A Comparison of Surrogate Success Measures in On-Going Representational Decision Support Systems: An Extension to Simulation Technology

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New technology and software development have provided corporate managers with a wide variety of decision making aids. One such tool, classified as a representational decision support system, is discrete event computer simulation. In order to assess the organizational impact of discrete event computer simulation, an instrument capable of measuring success is required. The importance of such assessment cannot be overemphasized. While empirical measurement of various information system inputs or independent variables such as information system budget expenditures or user participation is relatively straightforward, the development of corresponding output or dependent variables has been difficult. In an attempt to overcome these difficulties, researchers have suggested a variety of measurable surrogates. Work in this area has paved the way for the development of instruments used to assess success. This paper focuses on external validity aspects of two popular information system instruments, the Davis measure of User Acceptance of Information Technology and the Doll and Torkzadeh measure of End-User Computing Satisfaction (EUCS). These instruments were designed for general purpose use and tested across a variety of settings, times, and persons. To ensure this generalizability extended to a very specific form of information technology, these instruments were administered to discrete event computer simulation users and tested for psychometric stability. This study provides additional evidence that the Doll and Torkzadeh measure of End-User Computing Satisfaction retained its psychometric properties when applied to users of discrete event computer simulation and therefore provides a reasonable surrogate measure for success in the implementation of this technology. An initial assessment of the Davis measures of User Acceptance of Information Technology (Perceived Ease-of-Use, Perceived Usefulness) returned poorer scores on the fit indexes, but the evidence did indicate the expected factor structure was supported to some extent. The managerial implications of these findings are discussed.

INTRODUCTION

End user application of representational decision support systems (DSS) is currently receiving renewed attention in business and industry (Eldredge and Watson, 1996). A primary manifestation of the representational DSS is computer simulation (Alter, 1977). “Computer simulation involves the modeling of a process or system in such a way that the model mimics the response of the actual system to events that take place over time” (Schriber, 1987). In other words, simulation is simply using a computer to imitate the behavior of a complicated system and thereby gain insight into the performance of that system under a variety of circumstances (Thesen and Travis, 1992). Within this context, computer simulation can be classified as a decision support tool.

Discrete event computer simulation can be broken into two categories, simulation languages and simulators. A simulation language is a versatile, general purpose class of simulation software that can be used in a multitude of different modeling applications. These languages are comparable to FORTRAN, BASIC, COBOL or C, but have specific features to facilitate the modeling process. Some examples of simulation languages are GPSS/H, SLAM II, SIMSCRIPT II.5, and SIMAN V. A simulator is a user friendly software package that will aid in the development of a model for a particular...
application. Simulators and simulation languages are generally differentiated by several key features. Brunner (1988) characterized several of these as Ease of Use - designed specifically for the non-programmer; Tools for Quick Model Development - provide a fast method of model construction; and Base System Simulation Already Complete—a general model has already been constructed.

While implementations and use of computer simulation by end users have been reported with varying levels of success (Giannini, Grupe, and Saholsky, 1997; Gogg and Sands, 1990; St-Germain and Laveault, 1997; Wilt and Goddin, 1989) and failure (Duff, 1991; Keller, Harrell, and Leavy, 1991), underlying factors affecting these outcomes are only now being investigated empirically (McHaney and Cronan, 1998; St-Germain and Laveault, 1997).

In order for discrete event computer simulation and related technologies to continue growing in value, a better understanding of elements constituting successful implementation for end users need be developed. While efforts to empirically study success have only recently started to appear in the discrete event computer simulation literature, similar topics have been researched in the area of information systems (Bailey and Pearson, 1983; Baroudi, Olson and Ives, 1986; DeLone and McLean, 1992; Ginzberg, 1981; King and Epstein, 1983; Mahmood, 1987; and DSS (Guimaraes, Igbaria, and Lu, 1992). Although much of this research is general, its intent is to provide a dependent variable and give researchers and end users the ability to assess specific applications of information technology (Doll and Torkzadeh, 1988).

The identification of a dependent variable is a problem that both plagues and motivates information system (I/S) researchers. When Keen (1980) listed issues of utmost importance to the field of management information systems, he included the identification of a dependent variable among them. DeLone and McLean (1992, p. 61) echo the importance of this sentiment by stating, “if information systems research is to contribute to the world of practice, a well-defined outcome measure (or measures) is essential...without a well-defined dependent variable, much of I/S research is purely speculative.” Without a dependent variable, measurable in the context of valid and reliable instruments (Jarvenpaa, Dickson and DeSanctis, 1985), meaningful comparisons of competing software packages, implementation approaches, system attributes, and software features become impossible.

While much progress toward the identification of a dependent variable has been made, no single standard has gained widespread acceptance in the I/S community. Researchers have operationalized dependent variables according to various criteria. DeLone and McLean (1992) surveyed this literature and discovered most studies can be classified into six general categories — system quality, information quality, use, user satisfaction, individual impact, and organizational impact. They suggest researchers might develop a single comprehensive success instrument to account for all six dimensions.

Although this comprehensive, standard I/S instrument for success does not yet exist, several very respectable measures are presently available and in use. Among these are the Davis (1989) measure of User Acceptance of Information Technology and the Doll and Torkzadeh (1988) measure of End-User Computing Satisfaction. Past research has demonstrated instrument validity—content validity, construct validity, and reliability (Straub, 1989)—as well as internal validity and statistical conclusion validity for both instruments. Researchers have applied these instruments to various forms of information technology, both in and out of lab settings at various times (Adams, Nelson and Todd, 1992; Davis, 1989; Doll, Hendrickson, and Deng, 1998; Doll and Torkzadeh, 1988; Hendrickson, Massey, and Cronan, 1993; McHaney and Cronan, 1998). The successes of these tests add evidence to the argument that external validity and generalizability are present. However, until recently, neither instrument has been applied to discrete event computer simulation and the developers of these measures advise caution in their application to different forms of information technology.

The purpose of this study is to compare two general measures of information system success when applied to a group of professionals using discrete event computer simulation within the context of their jobs as decision makers and simulation analysts. This research seeks to determine if the Davis (1989) measure of User Acceptance of Information Technology (Perceived Ease-of-use, Perceived Usefulness) and the Doll and Torkzadeh (1988) measure of End-User Computing Satisfaction maintain psychometric stability when used to measure discrete event computer simulation success. The investigation focuses on establishing construct validity, internal validity and reliability. If the hypothesized psychometric properties of these instruments are consistent with prior studies (Doll, et. al., 1998; Doll, et. al., 1994; McHaney and Cronan, 1998), the use of these instruments can be extended to the measurement of success in discrete event computer simulation. While EUCS has been shown to be psychometrically sound when used in a discrete event computer simulation environment (McHaney and Cronan, 1998), this study determines which measure is best suited to this population.

BACKGROUND

The implementation of information system technology has traditionally been an uncertain process. Some systems are successful. Others are not. In order to identify the determinants of success, a researcher must first be able to operationalize success. Many empirical studies in the area of information systems have been concerned with this task (Bailey and Pearson, 1983; Baroudi, Olson, and Ives, 1986; Ein-Dor, Segev and Steinfeld, 1981; Guimaraes, Igbaria, and Lu, 1992; King and Epstein, 1983; Mahmood, 1987; Srinivasan, 1985).