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Extending the Technology Acceptance Model

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Abstract

We extend the Technology Acceptance Model (TAM) using elements from a Task-Technology Fit Model (TTF). We test our integrated IT utilization model using path analysis. Our results provide a model with more explanatory power, which should lead to a better understanding of choices about using software.

Introduction

While information technology utilization studies are common in the MIS literature (DeLone and McLean, 1992; Trice and Treacy, 1988), early studies lacked a strong theoretical foundation. Two significant models have emerged within the last decade which provide a strong theory base for studies of utilization behavior. The first model, the Technology Acceptance Model (TAM) (Davis, 1985), is a well known and widely accepted model in the MIS literature on software utilization. The second model, the Task-Technology Fit Model (TTF) (Goodhue, 1995; Goodhue and Thompson, 1995), addresses utilization from a different, although not entirely orthogonal, perspective. We believe that these models overlap in a significant way and if integrated may provide an even stronger model than either standing alone.

The objective of this research is to develop and evaluate an integrated TAM/TTF model. To evaluate our integrated model, we collected data on maintenance programmers' utilization of software maintenance support tools for 74 individually-performed maintenance projects. Programmers completed questionnaires before and after their maintenance project. A complete description of the research method as well as the items for each construct can be found in Dishaw and Strong (1995). We examined our integrated model using path analytic techniques, specifically the AMOS package in SPSS for Windows. We first separately tested TAM and a TTF model. Then, we tested several alternative paths for integrating TTF into TAM.

An integration of these models will be useful in understanding software utilization in a broader variety of circumstances, which is extremely important for software authors and managers of the software users. They need to understand how the customers and end-users of software actually choose to use or not use certain functions. The key to understanding software use decisions lies in understanding how the functions provided by the software fit the perceived needs of the user.

The Technology Acceptance Model (TAM)

The Technology Acceptance Model (Davis, 1985), in Figure 1, is a specific adaptation of the Theory of Reasoned Action (TRA) model (Ajzen and Fishbein, 1980) to the study of computer software usage. The TRA and its successor, the Theory of Planned Behavior (TPB) (Ajzen, 1985) are well known, and have been widely employed in the study of specific behaviors (Ajzen and Fishbein, 1980). In general, these theories (TRA, TAM) state that a behavior is determined by intention to perform the behavior. Actual behavior and intention have been found to be highly correlated (Ajzen and Fishbein, 1980; Davis, 1985). Intention, itself, is determined by attitude towards the behavior. Davis' research, in essence, examines the external variables which determine or influence attitude towards tool use. The TAM model identifies perceived ease of use, and perceived usefulness as key independent variables. Perceived usefulness is also indirectly influenced by perceived ease of use. The TAM includes the very important assumption that the behavior is volitional, which is to say voluntary or at the discretion of the user. The TAM model has been

tested in several studies of software use (Davis, Bagozzi and Warshaw, 1989; Mathieson, 1991; Adams, Nelson, and Todd, 1992).

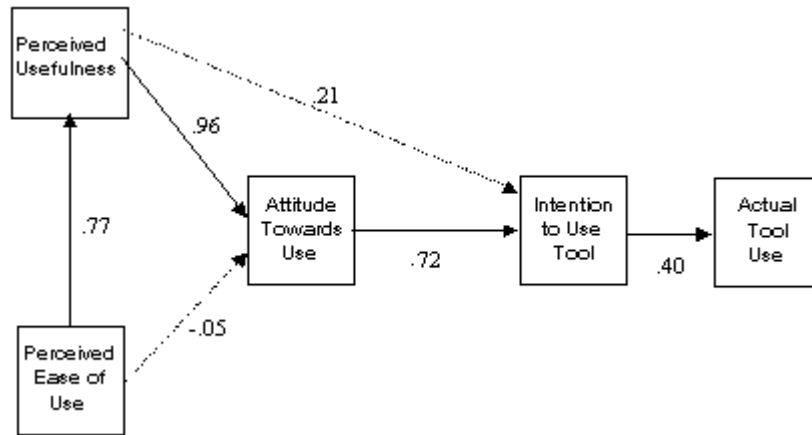


Figure 1: TAM Path Analysis

Data to test the TAM used the published items for the TAM constructs (Davis, 1989). Before testing our integrated model, we first test that the TAM holds for our data. The path analysis, see Figure 1, shows acceptable fit to the data. The amount of variance in the dependent variable, utilization, explained by this model was 16%.

Task - Technology Fit Model

The ability of software to support a task is expressed by the formal construct known as Task-Technology Fit (TTF), which is the matching of the capabilities of the technology to the demands of the task. TTF posits that software will be used if, and only if, the functions available to the user support (fit) the activities of the user. Rational, experienced users will choose those tools and methods which enable them to complete the task with the greatest net benefit. Software which does not offer sufficient advantage will not be used. Higher degrees of "Fit" lead to higher performance (Goodhue, 1988), and expectations of consequences of use (Goodhue, 1992). The latter finding is of primary interest in this study as it provides a link between fit and perceived usefulness.



Figure 2: TTF Path Analysis

We compute fit from characteristics of the task and the technology. Task characteristics are measured using a model of software maintenance tasks (Vessey, 1986) and a model of CASE technology (Henderson and Cooperider, 1990). Our computed TTF approach differs from the perceived fit operationalization used by Goodhue (1995) and Goodhue and Thompson (1995). Full details of this computed TTF approach are described in Dishaw and Strong (1995). A path analysis of the TTF model, see Figure 2, shows acceptable fit to the data. The amount of variance in the dependent variable, utilization, explained by this model was 10%.

Integration of TAM and the Task - Technology Fit Model

We posit that TTF determines, in part, three variables in the TAM model. TTF is expected to directly affect utilization, as it does in TTF models. TTF may also determine, in part, TAM's two independent variables, Perceived Usefulness and Perceived Ease of Use, which indirectly include aspects of the technology and the task for which the technology could be used. For example, the whole notion of usefulness implies that the software is used for something.

Justification for elaborating the TAM to include explicit references to task and technology is provided by the arguments of Goodhue (1992). Goodhue linked his TTF model with the technology usage model of Bagozzi (1982). Specifically, Goodhue asserts a link between perceived fit between task and technology and a key independent variable in the Bagozzi model, the expected consequences of using a technology. The expected consequences variable in Bagozzi (1982) closely corresponds to Perceived Usefulness in the Davis (1985) model. We therefore believe that TTF may determine, in part, Perceived Usefulness. There is also a relationship between Ease of Use and Usefulness (Davis, 1989). Usefulness is influenced somewhat by Ease of Use. Since TTF includes aspects of both task and technology, TTF may also determine, in part, Perceived Ease of Use. These two links are reasonable because the underlying assumption in the TRA family of models, including TAM, is that a person engages in a behavior because he or she has evaluated the benefits of engaging in that behavior and expects a certain result.

The integrated path model (Figure 3) uses solid lines to show all paths significant at the .05 level and dotted lines for those not significant at .05. This model represents a good fit to the data, providing a Chi squared statistic of 6.07 with 6 degrees of freedom ($p=.415$). The goodness of fit index was .97, and the adjusted goodness of fit index was .89. Total explained variance in the dependent variable was 23%. These results indicate that TTF indirectly determines Perceived Usefulness through the mediation of Perceived Ease of Use. In addition, there is a strong and significant effect of TTF on Utilization.

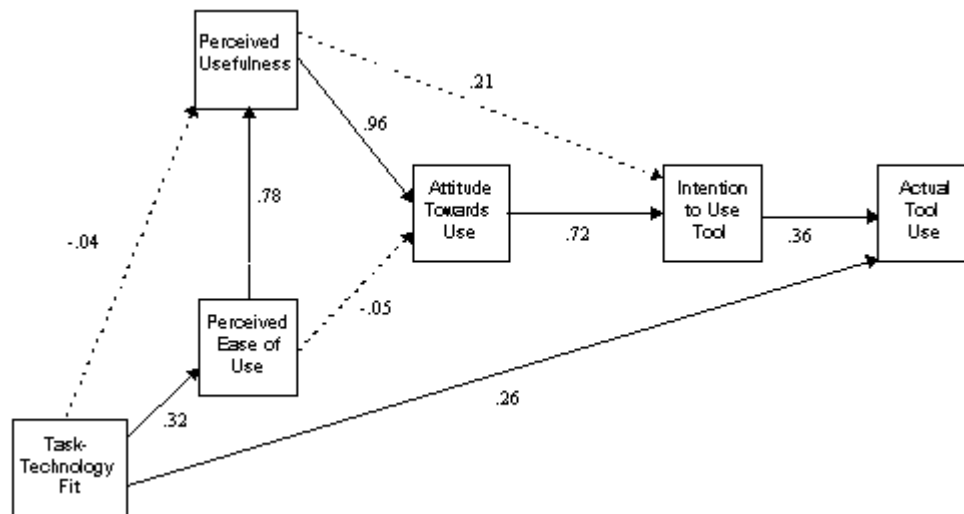


Figure 3: Integrated Path Model

Discussion and Conclusion

Our results suggest that TTF and Perceived Usefulness are related but only by way of the mediation effect of Perceived Ease of Use. TTF also determines Utilization independently of the TAM model. Thus, the utilization variance explained is higher for the combination of the TTF and TAM models than for either model alone.

These results have implications for research and practice. For research, the differences and overlap between the TAM and TTF should be explored further. Our results suggest that some aspects of utilization are determined by users' perceptions of the usefulness and ease-of-use of the tools and general attitude toward using the tools, while other aspects are affected by the matching of specific tool functionality to the specific

needs of a task. For practice, software authors need to be aware that actual utilization depends not only on perceived usefulness and ease-of-use, but also on how well the tool functionality matches the needs of the task at hand. Managers of software users, especially managers of software maintenance tool users, should be aware that low utilization of support tools may be caused by lack of fit between tool functions and task demands, rather than on the general usefulness and usability of the tools.

A longer version of this paper, with references, is available from the first author.