

# An Empirical Evaluation of User Information Satisfaction (UIS) Measures for Use with General Ledger Accounting Software

## I. Introduction

Keen [1987] defines the "mission" of Information Systems research as:

to study the effective design, delivery, use and impact of information technologies in organisations and society.

A key word in this definition is "effective". By implication, Information Systems (IS) researchers need measures of IS effectiveness. However, the measurement of IS effectiveness has proven very difficult. In fact, MIS Quarterly recently described it as one of the "haunting problems" of MIS [Executive Overview to Davis [1989], p.318].

Since the quality or effectiveness of information systems is so hard to measure directly, many researchers have turned to indirect measures such as User Information Satisfaction (UIS). Ives, Olson, and Baroudi [1983] describe UIS as a "perceptual or subjective measure of system success" that

provides a meaningful 'surrogate' for the critical but unmeasurable result of an information system, namely, changes in organizational effectiveness. [p.785]

If UIS is to be used as a dependent variable in Accounting Information Systems research (e.g., in attempting to assess the importance of different features of general ledger systems) the researcher must decide which of the many UIS measures that have been suggested in the literature is most suitable. The purpose of this paper is to test three UIS measures that appear suitable for use in measuring accountants' satisfaction with their computer-based general ledger systems. The first two UIS measures are (a) Ives, Olson, and Baroudi's Short-Form UIS measure [1983] later validated by Baroudi and Orlikowski [1989], referred to in this paper as the Short-Form UIS, and (b) Doll and Torzkadeh's End-User Computing Satisfaction measure [1988], referred to in this paper as Doll and Torzkadeh's

UIS. Both these UIS measures appear to be particularly well-validated; both were validated largely with data from accounting information systems. The third "home grown" five-factor UIS measure is a synthesis of the first two combined with some additional questions that relate specifically to features of computer-based general ledger (GL) systems. This five-factor measure was formulated to test the proposition that more focused questions, aimed specifically at GL-system features, could be used to explain more of the variance in overall satisfaction.

The paper is organized as follows: Section II describes the three UIS measures in more detail; Section III outlines the methodology used for testing the measures, Section IV describes the questionnaire developed to collect data for the three measures, the data collection process, and some summary statistics; and Section V presents the results from testing the three UIS measures. Finally, Section VI summarizes our findings and outlines the limitations of this study.

## **II. The Three Measures of User Information Satisfaction (UIS)**

Using a classification scheme similar to Ives and Olson's [1984, 597], Kim [1989] classifies 17 measures under three headings:

- (a) user attitudes towards information technology, the MIS department, or both,
- (b) user satisfaction with information quality, and
- (c) perceived effectiveness of an MIS.

\*\*\* Figure 1 goes approximately here \*\*\*

Kim suggests that these three types of measure are related as shown in Figure 1. In terms of Kim's model, the objective of this study is to find a type (c) measure of overall effectiveness. However, not all measures fall neatly into Kim's framework. For instance, in Kim's Figure 1 (p.3) he classifies Ives, Olson, and Baroudi's [1983] instrument as a measure of US-Attitudes (type (a) above). Yet, as discussed in detail below, a feature of this

instrument is that it contains a mixture of questions about three factors, one major factor being Information Quality (type (b) above). Could it be that a mixture of types (a) and (b) measures results in a type (c) measure?

Reviewing the literature, we were attracted to Ives, Olson, and Baroudi's Short-Form UIS and Doll and Torkzadeh's Computing Satisfaction instrument because appeared both to have been very thoroughly validated. The two measures overlap to the extent that they both contain questions about the quality of the information generated by the system. But they differ with respect to the other factors they measure. Of more concern, it is not obvious which of these factors are likely to be more important for measuring the satisfaction of GL-system users.

#### *The Ives, Olson, and Baroudi Instrument*

To develop their measure, Ives, Olson, and Baroudi reviewed in detail the work of Gallagher [1974], Jenkins and Ricketts [1979], Larcker and Lessig [1980], and Pearson [Bailey and Pearson 1983]. From these they selected Pearson's 39-scale instrument as the basis for their own UIS measure. They sent two questionnaires to 800 production managers in US manufacturing companies (two months apart), received 280 responses to the UIS questionnaire (a 35% response rate), and 200 pairs of responses. These they analyzed with the usual battery of reliability, validity, and factor analysis tests, and so produced a questionnaire consisting of 33 scales, each with two items (questions) per scale, that takes 20 to 30 minutes to complete. A Short-Form questionnaire (the instrument tested in this study) consisting of only 13 scales was also developed.

In 1986, Baroudi and Orlikowski [1988] evaluated Ives, Olson, and Baroudi's Short-Form questionnaire by asking users of large mainframe/mini-computer transaction processing systems in 26 New York organizations to complete the questionnaire. The applications were mainly accounting systems run by financial services institutions. Three hundred and fifty eight (358) respondents completed the questionnaire (response rate unstated). Responses were reliability and validity tested, and 12 of 13 scales loaded on the same three factors (*EDP Staff and Services*, *Information Product*, and *User Knowledge and Involvement*) as they had in the Ives, Olson, and Baroudi study. In addition, as described in more detail in Section III below, the score was validated against two groups of satisfied and

dissatisfied users. Baroudi and Orlikowski conclude that the Short-Form questionnaire is "a reliable and valid measure of UIS" [1988, 50].

The two Ives, Olson, and Baroudi instruments (Long-Form and Short-Form) have been used frequently to measure UIS. Doll and Torkzadeh [1988] report that one or other of them was used by Barki and Huff [1985], Mahmood and Becker [1985], Raymond [1985], and Galletta [1986]. However, there have been criticisms of the instruments. Doll and Torkzadeh report that Treacy [1985] found

difficulties in three areas: the variables found through exploratory factor analysis were labeled in imprecise and ambiguous terms; many of the questions used were poor operationalizations of their theoretical variables; and the instrument failed to achieve discriminant validity. [Doll and Torkzadeh 1988, 262]

In a similar vein, Galletta and Lederer [1989] describe Ives, Olson, and Baroudi's Long-Form measure as "probably the most refined measure of user satisfaction to date" [1989, 422], but they found it had test-retest problems, and that because of the heterogeneity of the items its results should be interpreted with caution. Galletta and Lederer conclude "This study provides evidence that an instrument previously accepted as reliable is, in fact, unreliable" [1989, 433]. Further testing of the Ives, Olson, and Baroudi's UIS measures is evidently warranted.

### *The Doll and Torkzadeh Instrument*

Doll and Torkzadeh [1988] specifically designed their instrument to measure end-user computing satisfaction. They conducted personal interviews with end-users (mainly middle and lower level managers) in 44 non-randomly selected firms, then administered an 18-item instrument employing what appear to be 5-point Likert-type scales [1988, 263-264]. After eliminating 8 of 626 responses where questionnaire responses did not match interview assessments, they had 618 responses for factor analysis. Three factors with eigenvalues greater than one emerged, but Doll and Torkzadeh argue that a five factor model was more interpretable. They labelled their five factors: *Content, Accuracy, Format, Ease of Use, and Timeliness*. Compared with the Short-Form UIS, *Ease of Use* is a new factor (the presumption in Ives, Olson, and Baroudi's measure seems to be that reports come from the EDP department). Doll and Torkzadeh's other four factors are all related to Ives, Olson, and Baroudi's *Information Product* factor. None of Doll and Torkzadeh's factors remotely resembles either *EDP Staff and Services* or *User Knowledge and Involvement*, but their Appendix [p.274] reveals they asked no questions in these areas.

### *A Five-Factor Measure of UIS for General Ledger Systems*

Both the Short-Form UIS and Doll and Torkzadeh's UIS are claimed to be general-purpose measures of factors related to IS success and IS effectiveness. However, as shown in Table 1, these instruments do not agree on either the factors to be measured, nor on their relative importance. Moreover, Finlay [1990] has suggested that "omnibus" measures of UIS are bound to fail. He says that different measures of effectiveness are needed for different systems.

\*\*\* Table 1 goes approximately here \*\*\*

To test the proposition that more focused questions could be used to explain more of the variance in overall satisfaction with computer-based GL systems, we decided to try to construct a more focused measure of our own. The approach adopted was to recognize that most GL systems today offer a hybrid of end-user computing and

centralized computing facilities. For instance, many GL systems allow users to define their own report formats, often interactively. Most accountants also control the timing of file updates and report generation. In this sense, accountants are end-users of their computer-based GL systems. On the other hand, most large GL systems are run on centralized computing resources, with centralized security systems, centralized file backup, and centralized chargeout. In this respect all the traditional problems of relationships between the EDP departments and users may be expected to influence the satisfaction of GL-system users.

Given this hybrid nature of GL-systems usage, it would appear that all four factors in Table 1 are likely to be important in explaining accountants' satisfaction with their GL systems. In addition, GL systems are all fairly homogeneous applications: they all capture transactions called journal entries; they all produce Profit and Loss statements and Balance Sheets; most generate reports comparing actual performance with budget; most provide on-line inquiry; and so on. We can, therefore, ask some much more specific questions about the factors that affect user satisfaction with GL systems than those asked in the general-purpose instruments described above. These more specific questions concern the various features such as reporting, budgeting, on-line inquiry, and data capture techniques, offered by different GL systems.

\*\*\* Figure 2 goes approximately here \*\*\*

The result is the five-factor model of UIS presented in Figure 2. The five-factor model hypothesizes that accountants' overall satisfaction with their GL systems is due to five independent variables: (1) *EDP Staff and Services*, (2) *User Knowledge and Involvement*, (3) *Information Product*, (4) *Ease of Use*, and (5) *GL-system Feature Usefulness-Satisfaction*. The Short-Form UIS uses only factors 1, 2, and 3. Doll and Torkzadeh's measure uses only factors 3 and 4. The five-factor model is simply a union of the first two with one GL-system-specific measure added: *GL-system Feature Usefulness-Satisfaction*. In our companion paper [Seddon et al. 1992] we explore the possibility that these five factors might not be independent (e.g., a system with better features might lead to better information quality) but at this early stage in our understanding of the relationships we just wanted to see if some linear combination of the five factors in Figure 2 would out-perform the two published measures.



### III. Methodology

The approach adopted for testing the above three measures was to collect data for a fourth measure of users' overall satisfaction with their general ledger systems, then to use regression analysis to test the correlation between this criterion variable and the three measures (and their factors). It is not suggested that this fourth measure is better than the other three measures. (If we knew for sure that it was, there would be no need to go any further.) Rather, the logical basis for the tests that follow is that all four measures measure the underlying construct (overall satisfaction with a GL system) with error. By careful choice of wording, the questions used for the criterion variable are focussed as directly as possible on overall satisfaction and effectiveness. Assuming the criterion measure is "headed in the right direction" (not that it is "on target") the UIS measure that correlates most closely with it will be judged the best<sup>1</sup>.

\*\*\* Figure 3 goes approximately here \*\*\*

Our criterion variable, labelled UIS in this study, is calculated as the average score for the four questions in Figure 3. The first three questions were based on the questions that Ives, Olson, and Baroudi used to measure of overall satisfaction -- the variable they called UIS4 [1983, 789 and 793]. The fourth question asks directly about user's overall satisfaction. Compared to the three studies discussed earlier:

- (i) Our UIS should be more valid for measuring satisfaction with a GL system than Ives, Olson, and Baroudi's UIS4, simply because all four questions in their UIS4 concern the "data processing group" not "your GL system".

---

<sup>1</sup> This approach is similar to that used by Ives, Olson, and Baroudi [1983, 788] to check the predictive validity of Pearson's measure. They also note that "A final claim of content validity cannot be made until the questionnaire and theory have been subjected to several alternative forms of testing with consistent findings" [pp.788-9]. This study is one such test.

- (ii) To validate their measure, Baroudi and Orlikowski [1988, 48] identified two groups of users, one with 26 satisfied users, the other with 44 dissatisfied users. They then tested the significance of the difference between the mean UIS scores for these two groups (with a t-test). Our UIS measure ranks respondents along a continuum and allows us to use regression analysis (albeit with ordinal, not interval, data) to test correlations between UIS measures.
- (iii) Doll and Torkzadeh used two questions for their criterion scale "Is the system successful" and "Are you satisfied with the system" [1988, 264] backed-up by an interviewer's personal assessment. Hopefully, our four-item measure has comparable validity.

#### **IV. Questionnaire Construction and Data Collection**

##### *Variables for the Short-Form UIS and Doll and Torkzadeh's UIS*

Two pages of our questionnaire requested information relating to variables 1, 2, and 3 of the model in Figure 2. Apart from minor editing (e.g., changing "Users' understanding of systems" to read "Your understanding of your GL system") all 13 Short-Form scales were transcribed directly from the Short-Form instrument. Ten of Doll and Torkzadeh's questions were merged with the Short-Form questions as illustrated in Figure 4. The remaining two questions for Doll and Torkzadeh's UIS, concerning usefulness and ease of use, are discussed shortly<sup>2</sup>.

\*\*\* Figure 4 goes approximately here \*\*\*

##### *GL-system Features*

---

<sup>2</sup> A full copy of the seven-page questionnaire is available from the authors. A good sense of the style and content of the first 2 pages of the questionnaire can be obtained by combining questions of the style shown in Figure 4(c) with the scales listed in the left-hand columns of Tables 4 and 6. For instance, question 4(c) corresponds to the third last line in Table 4, and Doll and Torkzadeh's scales A1 and A2 in Table 6.

Questions on GL-system features are required for the five-factor model. For each of the first eight features listed under variable 5 in Figure 2, i.e., excluding Documentation, respondents were asked a series of six questions like those shown in Figure 5. The ninth feature listed under variable 5 in Figure 2 was then assessed with a two-item scale that measured availability and comprehensiveness of documentation.

\*\*\* Figure 5 goes approximately here \*\*\*

Doll and Torkzadeh's UIS, and therefore our five-factor model, needs a measure of GL-system *Ease of Use* (EASE).

Provided there were responses to at least four different GL features<sup>3</sup> EASE was calculated as the average of the first two questions for each feature, e.g., the first two questions in Figure 5(a). The five-factor model also needs a measure of *Usefulness-of/Satisfaction-with the GL-system features* (USE\_SAT). Again, provided there were responses to at least four different GL features, USE\_SAT was calculated as the average of two questions for each feature, e.g., the third question in Figure 5(a) and the single question in Figure 5(c). Since there are two questions for each feature, and four to eight features for each acceptable response, these two variables (EASE and USE\_SAT) are both averages of from 8 to 16 answers about ease of use and feature usefulness.

#### *Data Collection*

After pre-testing draft questionnaires in three face-to-face interviews, we drew a random sample of 200 firms with 200 or more employees, annual sales greater than \$A25M, or issued capital exceeding \$A10M from "The Business Who's Who of Australia" [R.G. Riddell Pty Ltd 1988]. Letters were mailed to "the senior accounting officer" of each firm in mid-1989, with a request that the accompanying questionnaire should be directed to "the accountant who is familiar with the computer-based general ledger in your organization".

---

<sup>3</sup> Not all respondents used all features, so an average score is necessary. However, if respondents used less than four features their response was considered unreliable and excluded from the analysis. Eight of the 100 responses were excluded for this reason.

Eighty-three (83) responses were received by the cut-off date. After a follow-up letter a further 21 responses were received. Four of the letters returned were not completed at all (company policy), so the overall useable response rate was 100, or 50%. For each of the 62 questions asked in the questionnaire, responses from the early vs. late respondents were compared using Goodman-Kruskal's gamma statistic [Siegel and Castellan 1988, 291-298]. The gamma statistics indicate that late respondents scored their understanding of their GL system lower than early respondents<sup>4</sup>. This suggests that our data are probably not representative of the overall population of GL-system users (the 100 non-respondents are presumably more like late respondents than early ones [Parten 1966, 391]). How this bias in the data affects the following evaluation of UIS scores is unclear. In our opinion, UIS scores should be useful even when restricted to what might be described as the "more knowledgeable" users<sup>5</sup> who did respond to our questionnaire.

Descriptive data about respondents are shown in Tables 1 and 2a of the companion paper, Seddon et al. [1992, Survey Two]. Most respondents (85%) were financial accountants, and most (71%) had worked with computer-based GL systems for over five years. Only 55 respondents were supported by EDP departments, which means that the sample size for our tests of the Short-Form UIS measure (which includes an evaluation of the EDP department) is only 55.

\*\*\* Table 2 goes approximately here \*\*\*

Table 2 summarizes responses to Figure 3's four key questions used for the criterion UIS measure. The correlations in Table 2(a) are high. Cronbach's alpha is 0.954, which is good. The mean UIS score of 5.56 on a scale from 1 to 7 is higher than expected; most respondents, including late respondents, were quite satisfied with their GL systems. Table 2(b) shows how these scores were distributed.

---

<sup>4</sup> Curiously, their overall evaluations of their systems were not significantly lower.

<sup>5</sup> The label "more knowledgeable" seems appropriate since in both questions about "knowledge of the system" early respondents described themselves as having significantly more knowledge of the system than late respondents ( $p < 0.01$  for one question, and  $p < 0.05$  for the other). If non-respondents are like late respondents, those who did

## V. Results

### *Tests of the Ives, Olson, and Baroudi [1983] Short-Form UIS measure*

Tables 3 and 4 show tests of the Short-Form UIS measure, SF\_UIS, using only responses from the 55 users who reported having an EDP Department to support their GL system. The independent variable in Regression 3.1, Table 3, is SF\_UIS (the average of responses to all 13 questions on Ives, Olson, and Baroudi's Short-Form questionnaire). The dependent variable is our four-item criterion UIS measure described in Section III. Correlation between the two variables is significant at the 0.01% level, but the regression  $R^2$  is only 0.33.

\*\*\* Tables 3 and 4 go approximately here \*\*\*

Regression 3.2 uses the three component factors of the Short-Form UIS measure as independent variables. The *Information Product* factor, SF\_IP, which is the average of the five scales on Ives, Olson, and Baroudi's Short-Form UIS instrument, is significant at the 0.01% level. The *Knowledge and Involvement* factor, KI (three scales), is just significant, at the 10% level. Surprisingly, after controlling for SF\_IP and KI, the *EDP Staff and Services* variable, EDP (five scales), is not significantly correlated with UIS.

Table 4 is an attempt at replicating the factor analysis reported in Baroudi and Orlikowski [1988]. Guadagnoli and Velicer [1988] recommend that for factor analysis there should be no fewer than 150 subjects, and Kerlinger [1986, 593] advises that "A loose, but not bad rule-of-thumb might be: ten subjects for each variable". Our factor analysis is therefore of limited value: it has only 55 subjects and 4.2 subjects per variable (55 subjects for the 13 variables in the Short-Form UIS measure). Despite this, it is interesting to compare our factor analysis with Baroudi and Orlikowski's figures shown in the right-hand three columns of Table 4. Consistent with Baroudi and Orlikowski, all the EDP variables load onto one factor. However, loadings of the other eight variables are less clear; they all seem to relate to the *Information Product*. Since EDP has emerged as a clearly defined factor even with this small sample

---

respond are "more knowledgable".

(n=55), it is to be expected that if EDP were an important determinant of overall satisfaction with GL systems it would also be significant in the three-factor regression, Regression 3.2. The fact that it is not suggests that EDP support contributes little to the satisfaction of our (relatively satisfied) users of computer-based GL systems<sup>6</sup>.

#### *Tests of Doll and Torkzadeh's [1988] UIS measure*

Tables 5 and 6 show tests of Doll and Torkzadeh's UIS measure, DT\_UIS. As discussed in Section IV, the questions used to calculate DT\_UIS are not identical to Doll and Torkzadeh's, but the meanings of most questions are very similar. Regression 5.1 uses responses from the 92 users for whom DT\_UIS could be calculated. The independent variable is DT\_UIS. The dependent variable is our criterion UIS measure. The  $R^2$  of 0.72 in this regression is much higher than the 0.33 of Regression 3.1 (the Short-Form UIS).

\*\*\* Tables 5 and 6 go approximately here \*\*\*

Regression 5.2 uses the five component factors of Doll and Torkzadeh's UIS measure as independent variables. TIME, the average of the two questions on *Timeliness* (see questions at the bottom of Table 6), is significant at the 0.01% level. Both *Information Content* (CON) and *Ease of Use* (EASE) are significant at the 1% level. The *Format of Output* variable (FORM) is significant at the 5% level. The *Accuracy* variable (ACC) was not significant in Regression 5.2, but this is probably due to its high correlation ( $r=0.61$ ) with *Information Content*. The  $R^2$  of this five-factor regression is only slightly higher than that of Regression 5.1 (Doll and Torkzadeh's UIS).

The replication of Doll and Torkzadeh's factor analysis in Table 6 has only 92 subjects and a subjects to variables ratio of  $92/12=7.7$ . These figures are closer to Guadagnoli and Velicer's [1988] and Kerlinger's [1986] guidelines, but the factor loadings still cannot be used with confidence. After varimax rotation, three factors with eigenvalues greater than 1.0 emerged. Doll and Torkzadeh's five factor loadings are shown alongside for comparison. (Doll and Torkzadeh did not include their three factor analysis in their paper.)

---

<sup>6</sup> It is possible, of course, that poor relationships with the EDP department lead to dissatisfied users, and that our

### *Tests of our Five-Factor Model of UIS*

Having examined both the Short-Form UIS and Doll and Torkzadeh's UIS, this section presents results from testing the five-factor model proposed in Figure 2. Recall that Figure 2 is a union of the factors in both the previous two measures, with the addition of the fifth factor: *Usefulness-of/Satisfaction-with GL-system Features* (USE\_SAT). The reason for testing this model is to see whether inclusion of questions about general ledger systems produces a measure that explains variance in our criterion UIS measure more completely.

Not all respondents had an EDP department, so for the regression analysis we used Cohen and Cohen's technique [1983, Ch.7] of plugging missing EDP variables with the mean of non-missing scores, and including a dummy variable, *EDP\_Missing* (EDP\_M), to indicate when an EDP value was plugged. EDP\_M was assigned a 1 for plugged EDP, 0 for unplugged.

Figure 2 does not specify exactly how the *Information Product* variable is to be measured, so two different measures are tested in regressions 7.1 and 7.2 of Table 7. Regression 7.1 tests the five-factor model using the Short-Form *Information Product* variable (SF\_IP) as the *Information Product* variable. As in Regression 3.2, SF\_IP was significant though only at the 0.1% level (t-statistic 3.80). The Short-Form *Knowledge and Involvement* variable (KI) was significant at 1%, and the Short-Form *EDP Staff and Services* variable (EDP) was not significant. The most significant variable in Regression 7.1 is the fifth variable, USE\_SAT, which measures *Usefulness-of/Satisfaction-with various GL-system features* (t-statistic 4.69). Doll and Torkzadeh's *User-Friendliness/Ease of Use* variable (EASE) was not significant, but this is probably due to its high correlation ( $r=0.72$ ) with USE\_SAT<sup>7</sup>. The  $R^2$  for Regression 7.1 is 0.65, which is considerably lower than the 0.72 from Doll and Torkzadeh's UIS score in Regression 5.1.

---

random sample data failed to find enough dissatisfied users to make this relationship apparent.

<sup>7</sup> Davis [1989, Tables 8 and 9, 332] reports similar multi-collinearity problems with his *Usefulness* and *Ease of Use* variables. He found that when *Usage* was regressed on *Usefulness* and *Ease of Use*, *Ease of Use* was not significant. Re-running the regression without USE\_SAT, Doll and Torkzadeh's EASE variable took over much of USE\_SAT's role, with a coefficient of 0.31,  $t=3.38$ , significant at the 0.1% confidence level.

\*\*\* Table 7 goes approximately here \*\*\*

Regression 7.2 tests the five-factor model using what might be called Doll and Torzadeh's *Information Product* variable (DT\_IP) as the *Information Product* variable. DT\_IP is the average of Doll and Torzadeh's four Information Product-related factors, *Content*, *Accuracy*, *Format*, and *Timeliness*, but not *Ease of Use*. The  $R^2$  for Regression 7.2 is 0.75, considerably higher than the  $R^2$  for Regression 7.1 (0.65). As with regression 7.1, *Knowledge and Involvement* (KI) is significant, and *Ease of Use* (EASE) is not. *EDP Staff and Services* (EDP) is just significant at  $p < 0.1$ , but the sign of the coefficient is in the wrong direction.

The high correlation between EASE and USE\_SAT suggests that there may be only one underlying factor. Factor analysis was used to test the proposition that the EASE and USE\_SAT variables both relate to one factor. Five variables: *User Friendliness*, *Ease of Use*, *Usefulness*, *Flexibility*, and *Feature Satisfaction*, were constructed as outlined in Section IV, i.e., as the average of the scores for at least four features. Although Davis [1989] reports that *Ease of Use* and *Usefulness* are different constructs, principal-components analysis of our data extracted only one factor<sup>8</sup>. As only one underlying factor was extracted from the factor analysis, an average of the above five variables, named FEATURES, was constructed. Regression 7.3 shows this new variable used in place of EASE and USE\_SAT in Regression 7.2. The  $R^2$  for this four-factor model, regression 7.3, is 0.735, little different from the five-factor model in regression 7.2.

Noting that the  $R^2$ s of regressions 7.2 and 7.3 are not much larger than the  $R^2$  for regression with Doll and Torzadeh's UIS, regression 5.1, we ran regression 7.4 to see if the extra variables, i.e., *EDP Staff and Services*, *User Knowledge and Involvement*, and *Feature Satisfaction* added to the explanatory power of Doll and Torzadeh's UIS. Technically, they do. The F-statistic for the increase in explanatory power of regression 7.4 over 5.1 is significant at  $p < 0.01$  ( $F_{4,87} = 4.70$ ). Despite this, however, since the  $R^2$ s of the regressions are so similar, and we are not at all confident that our criterion UIS measure is any better than Doll and Torzadeh's, we are reluctant to

---

<sup>8</sup> This factor analysis involved 88 subjects with 5 variables, a ratio of 18:1. The first factor, eigenvalue 3.39,

argue that including the extra questions has improved the explanatory power of Doll and Torkzadeh's measure. More formally, we are unable to reject the null hypothesis that the additional variables add no explanatory power to Doll and Torkzadeh's UIS.

## VI. Conclusions

1. Doll and Torkzadeh's UIS appears to be more useful than the Short-Form UIS as a measure of overall user satisfaction with general ledger systems. The coefficient of determination ( $R^2$ ) in the regression of our criterion UIS measure on the Short-Form UIS (Table 3, Regression 3.1) is only 0.33, which is lower than one would hope for from a reliable UIS measure. Even when the three factors of the Short-Form UIS were included separately in the equation (Regression 3.2), the  $R^2$  was still quite low, 0.46. By contrast, the coefficient of determination ( $R^2$ ) in the regression of our criterion effectiveness measure on Doll and Torkzadeh's UIS measure (Table 5, Regression 5.1) is 0.72. This is much more acceptable than the 0.33 figure above.

2. The results in Table 7 test the proposition that additional questions, aimed specifically at GL-system features, could be used to explain more of the variance in overall satisfaction than the general-purpose measures alone. Although the statistical test indicates a significant difference ( $p < 0.01$ ) between the use of Doll and Torkzadeh's UIS alone and the same measure with additional GL-specific features, the  $R^2$ 's of regressions 5.1 and 7.4 are very similar (0.72 vs 0.76), and we are not sufficiently confident of the validity of our criterion UIS measure to conclude that the extra factors contribute to a more valid measure of UIS.

The implication of these two conclusions is that researchers needing a dependent variable for research into general ledger systems<sup>9</sup> should use measures similar to Doll and Torkzadeh's UIS as their surrogates for GL-system effectiveness. It is for this reason that Doll and Torkzadeh's UIS was used as the dependent variable in the regression in Table 9 of the companion paper, Seddon et al. [1992].

---

explained 68% of the variance. The second eigenvalue was only 0.57.

<sup>9</sup> With appropriate safeguards, this argument could probably be extended to any computer-based transaction-processing accounting system, since the modes of use are similar.

3. Although this study did not set out to comment on Kim's [1989] or DeLone and McLean's [1992, Figure 2, p.87] models of IS success measures, it is difficult to avoid noticing that regression 7.3 (in Table 7) provides strong support for both models. First, treating our criterion UIS measure as *IS Effectiveness* in Kim's model, the link from *Information Quality* to *IS Effectiveness* is supported by the highly significant t-statistic on the *Information Product* variable (DT\_IP) in regression 7.3. Similarly, treating our criterion UIS measure as capturing *User Satisfaction* in DeLone and McLean's model, the links from *Information Quality* and *System Quality*<sup>10</sup> to *User Satisfaction* are supported by the significant t-statistics on the *Information Product* and *Features* variables (DT\_IP and FEATURES) in regression 7.3. (In neither case is this study is able to test the Usage relationships because use of GL systems is mandatory.)

There are some obvious limitations to this study. First, the tests conducted in this study are only as valid as our criterion UIS variable is valid. Second, the sample sizes are too small for reliable factor analyses. Third, the questionnaire was directed to large firms, who, by and large, do not use PC-based ledger systems; determinants of satisfaction in PC-based systems might be different (e.g., because of lack of support, documentation might be more important). Fourth, the wording of the questions used in calculating Doll and Torkzadeh's UIS are not as close to the original as might be desired. Fifth, although questionnaires were sent to a random sample of relatively large firms, only half responded, and of those, most were very satisfied with their GL systems (mean UIS score 5.56 out of a possible 7). This means that there is not much variance in UIS for the regression analysis to work on. It would be useful to compare the results of this study with data from largely dissatisfied users -- perhaps the EDP and KI variables would be more important in explaining satisfaction of dissatisfied users. Finally, it would be useful to evaluate the UIS measures reviewed in this paper against less subjective measures of IS effectiveness, e.g., cost and time savings compared to previous systems.

---

<sup>10</sup> Table 7 of DeLone and McLean [1992, 84] lists *Ease of use* and *Usefulness of system features* as two of many

(5,300 words)

---

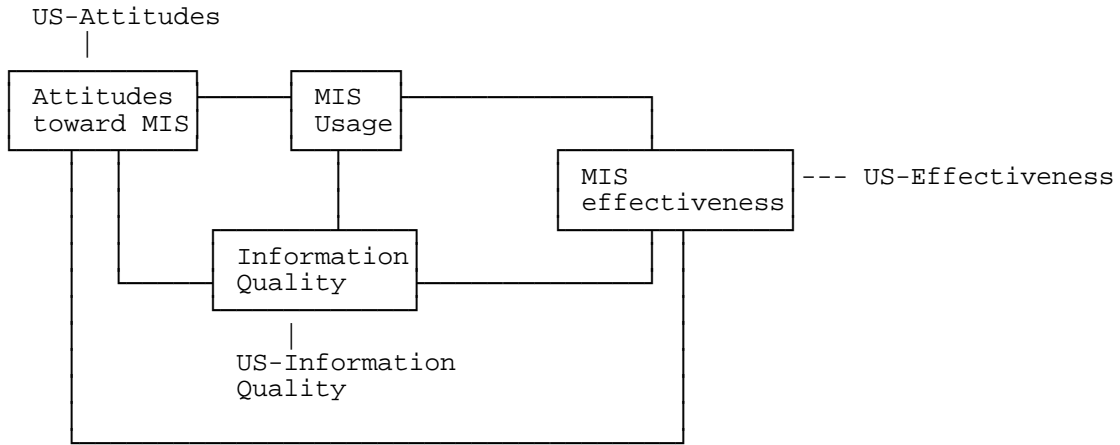
indicators of *System Quality*.

## References

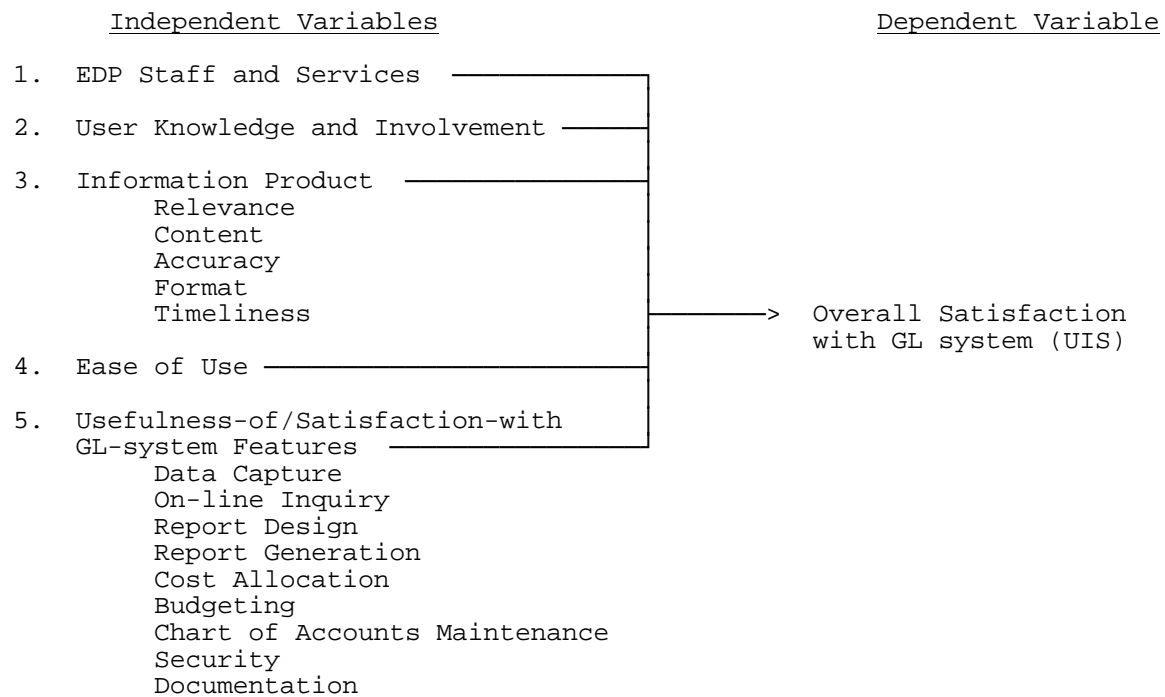
- Bailey, J.E., and S.W. Pearson. 1983. Development of a tool for measuring and analyzing computer user satisfaction. *Management Science* 29 (May): 519-529.
- Barki, H., and S.L. Huff. 1985. Change, attitude to change, and decision support system success. *Information and Management* 9: 261-268.
- Baroudi, J.J., M.H. Olson, and B. Ives. 1986. An empirical study of the impact of user involvement on system usage and information satisfaction. *Communications of the ACM* 29 (March): 232-238.
- Baroudi, J.J., and W.J. Orlikowski. 1988. A short-form measure of user information satisfaction: a psychometric evaluation and notes on use. *Journal of MIS* 4 Spring: 44-59.
- Cohen, J., and P. Cohen. 1983. *Applied Multiple Regression/Correlation Analysis For The Behavioral Sciences*. 2d ed. Lawrence Erlbaum Associates.
- Davis, F. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly* 13 (September): 319-340.
- Davis, G.B., and M. Olson. 1985. *Management Information Systems, Conceptual Foundations, Structure and Development*. 2d ed. McGraw-Hill.
- DeLone, W.H., and E.R. McLean. 1992. Information systems success: the quest for the dependent variable. *Information Systems Research* 3 (March): 60-95.
- Dennis, J.B. 1975. The design and construction of software systems. *Software Engineering: An Advanced Course*. Berlin: Springer-Verlag.
- Doll, W.J., and G. Torkzadeh. 1988. The measurement of end-user computing satisfaction. *MIS Quarterly* 12 (June): 259-274.
- Finlay, P. 1990. Measures of success for management support systems. Working paper, Department of Information Systems, Monash University (July).
- Fishbein, M., and I. Ajzen. 1975. *Belief, Attitude, Intention and Behaviour: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.
- Gallagher, C.A. 1974. Perceptions of the value of a management information system", *Academy of Management Journal* 17: 46-55.
- Galletta, D.F. 1986. A longitudinal view of an office system failure. *SIGOA Bulletin* 7: 7-11.
- Galletta, D.F., and A.L. Lederer. 1989. Some cautions of the measurement of user information satisfaction. *Decision Sciences* (Summer): 419-438.
- Guadagnoli, E., and W.F. Velicer. 1988. The relationship of sample size to the stability of component patterns: a simulation study. *Psychological Bulletin* 103: 265-275.
- Ives, B., and M.H. Olson. 1984. User involvement and MIS success: a review of research. *Management Science* 30 (May): 586-603.
- Ives, B., M.H. Olson, and J.J. Baroudi. 1983. The measurement of user information satisfaction.

*Communications of the ACM* 26 (October): 785-793.

- Jenkins, A.M., and J.A. Ricketts. 1979. Development of an instrument to measure user information satisfaction with management information systems. Working paper, Indiana University, Bloomington (November).
- Keen, P.G.W. 1987. MIS research: current status, trends and needs. In Buckingham, R.A., R.A. Hirschheim, F.F. Land, and C.J. Tully, eds. 1987. *Information Systems Education: Recommendations and Implementation*. Cambridge University Press: 1-13.
- Kerlinger, F.N. 1986. *Foundations of Behavioral Research*. 3d ed. New York: CBS College Publishing.
- Kim, K.K. 1989. User satisfaction: a synthesis of three different perspectives. *The Journal of Information Systems* 4 (Fall): 1-12.
- Larcker, D.F., and V.P. Lessig. 1980. Perceived usefulness of information: a psychometric examination. *Decision Sciences* 11: 121-134.
- Mahmood, M.A. and J.D. Becker. 1985. Effect of organizational maturity on end-user satisfaction with information systems. *Journal of MIS* 2 (Winter): 37-64.
- Parten, M. 1966. *Surveys, Polls and Samples: Practical Procedures*. New York: Cooper Square Publishers.
- R.G. Riddell Pty. Ltd. 1988. *The Business Who's Who of Australia*.
- Raymond, L. 1985. Organizational characteristics and MIS success in the context of small business. *MIS Quarterly*: 37-52.
- Seddon, P.B., M. Wong, and S.K. Yip. 1992. Computer-based general ledger systems: an exploratory study. *Journal of Information Systems*, this issue.
- Siegel, S., and N.J. Castellan. 1988. *NonParametric Statistics*. 2d ed. McGraw-Hill.
- Treacy, M.E. 1985. An empirical examination of a causal model of user information satisfaction. Center for Information Systems Research, Sloan School of Management, MIT (April).



**Figure 1: Kim's model of the relationship between Attitudes, Information Quality, and MIS effectiveness** (Source: [Kim 1989, Figure 3, p.6])



**Figure 2: Five-Factor Model of GL-system User Satisfaction**

- (a) How adequately do you feel your GL system meets the information processing needs of your area of responsibility?  
adequate 1\_\_2\_\_3\_\_4\_\_5\_\_6\_\_7 inadequate
- (b) How efficient do you feel your GL system is?  
efficient 1\_\_2\_\_3\_\_4\_\_5\_\_6\_\_7 inefficient
- (c) How effective do you feel your GL system is?  
effective 1\_\_2\_\_3\_\_4\_\_5\_\_6\_\_7 ineffective
- (d) Overall, are you satisfied with your GL system?  
dissatisfied 1\_\_2\_\_3\_\_4\_\_5\_\_6\_\_7 satisfied

**Figure 3: The four questions used to measure our criterion variable User Information Satisfaction (UIS)**

(a) Short-Form: Accuracy of output information:

inaccurate :\_\_ :\_\_ :\_\_ :\_\_ :\_\_ :\_\_ :\_\_ : accurate  
low :\_\_ :\_\_ :\_\_ :\_\_ :\_\_ :\_\_ :\_\_ : high

(b) Doll and Torkzadeh: Is the system accurate?

Are you satisfied with the accuracy of the system?

(c) Combined: Accuracy of output information:

inaccurate 1\_\_2\_\_3\_\_4\_\_5\_\_6\_\_7 accurate  
low 1\_\_2\_\_3\_\_4\_\_5\_\_6\_\_7 high  
satisfied 1\_\_2\_\_3\_\_4\_\_5\_\_6\_\_7 dissatisfied

Question (a) is from Baroudi and Orlikowski's (Short-Form) questionnaire [1988, 56-58]. Question (b) is from Doll and Torkzadeh [1988, 263-264]. (The exact layout of Doll and Torkzadeh's questionnaire is not disclosed in the paper, but it appears that a five-point Likert scale was used.) Our question "combining" Short-Form with Doll and Torkzadeh is shown in (c) above.

**Figure 4:** Constructing the question on Accuracy from the Short-Form and Doll and Torkzadeh

1. On-line inquiry (Information requested interactively)

Do you use, or have you used, the on-line inquiry feature of your GL system?

Yes |  |  
No |  | if No, please go to question 2

(a) The on-line inquiry is:

user friendly	1__2__3__4__5__6__7	user unfriendly
complicated	1__2__3__4__5__6__7	easy to use
useful	1__2__3__4__5__6__7	useless

(b) Flexibility of on-line inquiry is: (The capacity to change or to adjust in response to new conditions, demands or circumstances.)

flexible	1__2__3__4__5__6__7	rigid
low	1__2__3__4__5__6__7	high

(c) Overall, are you satisfied with your GL system's **on-line inquiry** feature?

dissatisfied	1__2__3__4__5__6__7	satisfied
--------------	---------------------	-----------

**Figure 5: Example of Feature Satisfaction part of Questionnaire**



**Table 2: Overall UIS**

2(a) Correlation matrix for the four questions in Figure 3

	Adequate	Efficient	Effective	Satisfied	UIS <sup>\$</sup>
Adequate	1.000	.863	.857	.770	.866
Efficient		1.000	.919	.840	.928
Effective			1.000	.845	.928
Satisfied				1.000	.853

(all significant at p=0.001)

<sup>\$</sup> Each item score was subtracted from the UIS score in order to avoid a spurious part-whole correlation.

2(b) Frequency Distribution of UIS scores (mean 5.56, std.dev. 1.16)

UIS Score	Frequency
0 - 1.25	1
1.5 - 2.25	2
2.5 - 3.25	3
3.5 - 4.25	4
4.5 - 5.25	27
5.5 - 6.25	40
6.5 - 7.00	19
unspecified	8
	<u>104</u>

**Table 3: Ives, Olson, and Baroudi's Short-Form UIS Score**

3.1 Overall Satisfaction (UIS) regressed on the Short-Form UIS score (SF\_UIS):

$$\begin{aligned} \text{UIS} &= 0.76 + 0.88 * \text{SF\_UIS} \\ (\text{t-stat}) & \quad (5.31) \\ & \quad \quad \quad *** \\ (\text{n} = 55, \text{Adj. } R^2 &= 0.33) \end{aligned}$$

3.2 Overall Satisfaction (UIS) regressed on the factors from the Short-Form UIS (see left-hand column of Table 4 for definition of factors):

$$\begin{aligned} \text{UIS} &= -2.15 + 0.05 * \text{EDP} + 0.25 * \text{KI} + 1.02 * \text{SF\_IP} \\ (\text{t-stat}) & \quad (0.39) \quad \quad (1.68) \quad \quad (4.94) \\ & \quad \quad \quad \quad \quad \quad \quad + \quad \quad \quad \quad \quad \quad \quad *** \\ (\text{n} = 55, \text{Adj. } R^2 &= 0.48) \end{aligned}$$

\*\*\* p<0.001, \*\* p<0.01, \* p<0.05, + p<0.1

**Table 4: Replication of Baroudi and Orlikowski's [1988] Analysis**

(Varimax rotation, only factor loadings >= 0.30 reported)

Our data:

Factor	Eigenvalue	% of Var	Cum %	Our factor name
1	5.80	44.6	44.6	EDP Staff and Services (EDP)
2	2.47	19.0	63.6	Information Product a (IPa)
3	1.07	8.2	71.8	Information Product b (IPb)

The 13 scales from the Short-Form questionnaire	Our data, n=55 (our factor names defined above)			Baroudi and Orlikowski [1988 49], n=358 (factor names defined in left-hand column)		
	EDP	IPa	IPb	EDP	SF_IP	KI
<u>EDP Staff and Services</u> (Short-Form factor name: EDP)						
Relationship with EDP staff	.88			.84		
Attitude of the EDP staff	.89			.82		
Communication with the EDP staff	.91			.84		
Processing of requests for changes to the existing system	.84			.49		.49
Time required for new systems development	.73			.49		.40
<u>Knowledge and Involvement</u> (Short-Form factor name: KI)						
Your understanding of your GL system	.31	.76				.80
Degree of EDP training provided by EDP staff or vendor	.54					.82
Feeling of participation	.71	.50		.37	.30	.59
<u>Information Product</u> (Short-Form factor name: SF_IP)						
Reliability of output information		.40	.76		.82	
Relevance of output information			.90		.77	
Accuracy of output information		.59	.58	.30	.82	
Precision of output information		.79			.82	
Completeness of output information		.76	.37	.30	.75	

**Table 5: The Doll and Torkzadeh [1988] (D&T) UIS Score**

5.1 Overall Satisfaction (UIS) regressed on Doll and Torkzadeh's UIS score (DT\_UIS):

$$\begin{aligned} \text{UIS} &= -2.07 + 1.33 * \text{DT\_UIS} \\ (\text{t-stat}) & \quad (15.25) \\ & \quad \quad \quad *** \\ (\text{n} = 92, \text{Adj. } R^2 &= 0.72) \end{aligned}$$

5.2 UIS regressed on the factors from Doll and Torkzadeh (see left-hand column of Table 6 for definition of factors):

$$\begin{aligned} \text{UIS} &= -1.59 + 0.42*\text{CON} + 0.07*\text{ACC} + 0.14*\text{FORM} + 0.22*\text{EASE} + 0.40*\text{TIME} \\ (\text{t-stat}) & \quad (3.28) \quad (0.77) \quad (2.05) \quad (3.02) \quad (4.94) \\ & \quad \quad \quad ** \quad \quad \quad * \quad \quad \quad ** \quad \quad \quad *** \\ (\text{n}=92, \text{Adj. } R^2 &= 0.73) \end{aligned}$$

\*\*\* p<0.001, \*\* p<0.01, \* p<0.05, + p<0.1

**Table 6: Replication of Doll and Torkzadeh's [1988] Factor Analysis**

(Varimax rotation, only factor loadings >= 0.30 reported)

Our data:

Factor	Eigenvalue	% of Var.	Cum. %	Our name for factor	
1	5.47	45.5	45.5	Information Quality	(Info. Qual.)
2	1.33	11.1	56.6	IS Usefulness	(Useful)
3	1.14	9.5	66.1	Format	(Format)

The 12 scales used to measure Doll and Torkzadeh's UIS	Our data, n=92 (Our factor names defined above)			Doll and Torkzedah's [1988 266], n=618 (factor names defined in left-hand column)				
	Info. Qual.	Useful	Format	CON	ACC	FORM	EASE	TIME
<u>Content</u> (Doll and Torkzadeh factor name: CON)								
C1 Relevancy of output information (useful...useless)?	.81	.31		.75				
C2 Does the information content of the GL system meet your needs?	.36	.67		.74				
C3 Relevancy of output information (relevant...irrelevant)?	.81	.33		.72		.36		
C4 Completeness of output information (sufficient...insufficient)?	.49		.33	.66		.35		
<u>Accuracy</u> (Doll and Torkzadeh factor name: ACC)	.78		.33		.86			
A1 Accuracy of output information (inaccurate...accurate)?	.74				.84			
A2 Accuracy of output information (satisfied...dissatisfied)?								
<u>Format</u> (Doll and Torkzadeh factor name: FORM)			.88	.30		.79		
F1 Format of output information (useless...useful)?		.40	.79		.36	.71		
F2 Format of output information (clear...unclear)?								
<u>Ease of Use</u> (Doll and Torkzadeh factor name: EASE)		.80					.82	
E1 Is the system <u>user friendly</u> ? (Average of scores from Features)		.82				.34	.80	
E2 Is the system <u>easy to use</u> ? (Average of scores from Features)								
	.44	.54	.31					.78
	.37	.63			.33			.77
<u>Timeliness</u> (Doll and Torkzadeh factor name: TIME)								
T1 Do you get the information you need in time (timely..untimely)?								
T2 Does the system provide up-to-date information?								

**Table 7: Five-Factor Model of UIS**

Regr.	Factor (see Figure 2)							n	Adj.R <sup>2</sup>
	1	2	3	4	5				
7.1	const.	EDP	EDP_M	KI	SF_IP	EASE	USE_SAT	93	0.65
	-1.39	-0.15	0.24	0.20	0.48	0.14	0.58		
	(t)	(-1.66)	(1.61)	(2.37)	(3.80)	(1.35)	(4.69)		
				**	***		***		
7.2	const.	EDP	EDP_M	KI	DT_IP	EASE	USE_SAT	92	0.75
	-1.78	-0.14	0.22	0.16	0.76	0.10	0.43		
	(t)	(-1.85)	(1.74)	(2.16)	(6.78)	(1.13)	(3.94)		
		+	+	*	***		***		
7.3	const.	EDP	EDP_M	KI	DT_IP		FEATURES	88	0.73
	-1.75	-0.10	0.14	0.13	0.85		0.44		
	(t)	(-1.23)	(1.08)	(1.73)	(7.48)		(4.45)		
				+	***		***		
7.4	const.	EDP	EDP_M	KI	DT_UIS		USE_SAT	92	0.76
	-1.90	-0.14	0.22	0.15	0.93		0.39		
	(t)	(-1.91)	(1.78)	(2.08)	(7.08)		(3.79)		
		+	+	*	***		***		

\*\*\* p<0.001, \*\* p<0.01, \* p<0.05, + p<0.1

Variables in the regression equations:

- UIS Our criterion dependent variable (see Figure 3 and Table 2)
- EDP EDP Staff and Services
- EDP\_MA dummy variable set to "1" for firms without EDP departments
- KI User knowledge and involvement
- SF\_IP Average of the Short-Form questionnaire's *Information Product* variables
- DT\_IP Average of Doll and Torkzadeh's *Information Product* variables
- EASE Ease of use
- USE\_SAT Usefulness-of/Satisfaction-with GL-system features
- FEATURES USE\_SAT and EASE combined as one variable
- DT\_UIS Doll and Torkzadeh's Computer User Satisfaction measure (see Table 5)

An Empirical Evaluation of User Information Satisfaction (UIS) Measures  
for Use with General Ledger Accounting Software

Peter Seddon and Siew-Kee Yip  
Department of Accounting and Finance  
The University of Melbourne  
8 May 2002

An Empirical Evaluation of User Information Satisfaction (UIS) Measures  
for Use with General Ledger Accounting Software

**SYNOPSIS**

This study provides an empirical evaluation of three user satisfaction measures for use with computer-based general ledger accounting systems. The three measures tested are Ives, Olson, and Baroudi's User Information Satisfaction (UIS) measure, Doll and Torkzadeh's End-User Computing Satisfaction measure, and a composite measure that includes questions specifically related to the features offered by general ledger systems.

Data relating to the above three measures, and an overall criterion measure of user satisfaction, were collected from 100 Australian firms. The results from analysis of the data suggest that Doll and Torkzadeh's is a more useful measure of satisfaction with general ledger systems than Ives, Olson, and Baroudi's UIS. The main determinants of user satisfaction with general ledger systems are found to be the relevance, content, accuracy, and timeliness of the information produced by the system.

(135 words)

Key words: User information satisfaction, Computer-based general ledger system, measurement

Draw in arrows for Kim's diagram

draw in arrows for last table