The role of moderating factors in user technology acceptance

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Abstract

Along with increasing investments in new technologies, user technology acceptance becomes a frequently studied topic in the information systems discipline. The last two decades have seen user acceptance models being proposed, tested, refined, extended and unified. These models have contributed to our understanding of user technology acceptance factors and their relationships. Yet they have also presented two limitations: the relatively low explanatory power and inconsistent influences of the factors across studies. Several researchers have recently started to examine the potential moderating effects that may overcome these limitations. However, studies in this direction are far from being conclusive. This study attempts to provide a systematic analysis of the explanatory and situational limitations of existing technology acceptance studies. Ten moderating factors are identified and categorized into three groups: organizational factors, technological factors and individual factors. An integrative model is subsequently established, followed by corresponding propositions pertaining to the moderating factors.
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1. Introduction

Driven by market competitiveness, business enhancement, service improvement and work efficiency, organizations have invested heavily in information technology with the likelihood of continuing this investment pattern into the foreseeable future (Chau and Hu, 2002). Some estimates show that since the 1980s, 50% of all new capital investment in organizations has been in information technology (Venkatesh et al., 2003). Understanding the factors that influence user technology acceptance and adoption in different contexts continues to be a focal interest in information systems (IS) research.

Several models and theories have been developed to explain user technology acceptance behavior. However, these models have some limitations. The first limitation concerns the explanatory power of the models. Most of the existing studies account for less than 60% of variance explained, especially those using field studies with profes-

sional users. Although there may be many other factors that are beyond researchers' reach, the differences in explanatory power between laboratory studies and field studies, and between studies using students and using professionals, imply some complex contextual factors in the real world that should be taken into account (e.g., the influence of organizational factors such as the voluntariness of IT usage). The second limitation of these models is the inconsistent relationships among constructs, making researchers question the generalizability of these models across differing contexts (e.g., Lee et al., 2003; Legris et al., 2003). These limitations call for improvement and refinement of existing studies.

Moderating factors may account for both the limited explanatory power and the inconsistencies between studies. In an early study, Adams et al. (1992) called for more examination of moderating factors. Several recent studies continue to call for the inclusion of some moderating factors (e.g., Lucas and Spitler, 1999; Venkatesh et al., 2003). Agarwal and Prasad (1998) explicitly criticized the absence of moderating influences in technology acceptance model (TAM), and called for more research to investigate moderating effects. Venkatesh et al. (2003) tested eight

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models and found that the predictive validity of six of the eight models significantly increased after the inclusion of moderating variables. Furthermore, they argued, "it is clear that the extensions (moderators) to the various models identified in previous research mostly enhance the predictive validity of the various models beyond the original specifications" (Venkatesh et al., 2003, p. 21). In addition, Chin et al. (2003) empirically examined and confirmed the significant influence of moderating factors in existing models of user technology acceptance.

While stating that "the extensive prior empirical work has suggested a large number of moderators", Venkatesh et al. (2003, p. 21) included only four in their study: experience, voluntariness, gender and age. Based on a careful literature review, we believe that there are more moderating factors with empirical evidence than the four studied. For example, the nature of the tasks may affect users' acceptance of technology, as does the nature of the technology. Few of these moderators were examined either conceptually or empirically in recent efforts. A systematic examination of significant moderating factors should contribute to our better understanding of the dynamics of the user technology acceptance phenomenon.

This study examines the moderating effects in user technology acceptance. It adds to the few studies that take into account the individual and contextual factors in technology acceptance (i.e., Igbaria et al., 1997). The objectives of this paper are three-fold. It first provides an overview of prior literature to disclose the limitations of explanatory powers and the inconsistencies between prior studies. Then the paper highlights the moderating factors that account for both the limitations of the explanatory power and the inconsistencies. Ten moderating factors that have strong empirical evidence are identified and categorized into three groups: organizational factors, technological factors and individual factors. And, finally, the paper proposes a new model with propositions pertaining to the effects of the moderating factors. Readers interested in other aspects of user technology acceptance research summaries, such as research emphases and evolutions, empirical sample sizes and characteristics, most influential authors, and critical comments from several major researchers, are encouraged to read a recent meta analysis by Lee et al. (2003), which lacks discussion of the effects of the moderating factors.

This study calls for more research attention to individual and contextual factors that are often neglected in technology acceptance studies but can be critical in applying theoretical models to specific situations in organizations. The study also provides a basis for further empirical investigation in this research area.

2. Overview of prior literature

A variety of models from different perspectives and at various levels have been developed to explain IT acceptance perceptions and behaviors: TAM (Davis, 1989; Davis et al., 1989), Computer Self-Efficacy (Compeau and Higgins, 1995a, b), Task–Technology Fit (Goodhue, 1995; Goodhue and Thompson, 1995), Motivational Model (Davis et al., 1992) and adapted Theory of Planned Behavior (Mathieson, 1991; Taylor and Todd, 1995b). These models have all been recognized in the ISs discipline. Using TAM as an example, abundant studies have been done to test (Davis, 1989, 1993; Davis et al., 1989; Adams et al., 1992), extend(Venkatesh and Davis, 1996, 2000; Igbaria et al., 1997; Venkatesh, 2000; Viswanath and Davis, 2000), or compare it with other models (Davis et al., 1989; Mathieson, 1991; Taylor and Todd, 1995b; Dishaw and Strong, 1999; Venkatesh and Davis, 2000). Overall, these theoretical models have contributed to our understanding of user acceptance perceptions and behaviors. In a recent study, a unified theory of acceptance and usage of technology was proposed and tested by integrating some of the prior models (Venkatesh et al., 2003).

However, there is still room for improvement. In this research, we focus on two aspects: the explanatory power of prior user technology acceptance research and the inconsistent relationships between studies.

In order to provide a comprehensive picture of the existing studies, we systematically selected published articles on technology acceptance to conduct the analysis. The articles were selected through the following procedure. First, primary IS journals and databases (such as ABI/ INFORM, WilsonSelect, JSTOR and ACM Digital Library) were systemically searched using a number of seed articles on user technology acceptance. Second, Social Science Citation Index (SSCI, January 1986–September 2003) was searched for the articles citing the above seed articles. Finally, 55 articles (see Appendix A) were chosen based on the following criteria: (1) The article was published in primary IS journals; (2) The article conducted one or more empirical studies of research; (3) User technology acceptance as well as its components received substantive consideration in the article; and (4) The results were presented in detail, followed by corresponding discussions.

2.1. The limitations of explanatory power

Our examination indicates that the vulnerability of explanatory power lies in two areas: the relatively low explained power and the variation of explanatory power owing to different research methods (i.e., laboratory experiments and field studies).

2.1.1. Limited explanatory power of R^2

Table 1 shows a comparison between TAM and other models. It indicates that as one of the most successful models, TAM's explanatory power is limited.

In one recent study, Venkatesh et al. (2003) compared eight user acceptance models on explanatory power. Their longitudinal studies showed that these models exhibited explanatory powers in the neighborhood of 40%. That is,