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December 1999

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### Recommended Citation

Dishaw, Mark; Strong, Diane; and Bandy, D. Brent, "Developing a General Method to Assess Task-Technology Fit" (1999). *AMCIS 1999 Proceedings*. 211.

<http://aisel.aisnet.org/amcis1999/211>

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# Developing a General Method to Assess Task-Technology Fit

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## Abstract

This research generalizes a method of assessing task-technology fit that was developed for software maintenance tasks and tools. A general instrument is developed for assessing task needs, technology characteristics, and the resulting fit for general problem solving tasks and problem-solving support tools.

## Overview

The most established method of assessing Task-Technology Fit (TTF) for general problem domains was first elaborated by Goodhue (1988). Goodhue's questionnaire instrument assesses TTF directly, rather than assessing task needs, technology features, and the resulting fit. While the instrument identifies 12 separate variables (Goodhue, 1988; 1992; 1995), its explanatory power is fairly low, with adjusted  $R^2$  in multiple regression models of less than 0.2 (Dishaw & Strong, 1998a). While low explanatory power is not unusual for social science models, this is much lower than the explanatory power of TAM, which produces adjusted  $R^2$  of approximately 0.4 (Adams, Nelson, & Todd, 1992; Davis, Bagozzi, & Warshaw, 1989; Taylor & Todd, 1995).

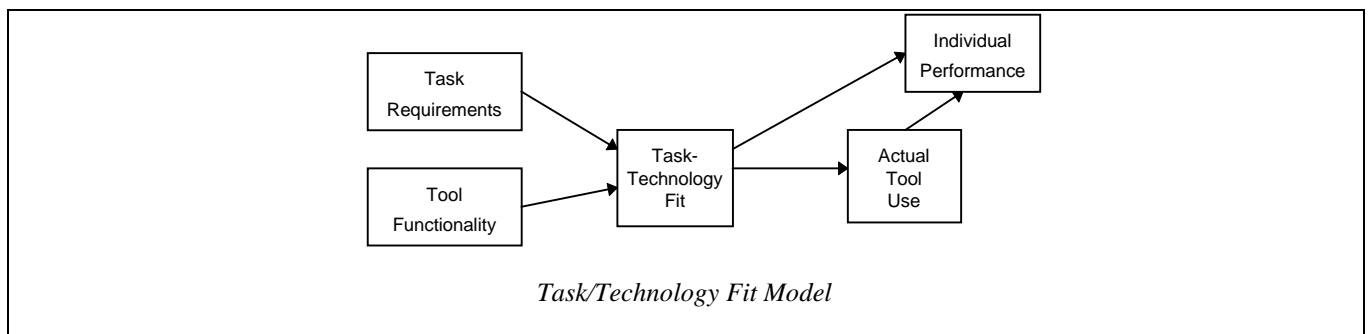
An alternative approach to TTF assessment, developed by Dishaw & Strong (1998b), provides much better explanatory power; in some cases  $R^2$  exceeded 0.5. This approach uses a definition of TTF that is conceptually similar to that of Goodhue (1988), but uses a different method of operationalizing Task-Technology Fit. Specifically, it assesses task needs, technology features, and the resulting fit. The method, however, has only been applied in a very specific venue, Software Maintenance.

This paper describes an extension of the Dishaw & Strong (1998b) study. Our goal is the development of an instrument that would be useful in assessing problem-solving tasks, and examining the support of such tasks with software, using the Dishaw & Strong alternative approach to Task-Technology Fit (TTF) assessment. We expect this approach will provide the higher explanatory power obtained from assessing task, technology, and the resulting fit for a larger class of tasks than software maintenance, i.e., for problem-solving tasks.

## Task - Technology Fit Models

The core thesis of Task-Technology Fit Models is that technology, e.g., software, will be used if, and only if, the functions available to the user support (fit) the activities of the user. A software function supports an activity if it facilitates that activity. Alternatively, the software must serve to lower the cost to the user of the performance of some task or action. Rational, experienced users will choose those tools and methods that enable them to complete the task with the greatest net benefit. Software that does not offer sufficient advantage will not be used.

The ability of software to support a task is expressed by the formal construct known as Task-Technology Fit, which is the matching of the capabilities of the technology to the demands of the task. Although a universal definition of task-technology fit does not exist, the literature contains a number of similar definitions. See for example Vessey & Galletta (1991), Goodhue (1992), Goodhue and Thompson (1995), Nance (1992), and Dishaw & Strong (1998b). The following is a general TTF Model.



In most of the studies discussed above and in Vessey (1991), the dependent variable in the models of fit is performance. Dishaw & Strong (1998a; 1998b), however, focus on the performance antecedent, tool usage, as the dependent variable. This is appropriate when the use of the tools is voluntary, as it was for the software maintenance tools used by the programmers in the organizations in which data were collected. This allowed them to consider a dependent variable that is closer, from the perspective of the causal chain, to the independent variable fit. This research continues tool usage as the dependent variable.

### **Application to Software Maintenance**

Dishaw & Strong (1998b) studied TTF in software maintenance. Following is a brief discussion of their model of fit between the maintenance task and software tool functionality, which will serve as the basis for the development of our general TTF assessment method.

**Maintenance Task Model.** Dishaw & Strong (1998b) based their model of the maintenance task and the key dimensions involved on the empirical work of several MIS researchers who have studied software development and maintenance activities. The specific actions that make up the major maintenance task activities of Understanding and modification, which are planning, knowledge building, diagnosis, and Modification activities, were identified by recording the actions of maintainers during protocol analysis sessions (Vessey, 1985; 1986). The first three activities cover understanding, while the last one is the actual program transformation activity. In addition to understanding and modification activities, which are the core activities of the maintenance task, coordination activities are also necessary (Coopriider and Henderson, 1991; Vessey and Sravanapudi, 1995).

**Maintenance Technology Model.** The Henderson and Coopriider (1990) Functional Case Technology Model (FCTM) provided a description of the basic functions present in design support software (CASE). They identified two major dimensions of tool functionality: Production and Coordination functionality. Production functionality is the functionality that supports an individual programmer developing or changing software. Coordination functionality is the functionality that supports the coordination activities necessary when an individual performer is working in an organization.

**Dimensions of Fit.** Dishaw & Strong (1998b) tested two primary dimensions of fit between maintenance task and technology. The first dimension

captures how well the set of production functions in the software maintenance tool supports the set of understanding and modification activities needed to accomplish a particular maintenance task. The second dimension captures how well the set of coordination functions in the software maintenance tool supports the set of coordination activities needed to accomplish a particular maintenance task. Fit is then computed along these two dimensions using an interaction approach (Venkatramen, 1989).

### **General TTF Assessment**

The goal in this project is to generalize the software maintenance TTF model and produce a general instrument.

**Model Development.** The developers of the task model and the technology model used for the software maintenance TTF application argue that their models are appropriate for general problem solving and tools that support design and problem-solving tasks. Vessey's original work is well grounded in the problem solving and cognitive science literature, and the technology model is grounded in the literature on information technology support functionality. Thus, the task and technology models are used as is in their general form, i.e., at the general level of production and coordination tasks and tool functionality. The software maintenance TTF application is generalized by changing the questionnaire items.

**Item and Scale Development.** The items on the long form of the Dishaw & Strong (1998b) maintenance assessment instrument were used as the basis for our new instrument. The long form contains items for all of the factors identified in Vessey's (1985, 1986) debugging model, as well as items for the functional case tool model. The long-form items were rewritten to reflect problem-solving tasks by removing references to software maintenance and debugging, and rewriting items to address problem-solving activities. Some items were deleted entirely. Similarly, the maintenance tool items were rewritten to reflect problem-solving support.

We tested the items on a panel of faculty, advanced students, and professionals in fields such as statistical modeling, simulation modeling, auditing, financial analysis, and software development. The items were revised based on their feedback. The items were then pre-tested using a small number students and professionals in the university who are doing work in the normal course of business or academic assignments.

## Research Method

**Data Collection.** The revised instrument is being employed in a broader test involving students from several classes. The instrument is being administered after the completion of an ordinary assignment. From this, we will obtain the approximately 100 or more data points necessary for conducting the data analysis.

**Data analysis.** The results of the data collection effort will be analyzed using factor analytic techniques, including Confirmatory Factor Analysis (CFA). This technique allows the researcher to refine the instrument and "cull" items which do not contribute the scale. The result of this analysis generally yields a significantly improved set of items, and scales with high reliability and stable psychometric properties. Confirmatory Factor Analysis (CFA) and tests of the overall fit of the model will be accomplished using the AMOS package included with the SPSS for Windows package (Arbuckle, 1997). Results will be available for presentation in August.

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