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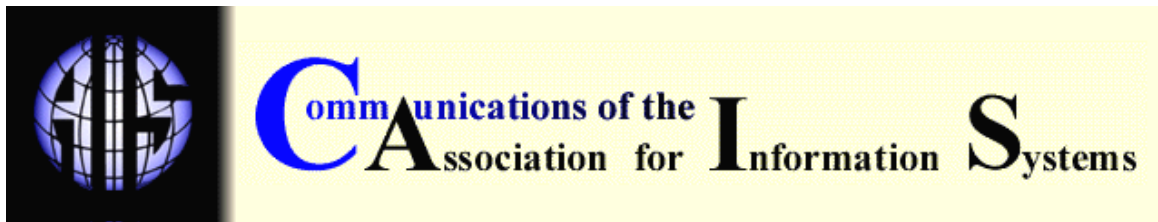*The Open University of Israel*

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MEASURING IS USER SATISFACTION: REVIEW AND IMPLICATIONS

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ABSTRACT

Demand for a means of measuring the success of information systems (IS) grew with the accelerated use of these systems. Defining success in this context is difficult. This paper reviews the literature on measuring IS user satisfaction, the most prevalent measure of IS success, and its implications. We present the problematic aspects of the IS user satisfaction tools, and discuss the need to develop up-to-date tools suitable for the sophisticated and complex systems developed today.

Keywords: information systems, IS, IS success measurement, user satisfaction

I. INTRODUCTION

Investments in developing and implementing information systems (IS) in organizations grew with the accelerated growth of computerization. These investments accelerated the demand for measuring the success of IS, as one way to determine return on investment. Measuring IS success is important for organizations and researchers [Srinivasan, 1985] and consistently ranked high on lists of the most critical problems of IS in the last twenty years [Brancheau et al., 1996; Dickson et al., 1984].

Studies indicate that the success of an information systems is hard to define because these systems represent an abstract concept that does not easily lend itself to direct measurement [DeLone and McLean, 1992]. Therefore, researchers tried to measure the success of IS as a function of cost-benefit [King and Schrems, 1978], information value [Epstein and King, 1983; Gallagher, 1974], or organization performance [Turner, 1982].

Cost-benefit, information value, and organization performance are difficult to apply as measures. For a system to be considered successful, it must be economically effective; that is, its benefits for the organization must exceed its costs. In practice, while the cost of information systems can be quantified (in terms of investment in resources, manpower, time, and other factors), it is often hard to quantify the benefits of IS. Some of the benefits are tangible, and can be translated into monetary or quantifiable terms. Such benefits include, for example, lower inventories, increased sales, reduced costs, and shorter reaction times. Other benefits are intangible, and therefore difficult to quantify; for example, improved decision-making capabilities, easier cross-checking of information, and simpler incorporation of information into the decision-making processes of senior management [Thong and Yap, 1996]. If the value of the information is hard to quantify, a user may still be asked for his or her view of the value of the information. In this case, economic-quantitative measures are replaced by a perceptual measure of the success of information systems.

Success cannot be attributed to a single factor. Complex relations of interdependence exist between the Information System and its environment, organization, users, and management. Thus, for example, improvements in organizational performance (such as reduced costs and increased income) cannot be attributed solely to the information system. Improvements may also result from other organizational changes, such as a modification of work processes, introduction of new work procedures, or personnel training [Gallagher, 1974; Goodhue, 1986].

Objective measures, such as computer usage time, the number of reports/queries issued over a specific period, or the number of file updates in a specified period of time, are more accurate, but are often inapplicable and difficult to measure:

1.   Their application requires preparation and financial investment on the part of the organization, such as installing software that measures the number of changes carried out in a file during a specified period of time.

2.   The users, aware of being "measured," may alter the way they use the system during the measurement period, and the proposed measuring tool would then fail to measure actual user behavior.

3.   These measures do not necessarily reflect the success of IS. Thus, for example, in a decision-support system, number of reports/queries issued by the system need not correlate with the quality of the decisions which the user can make, based on his/her use of the system [Melone, 1990].

The problematic nature of the measurement of the success of IS motivated researchers to seek factors that influence the success of IS either directly or indirectly, and to develop tools for measuring success that are inexpensive and easy to use.

DeLone and McLean [1992] analyzed more than 100 empirical papers containing IS effectiveness and success measures between 1981 and 1987. Of the multitude of measures they found, they identified six major factors of success, as shown in Figure 1.
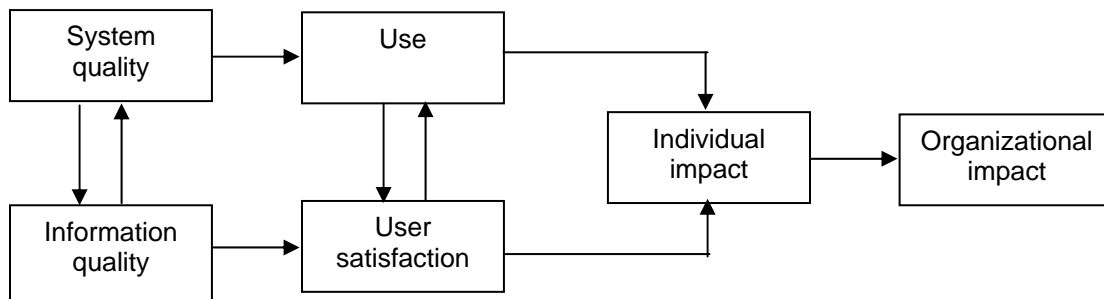
Source: [DeLone and McLean [1992] Figure 2, p. 87]

Figure 1. DeLone and McLean's Model of IS Success

Research that focused on specific systems provided a refinement of the DeLone and McLean model. Systems studied included executive information systems [Rainer and Watson, 1995], expert systems [Yoon et al., 1995], and management planning systems [Raghunathan and Raghunathan, 1994].

Following attempts to classify information systems, Swanson [1994] concluded that different types of systems have different properties, and these properties affect success evaluation. The results of all these studies, along with the basic DeLone and McLean model, suggest that IS success is composed of a set of factors that apply to all systems, in addition to a set of factors specific to each type of system.

Although ideally one would like to evaluate the success and effectiveness of an IS-based system on its degree of use in decision-making and the resultant productivity benefits, such an approach is generally not feasible [Noam and Seward, 1974; Ives, Olson and Baroudi, 1983]. Researchers identified several criteria of IS success:

- system usage [Lucas, 1978; Parvi and Huff, 1989];

- user satisfaction [Baroudi and Orlikowski, 1988, Rivard and Huff, 1988]; and

- performance [Lucas, 1978].

User satisfaction was found to be an important factor in measuring IS success. This article briefly reviews empirical tools for measuring IS user satisfaction. We also discuss the need to develop up-to-date tools suitable for the sophisticated and complex information systems developed today.

II. USER SATISFACTION AND IS SUCCESS

User satisfaction is an important criterion for measuring the success of IS. Though indirect, it is the most prevalent measure of IS success due to its applicability and ease of use [Melone, 1990; Mahmood et al., 2000].

The concept of IS user satisfaction can be traced to the work of Cyert and March [1963] who proposed that an information system which met the needs of its users would reinforce satisfaction with the system [Ives et al., 1983]. After this initial study, IS user satisfaction was the subject of lively research that reached its peak in the late 1980s [Iivari, 1997].

In the early 1970s, Powers and Dickson [1973] studied factors affecting IS success, and identified user satisfaction as one of the key factors affecting it. They assumed that if users are satisfied with an information system, they use it. Therefore, satisfaction is a good measure of IS success. Conversely, if its users do not perceive a system as satisfactory, they are unlikely to use it. Thus, in order to improve a system, it is important to know how its users perceive it, and where its weak points lie. Swanson [1974] found a high correlation between manager's involvement with the Management Information Systems development and their appreciation of the system, which implies that the key to system success is involvement of users. Neumann and Segev [1980] found a correlation between users' reaction to satisfaction factors and their perception of an organization's performance. Ives et. al., [1983] defined user satisfaction as the degree to which users believe that the information system at their disposal fulfills their needs. User satisfaction provides a significant surrogate for the critical product of the information system – which cannot be measured – namely, changes in organizational effectiveness. Baroudi, Olson, and Ives [1986] concluded that user satisfaction led to system use, and therefore should be preferred as a measure of the success of an information system.

Igbaria and Nachman [1990], based on data from 104 end users in six large companies, examined the individual, organizational, and system factors affecting the success of end-user computing, as reflected in end-user satisfaction. Their key result was that the leadership style of information system managers was positively and significantly related to user satisfaction. They also found a positive relationship between user satisfaction and hardware/software accessibility and availability, and system utilization.

Many other studies [e.g., Bailey and Pearson, 1983; Ives et al., 1983; Igbaria and Zviran, 1991, 1996: Zviran, 1992; Sengupta and Zviran, 1997] employ user information satisfaction as a dependent variable to indicate IS effectiveness and acceptance.

Sengupta and Zviran [1997] examined the use of the existing and widely-used user-satisfaction questionnaires in an outsourcing environment. Their conclusion was that these questionnaires are not suitable for use in such environments. They recommended the development of a comprehensive measure of user satisfaction in an outsourcing environment that would lead to the construction of new tools for assessing the information system outsourcing environment.

Gelderman [1998] investigated the validity and the mutual relations of the two commonly used measures for the success of IS: usage and user satisfaction. The results of the study indicate that user satisfaction is significantly related to IS performance. The study provides empirical evidence for the popular assumption that user satisfaction is the most appropriate measure of IS success.

Mahmood et al. [2000] focused their study on IS user satisfaction. Their research synthesized and validated the construct of IS user satisfaction using a meta-analysis. They analyzed the empirical results of 45 user-satisfaction studies published between 1986 and 1998, focusing on the relationship between user satisfaction and nine variables identified in these studies. This study is discussed in greater detail in section IV.

Chen et al. [2000] studied the measurement of user satisfaction with data warehouses. They identified the underlying factors of end-user satisfaction with data warehouses and developed an instrument to measure these factors. Their study demonstrated that most items in classic end-user satisfaction measures were also valid in a data warehouse environment.

Lin and Shao [2000] examined the relationship between user participation and system success, where the effects of user satisfaction and the two additional factors – user attitudes and user involvement – on system success, occur simultaneously. Empirical results from a survey of 32 organizations corroborated the positive link between user participation and user satisfaction and provided evidence for the interplay between user attitudes and user involvement.

Staples et al. [2002] studied the relation between expectations from information systems and perceived benefit and user satisfaction. They found support for the disconfirmation theory that unrealistically high expectations from IS would result in lower levels of perceived benefit and user satisfaction than those associated with realistic expectations.

Rai et al. [2002], in their study to assess the validity of DeLone and McLean's [1992] and Seddon's [1997] IS success models, found that IS user satisfaction impacts IS use: a higher level of satisfaction creates greater user dependence on the system. Their results support the posited impact of IS user satisfaction on IS use, assessed by system dependence, as suggested by the DeLone and McLean [1992] and Seddon [1997] models. This relationship is consistent with Davis' [1989] findings that attributes towards using the system shape system-usage behavior.

Recognizing the importance of user satisfaction as a surrogate measure for IS success, the measurement of user satisfaction was widely studied, and several measures and user satisfaction questionnaires were proposed. However, no single measure is widely accepted and no group of measures is used by all organizations. Most tools were developed following a review of the existing literature and tested using interviews, surveys, or a combination of the two.

III. TOOLS FOR MEASURING USER SATISFACTION

Appropriate tools for measuring user satisfaction and for identifying weak points or failures are imperative for accurate assessment of IS success. To meet this need, a number of tools were developed.

Gallagher [1974] developed a method for measuring perceptions of the value of a Management Information System. He constructed a questionnaire focusing on users' perceptions of the value of the information included in reports produced by the information system, and tested it by examining the answers of 75 managers who used an information system in a specific organization. Ives et al. [1983] and Conrath and Mignen [1990] argued that the questionnaire

developed by Gallagher focused only on the product of the information system (the reports) and not on the quality of the service given by the information systems department. They believed that the questionnaire might not be applicable to other information system products, and that it had problems of reliability and validity.

Jenkins and Ricketts [1979] developed an instrument for measuring user satisfaction based on literature reviews and interviews, and tested it in five laboratory experiments with 197 participants. The instrument consisted of 20 items presented as features of five factors: input procedure, system processing, report content, report format, and report value. Ives et al. [1983] and Conrath and Mignen [1990] argued that the instrument focused on information system products, and did not cover the services of information system departments. Joshi [1990] noted that the measure developed by Jenkins and Ricketts was suitable for a specific decision support system (DSS) environment, but, again, might not be applicable to a general information system environment.

Larcker and Lessig [1980] developed a measure based on their interviews, and tested it in a decision-making study with 29 graduate students. Ives et al. [1983] criticized the reliability and validity of this tool, arguing that it was created and tested in an artificial environment, and therefore was not applied to real-life information system environments or to typical information system problems.

Bailey and Pearson [1983] developed a 39-question tool for measuring user satisfaction, and tested it on 32 managers from eight organizations. Bailey and Pearson's work is considered the most important contribution to the development of a tool for measuring and analyzing user satisfaction [Conrath and Mignen, 1990]. DeLone and McLean [1992] affirmed that Bailey and Pearson's tool is a reliable instrument for measuring satisfaction and for conducting comparison studies. Klenke [1992] found that Bailey and Pearson was the most widely used instrument for measuring users' satisfaction with information system.

Bailey and Pearson [1983] reviewed 22 studies [including Powers and Dickson, 1973 and Swanson, 1974], and created an initial list of 36 variables that affect user satisfaction with an information system. Three IS experts examined the initial list and recommended adding 2 more variables. The researchers conducted interviews with 32 information system managers and compared their answers to the list of variables. Following this comparison they decided to add one more variable, reaching a final list of 39 variables that influence user satisfaction. Then they designed the questionnaire as a 7-point semantic differential adjective with 4 bipolar statements for each question, emphasizing the user's positive/negative feelings toward the system. A fifth statement was designed to test satisfaction as opposed to dissatisfaction with the variable, and a sixth statement was designed to test the importance as opposed to the unimportance of the variable. The 32 managers who took part in the interviews were asked to respond to the questionnaire, and 29 questionnaires were returned. Although the sample was small, Bailey and Pearson were able to demonstrate that a standard, valid, and reliable measuring tool should be constructed.

Ives et al. [1983] duplicated and expanded Bailey and Pearson's findings, and developed a short, 13-question tool based on their questionnaire. Initially, to reinforce the reliability and validity of the Bailey and Pearson questionnaire (as Bailey and Pearson's sample was too small statistically, 29 respondents for a 39-item questionnaire), Ives et al. performed a factor analysis on a sample of 200 production managers. Their analysis revealed four main factors with 22 questions at a cutoff level of 0.50:

- personnel and information system services
- information product
- knowledge and involvement
- support of an external supplier

Their next step was to reduce the number of questions on the questionnaire from 22 to the shorter version of 13 by leaving out questions with undesirable psychometric features (e.g., low

validity and factor loadings of less than 0.5), and reducing the four pairs of statements to two. In this way they hoped to create a valid, reliable tool, which could be answered quickly and easily. Their final instrument consisted of 13 questions with two response scales per question. Each response scale was scored on a 7-point, Likert-type interval scale, ranging from -3 (*Dissatisfied*) to +3 (*Satisfied*). The two response scales were reverse scored to eliminate the halo effect.

Baroudi and Orlikowski [1988] performed a psychometric evaluation of this short questionnaire. They collected questionnaires from 358 users of transactions processing systems in 26 organizations, and performed a reliability and validity test of the short questionnaire. The short questionnaire was shown to be valid and reliable.

Galletta and Lederer [1989] used 92 managers and executives as subjects to compare the test-retest reliability of the short questionnaire together with four summary questions under experimental and control conditions. They found that the summary questions behaved more reliably than the detailed questions perhaps because of problems with scale units and item heterogeneity. They called for reinstating questions from the long questionnaire that had been omitted and presenting the existing questions in greater detail. Doll et al. [1995] argued that the development process of the short questionnaire was inconsistent with its use, and showed that some factors lacked sufficient reliability and validity, but the tool itself was a good measure of overall satisfaction. They recommended further research to adjust the problematic questions in the short tool, and thus improve the reliability and validity of specific questions in the questionnaire. Doll and Torkzadeh [1988] argued that the tool was outdated and not suited to current computer environments, namely, end-user computer environments. They claimed that questions dealing with user interface (direct contact between the user and an on-line information system) and system flexibility (the ability to adjust the system to varying user requirements), should be added to the tool.

Olson and Baroudi [1983], who reviewed and critically analyzed pervious studies, argued convincingly for the adoption of the instrument designed by Bailey and Pearson [1983] on the basis of reliability, content, and predictive and construct validity. They also tested and recommended adoption of Ives and al.'s [1983] shorter and enhanced questionnaire. A long list of studies using either Bailey and Pearson's tool or Ives et al.'s short questionnaire can be found in the literature (Table 2 below). Some studies used only parts of Bailey and Pearson's questionnaire. However, eliminating questions necessitated a re-examination of the shortened tool's reliability and validity [Straub, 1989].

Miller and Doyle [1987] developed a 38-question tool for measuring the effectiveness of information systems in the business sector. Their tool consisted of 24 items taken from Bailey and Pearson's questionnaire; 12 items taken from the 26-item questionnaire of Alloway and Quillard [1981] which called for responses regarding "performance" and "importance"; and an additional two items. They tested the questionnaire on a sample of 177 user managers and 99 DP managers from 21 firms. Factor analysis was applied to the "performance" and "importance" parts of the questionnaire, the results of which strongly supported the construct validity. The instrument was found to be reliable (reliability coefficient for the overall instrument was 0.88).

Guimaraes and Gupta [1988] developed a questionnaire for measuring top management's satisfaction with an information system department. They created an initial list of 9 items following interviews with senior managers. Three groups of managers reviewed the list and made recommendations, which resulted in additional items, finally reaching a list of 19 items. The group of senior executives interviewed for the purpose of forming the initial list was asked to review the final list, grade the importance of each item and examine the list's clarity and readability. The questionnaire was tested through the answers of 109 senior executives and found to be reliable.

Doll and Torkzadeh [1988] developed a tool for measuring the satisfaction of end users. The major reason for the development of the new construct was that earlier constructs had been developed to measure satisfaction with information system function rather than satisfaction with a single information system application. The tool they proposed was designed for an end-user's computing environment, with direct contact between the users and the application software they were using; the users themselves were neither skilled nor were they information system experts.

The tool measured satisfaction with a specific application rather than general satisfaction. Etezadi-Amoli and Farhoomand [1991] criticized the manner in which the questionnaire was composed. They questioned the fact that respondents were asked to rate the frequency of satisfaction with features of the system, rather than their degree of satisfaction. They further claimed that the importance of each question was not measured, that reducing the number of questions from 40 to 12 was not carried out properly, and claimed that the tool had validity problems. Doll et al. [1994] performed a confirmatory factor analysis based on a sample of 409 respondents from 18 organizations to test alternative models of underlying factor structure and assess the reliability and validity of factors and items. The results provided some support for the Doll and Torkzadeh tool. McHaney et al. [2002] administered the Doll and Torkzadeh tool to Taiwanese end-users of typical business software applications. Their research provided evidence that the instrument was a valid and reliable measure in Taiwanese applications. Their findings strengthen the argument that the tool remains valid outside of the United States.

Etrzadi-Amoli and Farhoomand [1996] developed a questionnaire for measuring end-user satisfaction. The questionnaire consisted of 27 items measuring the satisfaction of end-users with a specific application, and 4 items measuring the implications of the application for the user and his or her work environment. The questionnaire was administered to 341 respondents in 22 organizations. Etezadi-Amoli and Farhoomand performed an explorative factor analysis, correlated the items with the seven derived factors, and deleted two items from the questionnaire. They later defined a model which correlateed between the six satisfaction factors (Items 1-27) and the factor of user performance (Items 28-31), and examined the quality of the model through confirmatory factor analysis. They found a relation between end-user satisfaction and user performance, but concluded that further research was needed to determine the nature of this relation.

Some researchers used single-question measures to determine user satisfaction (e.g., "Rate your overall satisfaction with the Information Systems in the organization"), but these measures do not provide sufficient information about the issue studied (in this case, user satisfaction is influenced by various factors). These measures are considered unreliable and involve large measuring errors [Nunnally, 1978]. In addition, they are unable to spot specific areas of dissatisfaction with information system.

Iivari [1997] noted several conceptual problems related to information system user satisfaction. The concept is used to refer both to the information system function and to a single information system application without always making clear the distinction between the two. Most of the measures of user satisfaction with the information system function suffer from severe limitations as a measure of user satisfaction with a single application.

Table 1 traces the major constructs for measuring user satisfaction beginning with Bailey and Pearson's dominant instrument in the early 1980s. For each construct, Table 1 lists the reference,

Table 1. Major User Satisfaction Constructs

Construct Reference	No. of items	Construction method	System to be assessed
Bailey & Pearson [1983]	39	Literature, interviews, empirical	IS function
Ives, Olson & Baroudi [1983]	13	Literature, empirical	IS function
Miller & Doyle [1987]	38	Literature, empirical	IS function
Guimaraes & Gupta [1988]	19	Interviews, empirical	IS department
Doll & Torkzadeh [1988]	12	Literature, interviews,empirical	IS application
Etezadi-Amoli & Farhoomand [1996]	31	Literature, interviews,empirical	IS application

the number of items it contains, the method of construction, and the kind of system it intends to assess.

STUDIES USING USER SATISFACTION MEASURES

Numerous studies used the tools for measuring user satisfaction to assess success of information systems. Until 1983, most studies used global ratings that asked participants for their opinion of the information system and their satisfaction with it, without ascertaining the reason for their responses. Unfortunately, such global ratings are not always accurate or reliable. They also may not uncover the pitfalls and problems that underlie the dissatisfaction. Without this information, implementing improvement procedures is hindered [Bailey and Pearson, 1983; Ives and Olson, 1984; Cote and Buckley, 1987]. In addition, in these studies no standard measure of satisfaction was used and exogenous variables were poorly controlled. Therefore, a comprehensive, valid set of factors to measure user satisfaction was needed, as was a standard acceptable instrument that measures not only the user's general reaction to each factor but a set of questions that would determine the reasons that respondents reacted as they did.

Most of the studies performed after Bailey and Pearson [1983], Ives et al. [1983], and Baroudi and Orlikowski [1988], used these original instruments, or parts of them, as a basis for constructing new questionnaires. The studies covered a variety of information system environments (e.g., decision support, on-line, supply ordering, accounting, human resources, and outsourcing). Table 2 lists the various studies in which user satisfaction measures were used for evaluating information system success.

IV. FACTORS FOR ASSESSING IS USER SATISFACTION

The factors affecting user satisfaction are often difficult to isolate due to their complex inter-relationships. A wealth literature is related to factors that influence IS user satisfaction.

Five principal factors for assessing user satisfaction with information systems were identified in the literature up to 1992. These factors derived from factor analysis procedures performed on Ives et al.'s [1983] short questionnaire and various questionnaires derived from Bailey and Pearson [1983]. The five principal factors identified are:

- *Relation between the organization's management and the information system* [proposed by Ein-Dor and Segev, 1981; evidence provided by Miller and Doyle, 1987; Tan and Lo, 1990].

- *Relation between the users and the information system* [proposed by Ein-Dor and Segev, 1981; evidence provided by Ives et al., 1983; Raymond, 1985, 1987; Mahmood and Becker, 1986; Miller and Doyle, 1987 and Tan and Lo, 1990].

- *Information received from the system* [proposed by DeLone and McLean, 1992; evidence provided by Ives et al., 1983; Raymond, 1985, 1987; Mahmood and Becker, 1986; Miller and Doyle, 1987 and Tan and Lo, 1990].

- *Information system's features* [proposed by DeLone and McLean, 1992; evidence provided by Mahmood and Becker, 1986; Miller and Doyle, 1987; and Tan and Lo, 1990].

- *Information system's service provider* [proposed by Ein-Dor and Segev, 1981; evidence provided by Ives et al., 1983; Raymond, 1985, 1987; Mahmood and Becker, 1986; Miller and Doyle, 1987 and Tan and Lo, 1990].

Table 2. Studies Based On User-Satisfaction Measures

Reference	Study Topic	Measures & Constructs	Respondents
Schewe [1976]	User attitudes and usage behavior	Design and use of a 10-item instrument	79 managers
Robey & Zeller [1978]	Factors affecting success or failure of information system	Implementation of Schultz & Slevin's instrument	11 managers and users
Maish [1979]	Relationship of users' behavior and attitudes toward IS	Design and use of a 52-item instrument.	62 respondents
Robey [1979]	The effect of user attitudes on MIS use	Implementation of Schultz & Slevin's instrument	66 salespersons
Ginzberg [1981]	Pre-implementation expectations and implementation failure	Design and use of a 5-item instrument	35 investment managers
Olson & Ives [1981]	User involvement in system design and user attitudes about IS services	Implementation of Guthrie [1972] dissatisfaction scale and other questions	83 users in 23 manufacturing companies
Cheney & Dickson [1982]	Organizational characteristics: user information satisfaction and job satisfaction	Design and implementation of a 44 items questionnaire	72 users in 15 organizations
King & Epstein [1983]	Assessing IS value	Using a single question in a multi-attribute approach	76 managers, 2 organizations
Bruwer [1984]	Model of success for computer-based IS	Design and use of a 14-item questionnaire	114 managers
Edmundson & Jeffrey [1984]	The impact of requirements analysis upon user satisfaction with packaged software	Use of a single question to measure general satisfaction	12 organizations
Jenkins, Naumann & Wetherbe [1984]	Systems development practices and results	Implementation of Jenkins, Milton & Rickett's [1982] 25-item questionnaire	72 development managers in 23 organizations
Langle, Leitheiser & Naumann [1984]	System development and Prototyping	Use of a single question to measure general satisfaction	Development managers, 78 organizations
Sanders, Courtney & Loy [1984]	Relationship between DSS usage and organizational communication	Design and use of a 12-item questionnaire	124 organizations 378 interface financial planning systems users
Sanders & Courtney [1985]	Influence of user's task environment on DSS success	Design and use of a 12-item questionnaire	378 DSS users in 124 organizations
Barki & Huff [1985, 1990]	Impact of change and attitude to change on DSS implementation success	Implementation of Ives et al.'s short questionnaire	42 DSS users
Doll & Ahmed [1985]	Documenting IS and user satisfaction	Design and use of a 11-item questionnaire	144 managers in 55 organizations

Mahmood & Medewitz [1985]	Impact of design methods on DSS success	Design and use of a 8-item questionnaire	48 graduate students
Srinivasan [1985]	Implementation of computerized modeling systems	Implementation of Jenkins & Ricketts' instrument	29 planners in an organization
Raymond [1985]	End-user satisfaction as a measure of success in small organizations	Implementation of a subset of 20 items from Bailey & Pearson	58 managers
Baroudi et al. [1986]	Impact of user involvement on system usage and information satisfaction	Implementation of Bailey & Pearson's instrument.	200 product managers
Lehman, Van Wetering & Vogel [1986]	Computerized business graphics and user satisfaction	Not specified	IS managers, 200 organizations
Mahmood & Becker [1986]	Effect of organizational maturity on end users' satisfaction with IS	Implementation of a subset of 22 items from Bailey & Pearson	57 managers and users
Rushinek & Rushinek [1986]	Effect of 17 variables on user satisfaction	Design and use of a 17-item questionnaire	4448 users
Snitkin & King [1986]	Determinants of effectiveness of personal DSS	Using a single question measure	31 users
Cats-Baril & Huber [1987]	DSS for ill-structured problems and the effect of design characteristics	Not specified	101 students
Hogue [1987]	Examination of management involvement in DSS	Using a single question measure	18 organizations
Mahmood [1987]	System Development Life Cycle [SDLC] and prototype methods	Using a single question measure	61 pairs of designers and users' managers
Mendelow [1987]	Information system departments	Implementation of a 42-item instrument	106 managers and information system experts
Taylor & Wang [1987]	Database with multiple dialogue interfaces	Measuring satisfaction with interface	93 students
Nelson & Cheney [1987]	End-user training	Implementation of Ives et al.'s short questionnaire	100 managers end-users in 20 organizations
Raymond [1987]	Validating and applying user satisfaction as a measure of MIS success in small organizations	Implementation of a subset of 20 items instrument from Bailey & Pearson	464 financial managers in small firms
Baronas & Louis [1988]	User involvement and system acceptance	Implementation of a subset of 13 items from Bailey & Pearson	92 employees in wage and personnel depts.
Baroudi & Orlikowski [1988]	Psychometric evaluation of Ives et al. questionnaire	Implementation of Ives et al.'s short questionnaire	358 employees, 26 companies

Montazemi [1988]	End-user satisfaction in small organizations	Implementation and validation of a subset of 35 items from Bailey & Pearson	86 end-users and 67 IS users
Tait & Vessey [1988]	Examining the effect of user involvement on system success	Implementation of Ives et al.'s short questionnaire	42 pairs of users
Galletta & Lederer [1989]	Evaluation of the reliability of Ives et al.'s short tool	Implementation of Ives et al.'s short questionnaire	92 managers in MBA course
Iivari & Karjalainen [1989]	Impact of prototyping on user satisfaction during the IS specification phase	Implementation of a subset of 10 items from Bailey & Pearson	10 reporters at a local TV station
Mahmood & Sniezek [1989]	Assessment of end-user satisfaction with DSS	Design and implementation of a 40-item instrument	201 DSS users
Conrath & Mignen [1990]	User satisfaction measurement	Implementation of a subset of 16 items from Bailey & Pearson	23 respondents
Igbaria & Nachman [1990]	Examining factors influencing the success of end user computing	Implementation of Ives et al.'s short questionnaire	104 end users in 6 large organizations
Joshi [1990]	Impact of equity theory on user satisfaction	Implementation of Ives et al.'s short questionnaire	226 users
Kim [1990]	Effectiveness of development teams in hospital IS environments	Implementation of Jenkins & Ricketts' instrument	125 end users
Tan & Lo [1990]	Validation of a user satisfaction instrument for office automation success	Implementation of a subset of 26 items from Bailey & Pearson	68 users of an office automation system
Hawk & Dos Santos [1991]	Effect of user involvement in information system development on user satisfaction	Implementation of Ives et al.'s short questionnaire	93 end users of 51 IS in 18 organizations
Zviran [1992]	User satisfaction as a measure for the success of IS in hospital environments	Implementation and validation of Ives et al. short questionnaire	101 users of IS in hospitals
Amoako-Gyampah & White [1993]	Impact of user involvement on user satisfaction	Implementation of a subset of 9 items from Bailey & Pearson	52 users of a new IS
Gatian [1994]	Relationship between user satisfaction and user performance	Implementation of Jenkins & Ricketts' instrument	108 executive managers and 79 department heads at 39 universities
Iivari & Ervasti [1994]	Interrelations among information satisfaction, IS implementation, and effectiveness of IS	Implementation of a subset of 13 items from Bailey & Pearson	93 users, 44 managers, and 21 information system professionals
Kettinger & Lee [1994]	Evaluation of user satisfaction with information system function	Implementation of Ives et al.'s 13-item short questionnaire	342 users of college information system services

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McKeen, Guimaraes & Wetherbe [1994]	Effect of user participation on user satisfaction	Implementation of a subset of 10 items from the Ives et al.'s short questionnaire	8 information system managers regarding 151 IS
Mirani & King [1994]	Development of a measure for end-user computing support	Implementation and validation of a subset of 12 items from Ives et al.'s short questionnaire	114 information center managers and 169 users
Vlahos & Ferratt [1995]	Measuring user satisfaction among Greek users	Using a single item measure	55 users in Greece
Yoon, Guimaraes & O'Neal [1995]	Factors affecting the success of expert systems	Design and implementation of a 9-item instrument	69 project managers
Guimaraes, Yoon & Clevenson [1996]	Factors important to expert systems success	Design and implementation of a 9-item instrument	114 project managers and 114 end users
Saarinen [1996]	Developing an instrument for measuring the success of IS development projects	Implementation of Ives et al.'s 13-item short questionnaire	48 project managers and line managers involved in 247 projects
Sengupta & Zviran [1997]	Measuring user satisfaction in an outsourcing information system environment	Implementation of Ives et al.'s 13-item short questionnaire	340 physicians, medical support personnel and administrators in 3 hospitals
Jiang et al. [2001]	Effect of self perception and user perception on user satisfaction	Implementation of Ives et al.'s instrument and remarks on its usage	193 IS users
McHaney et al. [2002]	Validation of the End-User Computing Satisfaction [EUCS] when applied to Taiwanese end-users	Implementation and validation of Doll & Torkzadeh's instrument	342 Taiwanese end-users in 25 organizations
Rai et al. [2002]	Assess the validity of IS success models	Several IS success constructs	274 system users of an integrated student IS

Ditsa and MacGregor [1995] examined a wide range of user satisfaction models and identified other key factors for assessing information system user satisfaction:

- *quality of the information from the information system*

- *user interface features of the information system*

- *support provided by information system staff, vendors, or manuals*

- *user involvement in the planning, development and implementation of the information system*

- *user attitudes toward the information system*

Palvia [1996] and Palvia and Palvia [1999] developed a model for examining the user satisfaction with IT of small business users. A contingency analysis of IT user satisfaction based on business-related factors and owner characteristics was performed. They found many new factors and specific items distinguishing the model from the models for medium and large organizations. A general observation was that *user (owner) attributes* impact IT satisfaction more than any of the business factors.

Iivari [1997] introduced a more refined framework for understanding an information system as an antecedent of information system user satisfaction, distinguishing the five aspects:

- System to be assessed

- Attribute-defined vs. user-defined satisfaction

- System features vs. system effects

- History-based vs. state-based

- information system state-based vs. information system schema-based

Seddon's [1997] re-specification of the DeLone and McLean [1992] model posits that different individuals are likely to evaluate the consequences of IS use in different ways and thus IS success is conceptualized as a value judgment made by an individual from the point of some stakeholder/interest group. Seddon et al. [1999] analyzed IS effectiveness and success measures in 186 empirical studies published in three leading IS journals between 1988 and 1996, and concluded that there is a need for different measures of IS effectiveness. They proposed a model for classifying IS effectiveness measures, using a two-dimensional matrix examining system and stakeholder variables.

The first dimension, system, refers to the type of system, and involves six components:

1. An aspect of IT use (e.g., a single form of user interface)	4. All IT applications used by an organization or sub-organization
2. A single IT application (e.g., a spreadsheet)	5. An aspect of a system development methodology
3. A type of IT or IT application (e.g., a data warehouse);	6. the IT function of an organization or sub-organization

The second dimension, stakeholder, refers to the individuals or organization for which the system is being evaluated. Seddon et al. note five aspects:

- the independent observer who is not involved as a stakeholder;

- the individual who wants to be better off;

- the group which wants to be better off;
- the managers or owners who want the organization to be better off;
- the country that wants the society as a whole to be better off.

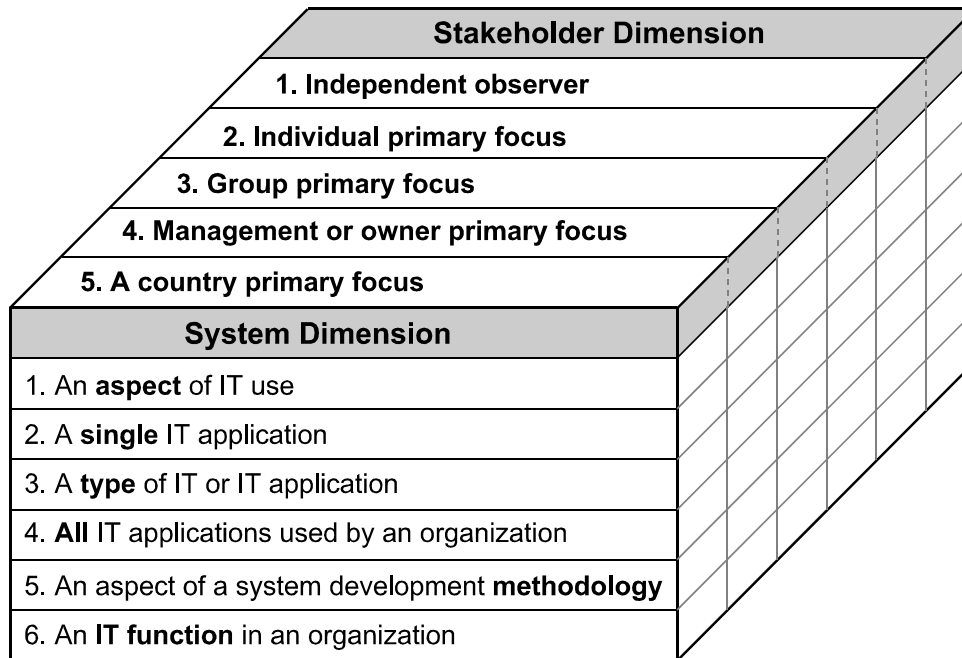The two-dimensional matrix is presented in Figure 2.

Figure 2. The Seddon et al. Two-Dimensional Model

The five viewpoints of the stakeholder and the six components of the type of system, give 30 different possible cells for measuring IS effectiveness.

The two-dimensional matrix was tested on the 186 empirical studies [Seddon et al., 1999]. The researchers suggested that in the world of conflicting human interests and vastly different systems, measures of different shapes and focus might be required. Also, different measures might be needed to assess the effectiveness and success of a system for different groups of stakeholders.

Mahmood et al. [2000] pointed out that the common definitions of the user satisfaction factors identified in previous studies were not always available, and that methods, techniques and sample characteristic tended to vary in the different studies. In an attempt to reduce some of this confusion, Mahmood et al. [2000] gathered some of the previous research and examined the empirical results of 45 information system user-satisfaction studies carried out between 1986 and 1998. This led them to propose the theoretical model shown in Figure 3.
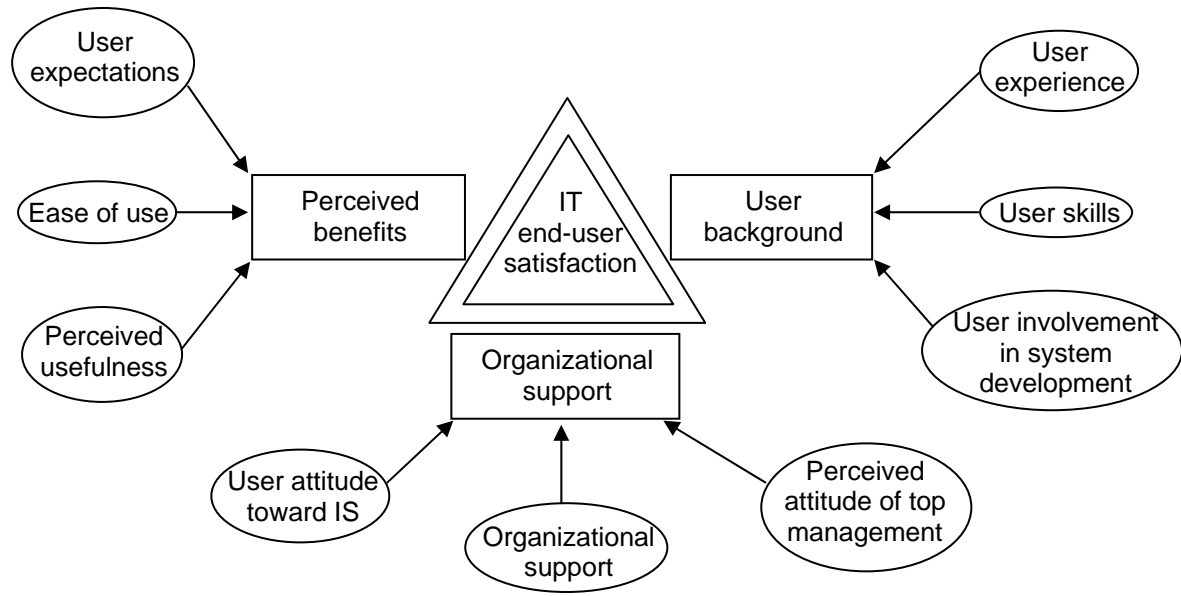
Source: [Mahmoud et al., 2000]

Figure 3. Mahmoud et al. Model

The model is composed of three major factors, each of which consists of three variables:

- *Perceived benefits and convenience*: User expectation, ease of use, and perceived usefulness

- *User background and involvement*: User experience, user skills and user involvement in system development

- *Organizational support and encouragement*: User attitude toward information system, organizational support and perceived attitude of top management

Mahmood et al. [2000] applied meta-analysis methodology to the empirical studies reviewed. Their study provided information on the size and significance of the various variables underlying the factors, as well as information on the degree of heterogeneity among the various variables and their effect size. They found positive support for the influence of all nine variables on information system user satisfaction and for the homogeneity of the effect of each of the nine variables on information system user satisfaction across the studies analyzed.

Another significant factor in today's advanced systems is information security [identified in Tan and Lo, 1990]. The purpose of information system security is to protect the confidentiality, integrity, and availability of information system systems [ITSEC, 1991] and thus to prevent unauthorized access to data and system resources and to protect the system from malicious code. This factor was conspicuously absent from most studies.

V. SUMMARY, CONCLUSION, AND RECOMMENDATIONS

This paper reviewed the literature on IS user satisfaction as a measure of information system success and its implications. Measuring IS success is important for organizations and researchers. Technological changes in hardware and software tools since the 1990s brought about the development of more complex Information Systems, superior user sophistication, and greater demands of systems. In addition, the traditional computing environment underwent

changes such as the transition from centralization to decentralization (distributed), the advent of server/client systems and communication networks, accelerated development and penetration of personal computers into organizations, integration of Intranet and Internet information systems, and increased use of information system outsourcing. These changes and developments accelerated the demand for tools to measure the success of information systems in these new environments.

A concise description of the need for improved and more advanced tools is expressed by Seddon et al. [1999]:

> "In a world of conflicting human interests and vastly different systems, different sharply-focused measures of information system effectiveness are likely to be needed for different purposes.… [D]ifferent measures are likely to be needed to assess the impact and effectiveness of a system for different groups of stakeholders."

Our review of IS success factors shows that the user satisfaction factor is an important criterion and the one most prevalent for measuring the success of information systems. User satisfaction directly impacts information system success. It is applicable and easy to measure. The Bailey and Pearson [1983] tool for measuring information system user satisfaction, and its short version formulated by Ives et al. [1983], are considered in the literature to be the two most important contributions to measuring and analyzing user satisfaction and still serve as the basic source for constructing new information system user-satisfaction questionnaires. Since their work was performed, other researchers continued to review previous research and empirical studies and to suggest various models and factors for measuring information system user satisfaction. As different types of information systems exhibit different properties, they suggest that measuring information system success involves a set of factors that apply to all systems in addition to a set of factors specific to each type of system measured.

Seddon's [1997] posited that different individuals were likely to evaluate the consequences of information system use in different ways and thus information system success is conceptualized as a value judgment made by an individual from the point of view of a specific stakeholder/interest group.

Mahmood et al. [2000] noted that the common definitions of the factors in previous models were not always available, and that methods, techniques, and sample characteristic tended to vary from study to study. Based upon previous research and by applying meta-analysis on 45 empirical studies, they proposed a new comprehensive model for information system user satisfaction. This model includes three principal factors: user background, perceived benefits, and organizational support.

Sengupta and Zviran [1997] recommended the development of a comprehensive measure of user satisfaction in an outsourcing environment that would lead to the construction of new tools for assessing the information system outsourcing environment. This recommendation, naturally, should be extended and generalized to all information system environments.

Future researchers of information systems, as well as practitioners, should consider Mahmood et al.'s [2000] model and Seddon's [1997] two-dimensional model, and adapt their questionnaires specifically to the target system and its environment. Future studies should also consider the security factor which is significant in today's advanced systems and was conspicuously absent from most studies.

Furthermore, as stated by Mahmood et al. [2000], the majority of IS user-satisfaction studies based their findings on a single dataset at one point in time. The rapid change in technology and in user requirements results in frequent changes in existing information systems, and these changes, in turn, directly impact user satisfaction. Thus, the assessment of information system user satisfaction requires longitudinal studies that reflect changing attitudes over a period of use.

As this review showed, the user satisfaction factor is applicable and easy to measure and directly impacts information system success. It is an important criterion and the one most prevalent for

measuring the success of information system. Thus, further research should be performed to improve the user satisfaction tools by applying the above conclusions and recommendations.

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