Development of a User Information Satisfaction Scale: An Alternative Measure With Wide Applicability

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ABSTRACT

This study assesses the psychometric properties of a modified version of the user information satisfaction (UIS) scale. Comparisons of this instrument, which uses perceived importance as a weight of perceived systems' performance, with other instruments which assess importance and performance either separately or as a difference score, provide support for the weighted-score method as a superior approach to measuring UIS. The study also argues for a measure that is more comprehensive which can be used for multiple applications as an alternative to the shorter forms advocated in the current research. In this regard, the authors propose a five-factor model as the basis for the UIS scale, test the model, and offer recommendations and suggestions regarding the new measure.

INTRODUCTION

A considerable amount of research has been devoted to date to the evaluation of management information systems. Much of the research has focused on the assessment of user information satisfaction (UIS) using perceptual measures [3, 4, 5, 15, 17, 20, 25, 26, 29, 36, 45, 47, 49] and, often, with conflicting results [17]. In this regard, two types of measures of UIS have gained the acceptance of academics and practitioners. One category of measures assesses general user information satisfaction [3, 30, 37], while the second focuses on user satisfaction with specific applications [15, 17]. Instruments in the second category have been tested in an end-user computing environment and consist of a limited number of items [15, 17].

The purpose of this study is to argue for a more comprehensive UIS scale that can be applied across various computing environments. The current scales are relatively short and cannot provide a thorough, in-depth understanding of the extent to which computer users are satisfied with their computing environment, specifically, with management information systems. In this study, a more comprehensive scale that captures a maximal number of dimensions of satisfaction is proposed. This requires the use of the latest scale development procedures utilized in the social sciences; such an approach to scale development is needed, since satisfaction is a psychological construct that must be captured using psychometric measurement techniques.

In this regard, we develop and test a confirmatory factor model of UIS and its determinants. In the process, an instrument measuring UIS will be tested and purified. This instrument contains dimensions of IS management and planning and systems' capabilities to support decision making, in addition to the dimensions covered by current UIS measurement instruments [5, 30], which cover the information product, IS services, and knowledge and user involvement.

CURRENT MEASURES OF UIS: A LITERATURE REVIEW

In this section, a number of approaches to assessing UIS are described. The three main approaches are perceived usefulness of information, perceived ease of use, and user computing involvement.

Each of these approaches is described below.

Perceived Usefulness of Information

One of the earlier measures used to evaluate management information systems is perceived usefulness of information, defined as the usefulness attributed to an information item by a decision maker for a specific decision-making process [31]. The measure has been assessed through items capturing a number of attributes of information, such as timeliness, relevance, uniqueness, accuracy, instructiveness, conciseness, ambiguity, readability, usefulness, responsiveness, applicability, desirability, meaningfulness, and other related qualities [25, 52]. A later study [11], redefined the construct to mean the degree to which a person believes that using a particular system would enhance his or her job performance [11, p.320].

Perceived Ease of Use

A related concept, perceived ease of use, refers to the degree to which a person believes that using a particular system would be free of effort [11, p.320]. Perceived ease of use was found to be a determinant of system use frequency. Yet usefulness of information was considered to be superior since it was much more strongly linked to usage than ease of use [11].

User Computing Involvement

User computing involvement, i.e., the extent to which the user engages in systems analysis activities, such as project definition and logical-design decisions, has been scrutinized as a determinant of information systems' success in numerous studies [4, 23, 29, 35, 39, 43] with limited success [14]. More recently, the concept has been examined in an end-user environment with more definitive results: individual differences between perceived and desired levels of involvement were found to define conditional states or frames of reference that govern the relationship between involvement and end-user computing satisfaction [14, p.1169]. Thus, based on the mentioned individual differences, involvement was proposed to act as an antecedent of end-user computing satisfaction.

Doll and Torkzadeh [14, 17], when modelling the relationships between involvement (perceived and desired) and end-user computing satisfaction, assume a causal link between the two. They propose that desired involvement affects end-user satisfaction first by having a positive impact on satisfaction, motivating higher levels of user involvement and, second, by having a negative impact on satisfaction if involvement congruence (difference between desired and perceived involvement) is decreased [17]. In testing the proposed relationships, the authors use a correlational analysis to support a causal link. However, a systematic association between the variables, as assessed through correlation, is merely one requirement for establishing causality. In order to provide support for their model, the authors must also assess other causality dimensions, such as how much variation in one variable can be explained by the other variable.

In the present study, user involvement is examined as a factor of UIS, along with other factors such as information quality and accessibility, IS management and planning, IS staff and services, and system support for decision making.

THE USER INFORMATION SATISFACTION CONSTRUCT

Conceptual Definition

User information satisfaction, a construct widely used by both academics and practitioners in information systems research, is defined as the extent to which users believe that the information system meets their requirements [30]. UIS is a measure of system quality, yet it is frequently interpreted as an indicator of systems' acceptance [14, 29].

A recent study of the evolution of the user-satisfaction construct in IS research [36] reveals that there is disagreement on the construct's conceptual definition and that it is used as a broad term, to encompass terms such as "felt need," "system acceptance," "perceived usefulness," "MIS appreciation," "feelings about the system" [30, 36], and "attitudes and perceptions" [33, 36]. Although representing a broad spectrum of dimensions, the UIS construct has gained wide acceptance in information systems research by both academics and practitioners. Its popularity may be due to the fact that it provides an overall evaluative assessment of information systems in general [36].

Operational Definition

Operationalizations of the UIS scale have their roots in the field of applied psychology, specifically in the job satisfaction area. Satisfaction has been examined as both an independent and as a dependent variable — as a predictor of various outcomes, such as usage rate, and as a feedback mechanism on system performance [25]. In addition, the construct has been assessed a) directly, as a summative measure of satisfaction facets [21] and b) indirectly, as a summative measure assessing the extent to which respondents have attained their job-related goals or fulfilled their job-related needs [41]. This second approach has been adopted in measuring UIS by computing the sum of the users' ratings on the performance of a set of information systems' attributes [3, 30, 37].

Satisfaction has also been operationalized as the discrepancy between the importance of an attribute and the perception of the performance of that attribute [32, 38, 41]. The major criticism of the discrepancy approach rests with the fact that a high-importance/high-performance discrepancy — i.e., a $7 - 7 = 0$ — is equivalent to a low-importance/low-performance discrepancy — i.e., $1 - 1 = 0$ [51].

Yet another operationalization of satisfaction was proposed using a scoring method where "importance" was treated as a weighting factor to performance evaluations [3]. However, in Pearson's sample, the weighted and unweighted scores were highly correlated. Accordingly, Ives, Olson and Baroudi [30] dropped the "importance" scale from the instrument since the additional information provided by the importance rating was considered redundant. Yet, the former sample has also been criticized for being relatively small and, possibly biased [36]. We believe that further testing of the instrument should have been performed before deciding to eliminate the "importance" scale.

Miller and Doyle [37] also used both the "iimportance" and "performance" scales in their instrument. However, the factor analysis of the "importance" responses resulted in ten factors accounting for only 55% of the total variance. Further low factor loadings led to the decision that the importance responses should not be used in the analysis.

Given the above operationalizations, the present study attempted to compare between the various approaches by evaluating the correlation between the global information satisfaction item and the various measures (i.e., importance, performance, the discrepancy between importance and performance, and weighted performance). The results revealed that correlations were higher between weighted performance and the global information satisfaction item than between the other measures and the respective item (see Table 1). For this reason, satisfaction was operationalized in the study as the sum of the weighted performance ratings across the information systems attributes, where weighted performance was calculated by multiplying the attribute performance by its normalized importance weight, as follows: UIS = SUM(IMPORTANCE * PERFORMANCE).

Yet another justification for the use of perceived importance as a weight of perceived performance rests with the fact that attitudes are estimated more accurately by considering both the belief strength and the evaluation of the respective attributes, rather than by using the sum of beliefs or the sum of the evaluations [22].

Table 1
Correlation Coefficients Between Ratings in the Different Scales and the Rating on the Global Satisfaction Question

Item	Import.	Perform.	Diff.	Weighted Perform.
Timeliness of information	.22*	.43*	.21*	.46*
Competence of system analysts	.03	.44*	.32*	.39*
IS staff/users communications	.10	.38*	.22*	.40*
Ease of use, clear documentation	.15	.31*	.14	.40*
Use of IS steering committee	.08	.37*	.29*	.37*
Ease of access to computer	.11	.31*	.26*	.35*
Currency of output information	.19*	.35*	.21*	.40*
Improving new systems development	.18*	.44*	.27*	.51*
Technical competence of IS staff	.06	.39*	.27*	.38*
User confidence in systems	.20*	.39*	.21*	.47*
Accuracy of output	.17*	.32*	.20*	.39*
Preparation of IS plan	.06	.38*	.28*	.39*
User influence over IS services	.04	.45*	.35*	.48*
Users' feeling of participation	.06	.38*	.29*	.43*
Flexibility of data and reports	.12	.48*	.33*	.53*
Positive IS staff attitudes to users	.19*	.42*	.22*	.51*
Quick access to computer data	.02	.46*	.42*	.45*
Setting of systems priorities	.10	.44*	.28*	.44*
Responsiveness to user needs	.10	.53*	.41*	.59*
Relevance of report contents	.21*	.46*	.24*	.52*
Top management involvement	.05	.37*	.27*	.40*
Availability of analysis models	.08	.40*	.31*	.43*
System support for decision making	.16	.49*	.35*	.55*

* significant at $p < .01$

A NEW, IMPROVED MEASURE OF USER INFORMATION SATISFACTION

A review of previous UIS measurement instruments reveals certain limitations and concerns regarding the clarity of the UIS construct, the validity of the instruments, and their applicability in various user environments. First, the number of scale items was reduced from an initial 39-item instrument [3] to a 13-item, short form [5, 30] and a 12-item instrument assessing end-user computing satisfaction [15]. The limited number of items led to questioning the ability of the instrument to measure overall user information satisfaction. While the short form could be appropriate for measuring satisfaction with batch-oriented transaction processing systems, it is doubtful that it would be appropriate for measuring satisfaction with online integrated MIS encompassing online processing, relational databases, data analysis models, and decision support systems. Second, this UIS scale has been recently criticized for lack of sufficient theoretical grounding [36], lack of homogeneity and of overall reliability [26].

Given the above criticisms, this study resorted to a more expanded version of the user information satisfaction scale, which was prompted by the need for a comprehensive instrument that can be applied across different MIS configurations, professions with varied information needs, and, if need should arise, across international user environments. Such an instrument is likely to be more reliable, since it consists of larger numbers of items that capture the key measure [26] and, therefore, to have superior psychometric properties [40].

Of the expanded versions of the user information satisfaction measure, the Miller and Doyle [37] version was selected as a basis for this study. The measure is comprised of 24 items from the Bailey and Pearson [3] scale and 12 items from the Alloway and Quillard [2] scale, plus two additional items [37]. This measure was initially thought to be lacking necessary psychometric properties and, as a result, was replaced by shorter measures. A review of this scale, however, revealed that, with adequate validation and purification, it could prove to be a superior measure — in terms of comprehensiveness and parsimony — that could potentially lend itself to more applications than alternative measures. Such a measure — which is even more comprehensive than the Bailey and Pearson [3] and the Ives et al. [30] measures — is also likely to be more reliable, as will be seen in subsequent sections.

As mentioned, satisfaction was operationalized in the study as the sum of the weighted performance ratings across the information systems' attributes since tests revealed that this operationalization was superior to other currently-accepted operationalizations.

METHODOLOGY AND RESULTS SCALE DEVELOPMENT

Specification of the Construct Domain

The psychometric literature specifies a number of steps that are necessary for developing a valid scale that will provide reliable results, which are consistent over time and across subjects. The first step in developing a scale involves specifying the domain of the construct and, in the process, delineating what is included in the definition and what is excluded from it [8]. User information satisfaction has been previously defined as the extent to which users believe that the information system meets their requirements [30]. We choose to define it, based on the literature review conducted in the previous sections, as the users' cognitive state of being adequately or inadequately served by an information system. This definition takes into consideration not only the satisfaction dimension, but also its opposite, dissatisfaction. Thus, an individual feeling that the system serves him or her adequately is considered a satisfied user, while an individual feeling that he or she is inadequately served by the system will be a dissatisfied user.

Item Generation

The second step in the procedure for developing better measures entails generating items that capture the domain of the construct as specified. In this step, a number of items of previous user information satisfaction scales, perceived usefulness scales, and involvement scales were considered. It was found that the Miller and Doyle [37] scale provides the foundation that best fits this purpose, since it included items of slightly different shades of meaning — this was achieved by appending the Alloway and Quillard [2] scale, as well as two additional items, to the original Bailey and Pearson [3] scale. Including such items is recommended because, by incorporating slightly different nuances of meaning in the statements in the item pool, the researcher provides better foundation for the eventual measure [8].

Some of the items in the Miller and Doyle [37] scale were edited so that the wording would be as precise as possible. In addition, one item — MIS department profitability — was eliminated from the scale because it was found to be too remote (not just a shade different) from the user information satisfaction target measure.

The initial scale in this study was comprised of 37 performance items scored on a scale from 1 to 7, where 1 indicated that performance relative to the item was very poor and 7 indicated that performance was excellent. The importance items were appended to the performance scale, using the format of the Miller and Doyle [8] scale. These items were scored on a similar scale, where 1 indicated that the attribute described by the item was irrelevant and 7 indicated that the attribute was very critical. The presentation of the instrument in this format resulted in a five-page questionnaire, which appeared to be long and to potentially lead to nonresponse; however, since the same items were used in both the importance and performance scales, the authors entertained the possibility of combining the two scales and presenting them in a three-column table format consisting of the scale items, the importance rating scale, and the performance rating scale, for ease of completion (see Appendix).

A pilot study was conducted to test for the possibility of introducing bias by combining the two scales of importance and performance on the same page. The original five-page instrument was administered to 23 evening MBA students who qualified as information systems' users. Two weeks later, the new format of the instrument was administered to the same group. A paired t-test was used to test for differences and the results showed no significant differences ($p < .05$) between the alternative administrations.

In addition to the performance and importance items, the questionnaire contained demographic and job-related questions, as well as the global satisfaction question. The global satisfaction question asked subjects how they would rate their satisfaction with their computer-based system in their organization. This question was then used to assess the correlation with the weighted items, as well as to establish causality in a confirmatory factor model.

Table 2
Respondents' Characteristics

Characteristics	% of Respondents
AGE	
Less than 30 yrs.	46
30–40 yrs.	39
More than 40 yrs.	15
MANAGERIAL LEVEL	
Top level	15
Middle level	47
Operational level	48
EDUCATION	
Less than college	7
College degree	27
Graduate degree	65
EXPERIENCE	
Less than 5 yrs.	36
5—10 yrs.	31
More than 5 yrs.	33
COMPUTER TYPE	
Mainframe	41
Minicomputer	11
Micro computer	43
METHOD OF ACCESS	
Interactive access	68
Use computer printouts	32

Sample and Data Collection

The data collection method employed in this study was survey research. The data collection instrument in the form of a questionnaire was distributed to a judgment sample of 300 individuals who qualified as computer applications' users. The subjects belonged to three manufacturing firms, three financial institutions, two retail/wholesale companies, and two utility companies. The questionnaires were administered to the subjects, along with a cover letter explaining the purpose of the study and assuring response confidentiality. The participants were asked to mail back the questionnaires in a return envelope. Of the 300 questionnaires administered, 248 were received. Of these, 230 were completed correctly and thus submitted to analysis. (See Table 2 for general characteristics of the respondents.)

MEASURE PURIFICATION

Reliability Assessment

The homogeneity of the set of information systems' attributes (items)was calculated using coefficient alpha. The method consists of computing the mean reliability coefficient for all the possible ways of splitting the measure items in half, thus overcoming the limitations of split-half reliability — where the size of the correlation depends on how the items were split in half, — and test-retest reliability — where respondents, due to memory effects, might reply in a similar manner to the questionnaire even if the items intercorrelate poorly (Churchill, 1979). A low coefficient alpha indicates that the items perform poorly in capturing the construct which motivated the measure, while a large alpha indicates that the measure captures the construct well. The standardized coefficient alpha for the measure before eliminating any items was .93, which is satisfactory.

In a subsequent step, item-to-total correlations were computed. Three items had low corrected item-to-total correlations ($r < .5$) and were identified as possible candidates for elimination. These items were: integration of office communication services and IS services, access to data and models by users without involving IS staff, and low percentage of hardware and system downtime.

Exploratory Factor Analysis

Some analysts prefer to perform exploratory factor analysis before doing anything else in order to suggest dimensions. Since coefficient alpha was high and only three items were identified as candidates for elimination by the item-to-total correlation, all 37 items were subjected to exploratory factor analysis. A principal components analysis with a varimax rotation yielded eight factors that explained 63.4% of the total variance. The number of factors extracted was determined by the program default (i.e., eigenvalues greater than 1). The rotated factor matrix revealed that fourteen items had factor loadings of less than .50 and were eliminated. Three of the eliminated items were the same items previously identified as having low item-to-total correlations. The remaining 23 items were submitted to a second factor analysis, resulting in the extraction of 5 factors explaining 62.3% of the total variance. Table 3 presents the five factors, their eigenvalues and percentage of variance explained, as well as the related factor loadings.

The factors obtained were found to lend themselves to a meaningful classification that is congruent with the MIS conceptual framework. The first factor was labelled as information quality and accessibility, which is in agreement with the definition of information as data that has been transformed into a meaningful and useful form for information users. The items loading on this factor explain the characteristics of information in terms of the time dimension — timeliness and currency; the content dimension — accuracy, completeness, and relevance; and the form dimension — flexibility, ease of use, and access.

Items loading on the second factor relate to information systems' management and planning. Variables loading on the third factor relate to the competence of IS staff and services, while those loading on the fourth factor relate to the quality of the information system and its ability to support decision making. The fifth factor relates to attributes pertaining to creating an environment lending itself to user involvement.

Table 3
Factor Analysis Results

Factors	Factor Loadings
Factor 1: Information Quality and Accessibility	
(Eigen=8.15; % of var=35.4)	
Availability and timeliness	.77
Quick, flexible access to data	.76
Accuracy and completeness	.72
Flexibility of data and reports	.68
User confidence in system	.68
Ease of access to system	.62
Currency of output	.62
Ease of use	.60
Relevancy of reports	.56
Factor 2: IS Management and Planning	
(Eigen=2.50; % of var.=10.8)	
Setting of priorities	.78
Use of a steering committee	.71
Top management involvement	.61
IS planning	.60
New system development	.50
Responsiveness to user needs	.50
Factor 3: IS Staff and Services	
(Eigen=1.41; % of var.=6.1)	
Competence of system analysts	.72
Technical competence of IS staff	.69
IS staff/user communications	.63
Factor 4: System Support for Decision Making	
(Eigen=1.20; % of var.=5.2)	
System support for decision making	.73
Availability of data analysis models	.76
Factor 5: User Involvement	
(Eigen=1.09; % of var.=4.8)	
Users' feeling of participation	.84
Users' control over IS services	.76
Positive IS staff attitude to users	.64

Confirmatory Factor Analysis

The reliability and structure of the remaining items were analyzed using confirmatory factor analysis. LISREL-7 revealed that the five-factor correlated structure had a chi-square statistic of 720.95 (df=238, p<.01). The chi-square was relatively high, but this is not uncommon even for models with a good fit, given the large sample size. A superior indicator of the model fit in instances where sample size is large is provided by the goodness of fit index, which for this model was .812. Moreover, each indicator t-value exceeded 8.81 (p<.01) and correlations between the user information satisfaction latent construct and the five factors were .67, .67, .55, .61, and .58, respectively, revealing a satisfactory model.

MEASURE VALIDATION

Content Validity Assessment

Specifying the domain of the construct, generating items that exhaust the domain, and purifying the measure should produce a measure that has content (face) validity; that is, the measure "looks right" [8] and adequately covers the entire domain of the construct under study. Since the recommended procedures were followed in building the scale and, at a glance, the measure looks adequate for its purpose, it can be claimed that the user informa≠tion satisfaction scale has face validity.

Table 4
MTMM Correlation Matrix

	F11	F12	F13	F14	F15	F16	F17	F18	F21	F22	F23	F24	F25	F26	F31	F32	F33	F41	F42	F51	F52	F53
F11	50																					
F12	52	47																				
F13	47	54	42																			
F14	50	54	49	47																		
F15	40	55	40	36	34																	
F16	48	49	43	41	27	47																
F17	41	41	46	37	46	33	34															
F18	44	42	45	52	37	32	41	36														
F21	22	25	27	32	36	20	10	38	28													
F22	15	12	17	21	19	11	13	22	18	52												
F23	14	09	11	25	16	09	15	19	23	47	58											
F24	13	17	24	20	17	17	25	22	22	46	56	46										
F25	24	32	31	35	35	30	27	41	43	47	42	32	43									
F26	40	37	29	53	42	27	23	37	53	53	30	42	43	50								
F31	38	23	24	33	27	21	30	35	32	38	36	32	31	40	33							
F32	18	21	24	26	18	15	24	27	36	26	42	39	40	36	36	53						
F33	14	25	20	21	29	27	25	23	33	32	33	25	26	39	31	49	47					
F41	27	30	24	36	26	31	24	18	45	40	28	47	38	38	51	27	38	32				
F42	22	25	18	28	21	21	20	16	27	30	34	37	38	35	42	26	37	27	65			
F51	08	24	17	29	26	22	20	14	30	30	30	34	27	30	45	15	28	41	35	30		
F52	20	25	23	30	28	33	29	22	37	30	29	35	25	34	47	28	33	43	35	28	72	
F53	15	33	12	35	31	18	25	28	47	39	25	34	29	39	44	34	39	46	36	21	46	41

Note: The notation F11, F12, etc., represents Item 1 of Factor 1, Item 2 of Factor 1, etc.

Construct Validity Assessment

Reliability and content validity are a necessary, but not sufficient, condition for construct validity [48]. Construct validity is directly related to the question of what the instrument is in fact measuring, i.e., what construct, trait, or concept underlies a person's performance or score on a measure [8]. To be construct valid, the measure should correlate with other measures designed to measure that same construct; such a measure is said to have convergent validity. Establishing whether the measure has convergent validity using the multi-trait multi-method [6] approach requires that the correlations between the measures of the same theoretical construct should be different from zero, and large enough to warrant further investigation. Table 4 reveals that the correlations are significantly different from zero.

Another requirement for construct validity is that the measure should be indeed novel and not simply a reflection of another variable — that is, the measure should have discriminant validity. Discriminant validity is indicated by predictably low correlations between the measure of interest and other measures that are supposedly not measuring the same variable or concept [8]. Again, the multi-trait multi-method [6] procedure was used to assess discriminant validity: the procedure required counting the number of times that an item in the measure correlates more with an item of another factor than with the items of its own theoretical factor. Campbell and Fiske [6] suggested that the discriminant validity requirement is satisfied if the number of violations to the above criterion is less than half the total number of possible comparisons. An examination of Table 4 reveals that there are only 22 violations, well below the permissible upper ceiling.

A final step in establishing whether the measure has construct validity entails demonstrating that the measure behaves as expected in relation to other constructs, that is, if the measure has predictive or criterion validity [46]. In order to assess the scale's predictive validity, the scale items should be compared to the global (target) measure (Question #48 in the Appendix). The procedure should meet the requirements of the following propositions:

1. The IS attribute items (A) and overall user information satisfaction (B) are related.
2. The user information satisfaction scale X provides a measure of A.
3. Y provides a measure of B.
4. X and Y correlate positively [8].

Following the above set of propositions, items of the scale were compared with the global question asking respondents to rate their level of satisfaction with the overall information system in their organization. Some noteworthy findings resulted: correlating the performance score alone with the satisfaction measure yielded significantly lower scores ($p<.01$) than correlating the performance scores multiplied by the importance weight (i.e., weighted performance) with the satisfaction score — see Table 1.

DISCUSSION AND CONCLUSIONS

This paper argues for a more inclusive, 23-item scale to be used in assessing user information satisfaction. Such a scale is necessary, since user environments vary greatly from one institution to another — and these variations are even greater for users in different countries. That is, depending on the corporate culture, or the national culture, as the case may be, satisfaction with the different computer configurations can only be captured by different constructs — hence the need for a more comprehensive scale that contains a maximal number of dimensions related to user information satisfaction.

The scale combines items from the Bailey and Pearson [3] scale, the Alloway and Quillard [2] scale, in addition to two more items in order to provide a more complete evaluation of UIS. The scale captures dimensions that are congruent with the MIS theoretical framework. The first factor, information quality and accessibility, is in agreement with the definition of information as data that has been transformed into a meaningful and useful form for information users. The components loading on this factor cover the time dimension of information (timeliness and currency), the content dimension (accuracy, completeness, and relevance), and the form dimension (flexibility, ease of use, and access).

Items loading on the second factor relate to information systems' management and planning, such as the setting of priorities, the use of a steering committee, top management involvement, and IS planning, among others. Variables loading on the third factor relate to the competence of IS staff and services. These variables capture the dimensions of competence of systems analysts and IS staff and the IS staff/user communications. The items loading on the fourth factor relate to the quality of the information system and its ability to support decision making, while the fifth factor relates to attributes pertaining to creating an environment lending itself to user involvement, such as users' feeling of participation, users' control over IS services, and attitude of staff toward users.

Given its more comprehensive nature, the scale has wide applicability across different MIS configurations, across professions with varied information needs, and across international user environments. Moreover, it has a higher reliability, and thus it is psychometrically superior to the shorter versions that are advocated in many publications.

The present study argues for reverting to the operational approach initially advocated by Bailey and Pearson [3] where the scale items were evaluated as importance-weighted perceived performance measures. This approach was found to result in a higher predictive validity of the measure, since the items arrived at by multiplying perceived performance by the importance weight resulted in higher correlations with the global UIS measure than the performance-only and importance-only items, or than the difference score between importance and performance. The length of the scale due to the assessment of both importance and performance measures may be an issue raised by advocates of the shorter form. However, since the importance measure is presented alongside the performance measure without introducing any potential bias, where both measures follow the attribute item — see Appendix, — the new version reduces greatly instrument completion time.

Further psychometric assessment of the scale revealed that it has a high reliability and that it has high content, convergent, and discriminant validity, in addition to predictive validity. When submitted to confirmatory factor analysis, the scale performed quite well, revealing a good fit, overall.

Since this scale has superior psychometric properties and it lends itself to a wide range of applications, it is highly recommended for use in various MIS environments, across systems organizations, and even across cultural environments. Future research might consider a comparative approach of scale applicability: the scale could be evaluated in various environments and cross-comparisons could be made. An interesting proposition would be to test if the same underlying factors surface in a different cultural environment; since the new scale has more items and it covers more UIS dimensions, testing this proposition would easily allow for such comparisons.

User characteristics have a significant impact on user perceptions of information system effectiveness. In order to ensure user satsfaction, developers of software packages should take end-user characteristics into consideration and design special versions for different types of industries, while taking the corporate and national cultural environment into account, in order to better meet their needs. This comprehensive scale facilitates identifying areas where the system in place does not meet user needs, and allows developers to adjust such systems to be more responsive and practical in different environments.

REFERENCES

[1] Ajzen, I., and Fishbein, M., *Understanding Attitudes and Predicting Social Behavior,* Englewood Cliffs, New Jersey, Prentice Hall, 1980.

[2] Alloway, R. and Quillard, J., *Top Priorities for the Information Systems Function,* CIRS Working Paper No.79, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, Massachusetts, 1981.

[3] Bailey, J. and Pearson, S., "Development of a Tool for Measuring and Analyzing Computer User Satisfaction," *Management Science,* Volume 29, Number 5, 1983, pp. 530-545.

[4] Baroudi, J., Olson, M., and Ives, B. "An Empirical Study of the Impact of User Involvement on System Usage and Information Satisfaction," *Communications of the ACM,* Volume 29, Number 3, 1986, pp. 232-238.

[5] Baroudi, J. and Orlikowsky W., "A Short-Form Measure of User Information Satisfaction: A Psychometric Evaluation and Notes on Use," *Journal of Management Information Systems,* Volume 4, Number 4, 1988, pp. 44-59.

[6] Campbell, D. and Fiske, D., "Convergence and Discriminant Validation by the Multitrait Multimethod Matrix," *Psychological Bulletin,* Volume 56, Number 1, pp. 81-105.

[7] Card, S., Moran, T. and Newell, A. *The Psychology of Human Computer Interaction,* Hallsdale, New Jersey, Lawrence Erlbaum Associates, 1983.

[8] Churchill, G., "A Paradigm for Developing Better Measures of Marketing Constructs," *Journal of Marketing Research,* Volume 16, 1979, pp. 64-73.

[9] Cohen, J. and Cohen, P., *Applied Multiple Regression/ Correlation Analysis for the Behavioral Sciences,* Hillsdale, New Jersey, Lawrence Erlbaum Associates, 1975.

[10] Cronbach, L., "Coefficient Alpha and the Internal Consistency of Tests," *Psychometrica,* Volume 16, 1951, pp. 297-354.

[11] Davis, F., "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly,* Volume 13, Number 3, 1989, pp. 319-340.

[12] Davis, F., Bagozzi, R. and Warshaw, P., "User Acceptance of Computer Technology: A Comparison of Two Theoretical Models," *Management Science,* Volume 35, Number 8, 1989, pp. 982-1003.

[13] Davis, G., *Management Information Systems: Conceptual Foundations, Structure and Development,* New York, New York, McGraw Hill, 1974.

[14] Doll, W. and Torkzadeh, G., "A Discrepancy Model of End-User Computing Involvement," *Management Science,* Volume 35, Number 10, 1989, pp. 1151-1171.

[15] Doll, W. and Torkzadeh, G., "The Measurement of End-User Computing Satisfaction," *MIS Quarterly,* Volume 12, Number 12, 1988, pp. 259-274.

[16] Doll, W. and Torkzadeh, G., "A Congruence Construct of User Involvement," *Decision Sciences,* Volume 22, Number 2, 1991, pp. 443-453.

[17] Doll, W. and Torkzadeh, G., "The Measurement of End-User Computing Satisfaction: Theoretical and Methodological Issues," *MIS Quarterly,* Volume 15, Number 1, 1991, pp. 5-10.

[18] Emery, J.C., "Cost/Benefit Analysis of the Information Systems," in J.D. Couger, M.A. Cober, and R.W. Knapp (Eds.), *Advanced System Development/Feasibility Techniques,* New York, New York, 1982.

[19] Estes, R.W., "An Assessment of the Usefulness of Current Cost and Price Level Information by Financial Statement Users," *Journal of Accounting Research,* Volume 6, Number 2, 1968, pp. 200-207.

[20] Etezadi-Amoli, J. and Farhoomand, A.F., "On End-User Computing Satisfaction," *MIS Quarterly,* Volume 15, 1991, pp. 1-3.

[21] Ewen, R.B., "Weighting Components of Job Satisfaction," *Journal of Applied Psychology,* Volume 51, 1967, pp. 68-73.

[22] Fishbein, M. and Ajzen, I., "Attitudes and Opinions," *Annual Review of Psychology,* Volume 23, 1972, pp. 487-504.

[23] Franz, C.R. and Robey, D., "Organizational Context, User Involvement, and the Usefulness of Information Systems," *Decision Sciences,* Volume 17, Number 3, 1986, pp. 329-356.

[24] Galletta, D.F., "A Longitudinal View of an Office System Failure," *SIGOA Bulletin,* Volume 7, Number 1, 1986, pp. 7-11.

[25] Galletta, D. F. and Lederer, A.L., "Some Cautions on the Measurement of User Information Satisfaction," *Decision Sciences,* Volume 20, Number 3, 1989, pp. 419-436.

[26] Gallagher, C.A., "Perceptions of the Value of Management Information Systems," *Academy of Management Journal,* Volume 17, Number 1, 1983, pp. 46-55.

[27] Ginzberg, M.J., "A Study of the Implementation Process," *TIMS Studies on the Management Sciences,* Volume 13, 1979, pp. 85-102.

[28] Gorry, G.A. and Scott Morton, M.S., "A Framework for Management Information Systems," *Sloan Management*

Review, Volume 13, Number 1, 1971, pp. 55-70.

[29] Ives, B. and Olson, M.H., "User Involvement and MIS Success: A Review of Research," *Management Science,* Volume 30, Number 5, 1984, pp. 586-603.

[30] Ives, B., Olson, M.H. and Baroudi, J.J., "The Measurement of User Information Satisfaction," *Communications of the ACM,* Volume 26, Number 10, 1983, pp. 785-793.

[31] Larcker, D.F. and Lessig, V.P., "Perceived Usefulness of Information: A Psychometric Examination," *Decision Sciences,* Volume 11, Number 1, 1980, pp. 121-134.

[32] Locke, E.A., "What is Job Satisfaction?," *Organizational Behavior and Human Performance,* Volume 4, 1969, pp. 309-336.

[33] Lucas, H., "Performance and the Use of an Information System," *Management Science,* Volume 21, 1975, pp. 908-919.

[34] Mahmood, M. and Becker, J., "Effect of Organizational Maturity on End-Users' Satisfaction with Information Systems," *Journal of Management Information Systems,* Volume 2, 1985, pp. 37-64.

[35] Mann, R. and H. Watson, "A Contingency Model for User Involvement in DSS Development," *MIS Quarterly,* Volume 8, Number 1, 1984, pp. 27-38.

[36] Melone, N.P., "A Theoretical Assessment of the User-Satisfaction Construct in Information Systems Research," *Management Science,* Volume 36, Number 1, 1991, pp. 76-91.

[37] Miller, J. and Doyle, B.A., "Measuring the Effectiveness of Computer-Based Information Systems in the Financial Services Sector," *MIS Quarterly,* Volume 11, Number 1, 1987, pp. 107-124.

[38] Mobley, W.H. and Locke, E.A., "The Relationship of Value Importance to Satisfaction," *Organizational Behavior and Human Performance,* Volume 5, 1970, pp. 463-483.

[39] Mumford, E.F. and J. Hagwood. "A Participative Approach to the Design of Computer Systems," *Impact of Science on Society,*Volume 28, Number 3, 1978, pp. 235-253.

[40] Nunnally, J.C., *Psychometric Theory,* New York, New York, McGraw Hill Book Co., 1978.

[41] Porter, L.W., "A Study of Perceived Need Satisfaction in Bottom and Middle Management Jobs," *Journal of Applied Psychology,* Volume 45, 1961, pp. 1-10.

[42] Robey, D., "User Attitudes and Management Information System Use," *Academy of Management Journal,* Volume 22, Number 3, 1982, pp. 527-538.

[43] Robey D. and Farrow, D., "User Involvement in Information System Development: A Conflict Model and Empirical Test," *Management Science,* Volume 28, Number 1, 1982, pp. 73-85.

[44] Rockart, J.F., "The Role of the Information Systems Executive: A Critical Success Factor Perspective," *Sloan Management Review,* Volume 24, Number 1, 1982, pp. 3-13.

[45] Rushinek, A. and Rushinek, S.F., "What Makes Users Happy?" *Communications of the ACM,* Volume 29, Number 7, 1981, pp. 594-598.

[46] Sethi, V. and King, W.R., "Construct Measurement in Information Systems Research: An Illustration in Strategic Systems," *Decision Sciences,* Volume 22, Number 3, 1991, pp. 455-472.

[47] Srinivasan, A., "Alternative Measures of System Effectiveness: Associations and Implications," *MIS Quarterly,* Volume 9, Number 3, 1985, pp. 243-253.

[48] Straub, D.W., "Validating Instruments in MIS Research," *MIS Quarterly,* Volume 13, Number 2, 1989, pp. 147-165.

[49] Torkzadeh, G. and Doll, W.J., "Test-Retest Reliability of the End-User Computing Satisfaction Instrument, *Decision Sciences,* Volume 22, Number 1, 1991, pp. 26-37.

[50] Treacy, M.E., *An Empirical Examination of a Causal Model of User Information Satisfaction,* Center for Information Systems Research, Sloan School of Management, Massachusetts Institute of Technology, 1985.

[51] Wanous, J.P., "Measurement and Meaning of Job Satisfaction," *Journal of Applied Psychology,* Volume 56, Number 2, 1972, pp. 95-105.

[52] Zmud, P.W., "An Empirical Investigation of the Dimensionality of the Concept of Information," *Decisions Sciences,* Volume 9, Number 2, 1978, pp. 187-196.

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APPENDIX
Information systems effectiveness questionnaire

Please consider the following attributes of overall information systems activity in the company. Two scales should be completed for each attribute:

(A) How IMPORTANT you feel that each attribute is to the company as a business using the scale:

1	2	3	4	5	6	7
Irrelevant		Possibly useful		Important		Very critical

(B) The degree of PERFORMANCE attained within the company using the scale:

1	2	3	4	5	6	7
Very poor	Poor			Good		Excellent

USING THE DESCRIPTIONS PROVIDED ON THE SCALES, CIRCLE THE NUMBER YOU FEEL MOST REPRESENTS YOUR EVALUATION OF EACH ATTRIBUTE.

	IMPORTANCE RATINGS	PERFORMANCE RATING
1. Availabity and timeliness of information provided by the systtem	1 2 3 4 5 6 7	1 2 3 4 5 6 7
2. Quality and competence of system analysis	1 2 3 4 5 6 7	1 2 3 4 5 6 7
3. Communications between Information services staff and managerial users	1 2 3 4 5 6 7	1 2 3 4 5 6 7
4. Integration of office communication and information systems.	1 2 3 4 5 6 7	1 2 3 4 5 6
5. Prompt processing of requests for changes to existing systems.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
6. Efficient running of current systems — (ease of use, costs, documentation and maintenance).	1 2 3 4 5 6 7	1 2 3 4 5 6 7
7. Use of a management committee for overseeing and monitoring all major information systems.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
8. Access to data and models by users without involving the Information Services department.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
9. Information Services support for users in preparing proposals for new systems.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
10. Ease of access for users to computer facilities via terminals/P.C.'s	1 2 3 4 5 6 7	1 2 3 4 5 6 7
11. Currency (up-to-datedness) of output information.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
12. Short development time required for new systems.	1 2 3 4 5 6 7	1 2 3 4 5 6 7
13. A low percentage of hardware and systems downtime.	1 2 3 4 5 6 7	1 2 3 4 5 6 7

	IMPORTANCE RATING							PERFORMANCE RATING						
14. The improving of new systems development (with cost, quality and disruptions).	1	2	3	4	5	6	7	1	2	3	4	5	6	7
15. High degree of technical competence of the staff in the Information Services department.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
16. Effective training programs for users in general information systems capabilities.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
17. User confidence in systems.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
18. Accuracy and completeness of output information.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
19. Preparation of a strategic plan for developing information systems.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
20. User-oriented systems analysts who KNOW user operations.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
21. The influence the user has over which information services are provided.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
22. Users' feeling of participation.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
23. Flexibility of data and reports.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
24. Positive attitude of Information Services personnel towards users.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
25. Quick and flexible access to computer data.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
26. Data security and privacy.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
27. Information systems providing competitive advantage for the firm.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
28. Users' understanding of systems.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
29. Setting of systems priorities to reflect overall organizational objectives.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
30. Systems responsiveness to changing user needs.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
31. Relevance of report contents to intended functions.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
32. Increasing the effort in developing new systems relative to maintaining existing systems.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
33. Application of modern database technology.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
34. Top management involvement in defining and monitoring information systems policies.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
35. Overall cost-effectiveness of information systems.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
36. The availability of models to analyze business alternatives.	1	2	3	4	5	6	7	1	2	3	4	5	6	7
37. Data analysis capabilities to support decision making.	1	2	3	4	5	6	7	1	2	3	4	5	6	7

PART II

PLEASE CIRCLE THE APPROPRIATE NUMBER

38. **Your age:**
    1. Under 25   2. 25–30   3. 30–35   4. 35–40
    5. 40–45   6. 45–50   7. 50–55   8. 55 or above

39. **Your position in the organization hierarchy:**
    1. Top management   2. Middle management   3. Operational management

40. **Level of education:**
    1. High school   2. Two year college
    3. College/University degree   4. Graduate degree

41. **Years of experience:**
    1. Less than 2 years   2. 2–3 years   3. 3–5 years
    4. 5–10 years   5. More than 10 years

42. **Type of computers you mainly work with:**
    1. Mainframe   2. Minicomputer   3. Microcomputer   4. Workstation

43. **Method of access to computer applications:**
    1. Direct interface with the computer.
    2. Use computer outputs.
    3. None

44. Overall how would you rate your satisfaction with the computer-based information system in your organization.

1	2	3	4	5	6	7
Non-existent		Poor		Good		Excellent