constructs (e.g., Adams et al., 1992; Hendrickson, Massey, & Cronan, 1993; Segars & Grover, 1993). Second, other studies provided theoretical underpinning of the relative importance of TAM constructs-that is, perceived usefulness and perceived ease of use (e.g., Karahanna, Straub, & Chervany, 1999). Finally, some studies extended TAM by adding additional constructs as determinants of TAM constructs (e.g., Karahanna & Straub, 1999; Venkatesh, 2000; Venkatesh & Davis, 2000; Koufaris, 2002). Synthesizing prior research on TAM, we developed a theoretical framework that represents the cumulative body of knowledge accumulated over the years from TAM research (see Figure 1). The figure shows four different types of determinants of perceived usefulness and perceived ease of use-individual differences, system characteristics, social influence, and facilitating conditions. Individual difference variables include personality and/or demographics (e.g., traits or states of individuals, gender, and age) that can influence individuals' perceptions of perceived usefulness and perceived ease of use. System characteristics are those salient features of a system that can help individuals develop favorable (or unfavorable) perceptions regarding the usefulness or ease of use of a system. Social influence captures various social processes and mechanisms that guide individuals to formulate perceptions of various aspects of an IT. Finally, facilitating conditions represent organizational support that facilitates the use of an IT.

Determinants of Perceived Usefulness

Venkatesh and Davis (2000) proposed an extension of TAM—TAM2—by identifying and theorizing about the general determinants of perceived usefulness—that is, *subjective norm, image, job relevance, output quality, result demonstrability,* and



Figure 1: Theoretical framework.

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Table 1: Determinants of perceived usefulness.

Determinants	Definitions
Perceived Ease of Use	The degree to which a person believes that using an IT will be free of effort (Davis et al., 1989).
Subjective Norm	The degree to which an individual perceives that most people who are important to him think he should or should not use the system (Fishbein & Ajzen, 1975; Venkatesh & Davis, 2000).
Image	The degree to which an individual perceives that use of an innovation will enhance his or her status in his or her social system (Moore & Benbasat, 1991).
Job Relevance	The degree to which an individual believes that the target system is applicable to his or her job (Venkatesh & Davis, 2000).
Output Quality	The degree to which an individual believes that the system performs his or her job tasks well (Venkatesh & Davis, 2000).
Result Demonstrability	The degree to which an individual believes that the results of using a system are tangible, observable, and communicable (Moore & Benbasat, 1991).

perceived ease of use-and two moderators-that is, experience and voluntariness. The first two determinants fall into the category of social influence and the remaining determinants are system characteristics as per the theoretical framework shown in Figure 1. Table 1 provides the definitions of the determinants of perceived usefulness. TAM2 presents two theoretical processes-social influence and cognitive instrumental processes-to explain the effects of the various determinants on perceived usefulness and behavioral intention. In TAM2, subjective norm and image are the two determinants of perceived usefulness that represent the social influence processes. Drawing on Kelman's (1958, 1961) work on social influence and French and Raven's (1959) work on power influences, TAM2 theorizes that three social influence mechanisms-compliance, internalization, and identification-will play a role in understanding the social influence processes. Compliance represents a situation in which an individual performs a behavior in order to attain certain rewards or avoid punishment (Miniard & Cohen, 1979). Identification refers to an individual's belief that performing a behavior will elevate his or her social status within a referent group because important referents believe the behavior should be performed (Venkatesh & Davis, 2000). Internalization is defined as the incorporation of a referent's belief into one's own belief structure (Warshaw, 1980). TAM2 posits that subjective norm and image will positively influence perceived usefulness through processes of internalization and identification, respectively. It further theorizes that the effect of subjective norm on both, perceived usefulness and behavioral intention will attenuate over time as users gain more experience with a system.

In TAM2, four constructs—job relevance, output quality, result demonstrability, and perceived ease of use—capture the influence of cognitive instrumental processes on perceived usefulness. Drawing on three different theoretical paradigms that is, work motivation theory (e.g., Vroom, 1964), action identification theory (e.g., Vallacher & Wegner, 1987), and behavioral decision theory (e.g., Beach & Mitchell, 1996, 1998), Venkatesh and Davis (2000) provided a detailed discussion

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