Validation of a Computer User Satisfaction Questionnaire to Measure IS Success in Small Business

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The determination of factors that influence success in small business information systems (IS) is of obvious importance to the individuals running those businesses and to the regional economies where the businesses are located. The first step in this process is to develop models of interacting factors that contribute to success. Considerable progress has already been made in this area. DeLone and McLean (1992), for example, identified six inter-related factors that help to account for success. Their model has served as a platform for other researchers in this area (e.g. Seddon and Kiew, 1996). A second important step in this process is the development of well-validated instruments that can be used to measure the constructs making up the models. Without such instruments, it is not possible to go beyond mere speculation about possible contributors to small business IS success. The present study reports on the factorial validation of an instrument that can be used to assess core constructs identified by previous researchers as predictors of success. The instrument also contains a two-item measure of user satisfaction, a variable that is commonly accepted as a surrogate measure of IS success.

ACM Classification: H.1.1 (Models and Principles – Systems and Information Theory), K.6.3 (Management of Computing and Information Systems – Software Management), K.6.4 (Management of Computing and Information Systems – System Management)

Manuscript received: 10 June 2003
Communicating Editor: Graham Low

INTRODUCTION

In a pure economic sense, the way to determine the worth of any type of business information system is to calculate the benefits and then subtract the developmental and operational costs. However, Ives *et al* (1983; 1984) stated that this view is too simplistic to be applied to the determination of the success of information systems. They identified intangible costs and benefits, the disparate and *ad hoc* nature of some system types (e.g., DSS, AI), and unavailability of data on extent of system use as additional major issues that need to be addressed when examining IS success.

As an alternative to economic indicators, many researchers have resorted to attitudinal scales. Foremost among these in the area of small business IS research is the User Information Satisfaction (UIS) instrument developed by Raymond (1985). The UIS has been used extensively, particularly in the US, to gauge Computer Based Information System (CBIS) success in small organizations. Examples of its use as an evaluative tool include projects exploring:

- implementation of pre-packaged software (Chau, 1994);
- adoption of CBIS (Thong and Yap, 1995; Thong, 1999; MacGregor and Bunker, 1996);
- adoption of micro-computer based systems (Chen, 1993);
- adoption of in-house-developed CBIS (Lees, 1987); and
- implementation of specific software packages (Seddon and Kiew, 1996).

In the midst of this widespread usage, there has been some criticism of the UIS on the basis of its limited applicability to information systems as a whole and its poor theoretical base (DeLone, 1990; cited in Heikkila *et al*, 1991). As a result, the UIS instrument has undergone modifications. Heikkila *et al* (1991) extended the range of dimensions covered by the UIS so that in addition to the central CBIS Success factor, it included measures of the development process, the quality of the IS, and the impact and value of the IS to the organisation. DeLone and McLean (1992) took the developmental process a step further when modifying the UIS to make it suitable for assessing the six interacting factors which they believed to be crucial to IS success. The six factors were System Quality, Information Quality, Use, User Satisfaction, Individual Impact, and Organizational Impact.

DeLone and McLean emphasised that the six factors did not operate independently but interacted to influence success. Seddon and Kiew (1996) took the next step when they proposed a path model showing the nature of the interactions among the six factors. At the same time, they made several key alterations to DeLone and McLean's list of core variables and changed the way in which they were measured. The first key change involved the substitution of Usefulness for Use. Their justification for this change was that the level of use may not be determined by the usefulness of the system but by time constraints on potential users. Additionally, use of a CBIS may be compulsory and imposed by the task or organisation, and the number of hours of usage may convey little or no information about its usefulness or success. A further change involved the inclusion of the constructs 'Importance of the System' and 'Task Importance' to balance the possibility that systems performing more important tasks may be regarded as more useful irrespective of actual system quality.

After making these changes, Seddon and Kiew's final research instrument represented a combination of scales from various researchers:

- eight questions on *System Quality* from Doll and Torkzadeh (1988) and Davis (1989), plus three additional questions;
- ten questions on *Information Quality* from Doll and Torkzadeh (1988);
- six questions on *Perceived Usefulness* from Davis (1989);
- four questions on *User Satisfaction* from Seddon and Yip (1992);
- five questions on *Importance of System* from Zaichkowski (1985).

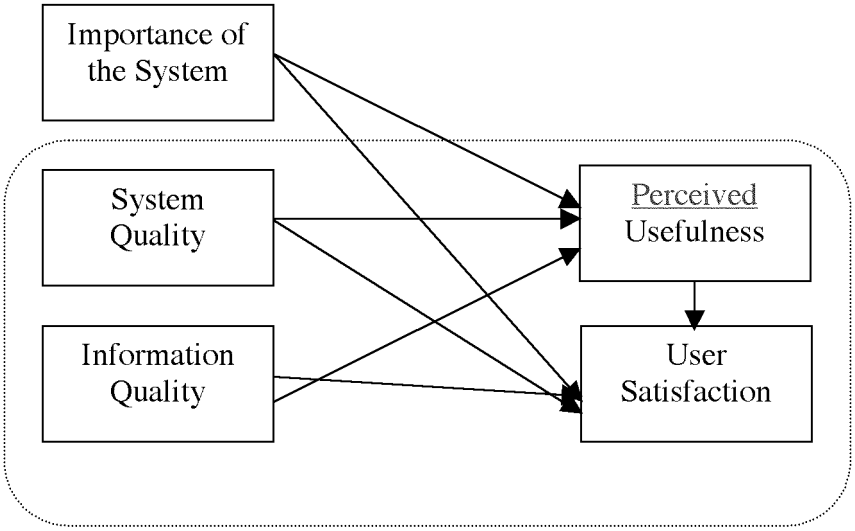

Figure 1: SEM of IS Success (Seddon and Kiew, 1996)

Seddon and Kiew's model showing the interactions among these variables is reproduced in Figure 1.

On the basis of their analysis of data collected from 94 users of a new university accounting system, Seddon and Kiew concluded that their model captured the major sources of variance associated with user satisfaction and that their revised instrument could be employed to assess both user satisfaction and the four most important constructs contributing to satisfaction: Importance of the System, System Quality, Information Quality, and Usefulness. Unfortunately, although they tested their measurement model using structural equation modelling (SEM) techniques, they provided little in the way of psychometric information about their instrument. Inspection of the factor loadings shown in their measurement model suggests that there may have been a high degree of multicollinearity among some items, raising the possibility of further refinements to their instrument.

AIMS AND RESEARCH METHODOLOGY

Given the rapid growth of computers in small business and the need for research on key constructs relating to the successful implementation of computer systems in small business, the lack of validated scales is a barrier to the development of theory that will guide practitioners in this field. The main aim of the present study was to review and extend the Seddon and Kiew version of the UIS and, in so doing, to provide researchers with a valid and reliable instrument that covers all the key constructs identified by researchers in this field.

Following the guidelines set out for questionnaire validation by Comrey (1988) and Gorsuch (1997), the main analytical tool was exploratory factor analysis (EFA). EFA is a technique that can be used to reduce a large dataset to a smaller number of underlying explanatory constructs. There are various methods of EFA, some of which seek to explain the total variance in the dataset (principal components), whilst other techniques (common factor analysis) target only the shared variance, excluding variance unique to each variable. Because our interest was primarily in the underlying structure of the UIS, we used common factor analytic techniques (Gorsuch, 1997). Our expectation was that groups of items included in our survey instrument would define separate

factors and that these factors would correspond with the constructs purportedly measured by the UIS. Other items were expected to define constructs introduced in the present study. Evidence of factorial validity provides empirical justification for forming scales based on the factors and for using those scales in applied settings. Other methodological details relating to the factor analyses will be explained in the Results section.

Internal consistency reliability analysis (coefficient alpha) was employed as a supplementary tool to refine the scales. Whereas factor analysis is useful for identifying those items that properly belong to a scale, reliability analysis is helpful for determining how many items are needed to measure a construct. For example, whilst EFA might indicate that all 10 items selected to represent a particular construct load on the relevant dimension, subsequent internal consistency reliability analysis may indicate that fewer than 10 items are actually needed for reliable measurement of this construct. Used together in the proper manner, factor analysis and reliability analysis are powerful tools for validating and refining scales.

In the sections that follow, we describe the sampling procedure so that the reader will understand the characteristics of the validation sample. We then proceed to a description of the questionnaire and the subsequent factor analysis of the questionnaire. Descriptive statistics for the various scales are then provided to allow the reader to see how scores were distributed for this sample and to see the relations among the scales. Finally, some recommendations are made regarding possible uses of the instrument.

DATA COLLECTION

The data collection for the study targeted small wholesaling and manufacturing businesses on the Mid North Coast Region of New South Wales. They were selected from the Business Enterprise Register (BER), a database of over 13,500 businesses in the region. The Australian Bureau of Statistics (ABS, 1995) definition of small business was adopted for this study. This definition describes small manufacturing businesses as having fewer than 100 employees and small wholesaling businesses as having fewer than 20 employees. The BER contained details of the number of employees. Suitable businesses were selected by listing all wholesalers and manufacturers that fell within the definition of 'small' as per the ABS. Table 1 shows the distribution of the small manufacturers and wholesalers that responded to the survey and the distribution of all manufacturers and wholesalers across the region. The Table demonstrates that the sample was representative of the population of manufacturers and wholesalers from the BER.

Using a type of stratified sampling technique, businesses were selected sequentially from the BER by organization number, but ensuring that the number selected in each sub-region reflected the distribution of the total number of businesses. The main survey was administered by sending a pre-advice letter to those businesses selected to be in the sample. This letter advised them of the study and informed them that a representative of the research team would be contacting them sometime within a fortnight of their receipt of the letter. Each business that was sent a pre-advice letter was contacted to ascertain its willingness to participate in the survey and to confirm that it used a Computer-Based Information System to support its business functions. Businesses that indicated their willingness to participate and used a CBIS were each mailed a survey package. A total of 240 businesses from the 598 selected from the database were sent survey packages. Of these, 171 surveys were returned.

DESCRIPTION OF THE QUESTIONNAIRE

The questionnaire included a subset of the items used by Seddon and Kiew (1996). As mentioned earlier, inspection of item content and statistical data reported in their paper suggested a certain

		Manufacturers		Wholesalers		Manufacturers/ Wholesalers		Region's Totals	
		Sample	All	Sample	All	Sample	All	Sample	All
Coffs Harbour	(n)	117	239	58	68	8	12	183	319
	(MNC)	19.6%	21.8%	9.7%	6.2%	1.3%	1.2%	30.6%	29.2%
	(SR)	63.9%	74.9%	31.7%	21.3%	4.4%	3.8%		
Hastings	(n)	147	276	75	141	3	11	225	428
	(MNC)	24.6%	25.1%	12.5%	12.9%	0.5%	1%	37.6%	39.0%
	(SR)	65.3%	64.5%	33.3%	32.9%	1.3%	2.6%		
Manning/ Gloucester	(n)	72	150	66	131	16	23	154	304
	(MNC)	12.0%	13.7%	11.1%	12%	2.7%	2.1%	25.8%	27.8%
	(SR)	46.8%	49.3%	42.9%	43.1%	10.4%	7.6%		
Macleay	(n)	24	30	12	14			36	44
	(MNC)	4.0%	2.7%	2.0%	1.3%			6.0%	4.0%
	(SR)	66.7%	68.2%	33.3%	31.8%				
Region's Totals		360	695	211	354	27	46	598	1095
		60.2%	63.4%	35.3%	32.4%	4.5%	4.2%		

(n) – number of wholesalers and/or manufacturers
(MNC) – percentage distribution by industry type within the Mid North Coast region
(SR) – percentage distribution by industry type within the sub-region

Table 1: Distributions of Sample Population of Wholesalers and Manufacturers by Region and Sub Regions

amount of item redundancy. From a psychometric point of view, there is nothing wrong with item redundancy but if items can be deleted without reducing the reliability or validity of the scale, efficiencies can be achieved. Potentially redundant items were identified by inspection of content and factor loadings reported in their paper.

Two other changes were made to the Seddon and Kiew instrument. Firstly, the items were recast in general terms, rather than targeting a particular software package, as was the case in their study. Secondly, we broadened their Importance of System Construct to include other functions besides Accounting. Both of these changes were aimed at achieving a more generic instrument.

Demographics

The questionnaire began with a series of items relating to demographic characteristics of the small business. These questions, along with summary statistics, are shown in Table 2.

System Usage Characteristics

Seddon and Kiew used seven items to measure a construct called System Quality. We selected the four items with the highest factor loadings from the Seddon and Kiew study and added three new items to include aspects of costs and benefits. We also re-labelled the construct using the more neutral term System Usage Characteristics. The items employed a seven-point Likert response format with *Strongly Disagree* and *Strongly Agree* anchoring the opposite ends of the response scale.

Information Quality

Seddon and Kiew used 10 items for the measure of Information Quality. We reduced the number of items to six on the basis of factor loadings shown in their paper. The response format used for System Usage Characteristics was also used here.

Perceived Usefulness

Seddon and Kiew used six items to assess this construct. Inspection of factor loadings suggested a high degree of overlap among these items, so we retained the first three and then added two new items which assessed whether the system saved time and money. The response format was the same as that used for Information Quality.

Importance of the System

Importance of the System was one of the new scales introduced by Seddon and Kiew to assess the perceived importance of the accounting function. Their rationale for including this scale was that perceptions of other components of the system may be overshadowed by the perceived importance of those components. By measuring perceived importance, one can then control for its influence when examining relations among other variables. Given the broader scope of our own instrument, we extended this section to include management and planning applications, accounting applications, Small Office Home Office (SOHO), internet, e-commerce and email. The items employed a seven-point Likert response format with *Not Important* and *Essential* anchoring the opposite ends of the response scale.

User Satisfaction

As Seddon and Kiew noted, User Satisfaction is the central construct in the evaluation of CBIS success. They used four items from the Seddon and Yip (1992) study as their measure of satisfaction. These four items covered the extent to which users felt the system met their information processing needs, their ratings of system efficiency and effectiveness, and how satisfied they were. We dropped the two efficiency and effectiveness questions because of their vagueness and added a question relating to need for vendor support, a behavioural item that we thought would be linked with feelings of user satisfaction (or dissatisfaction). The items employed a seven-point Likert response format with *Never* and *Always* anchoring the opposite ends of the response scale.

RESULTS – DEMOGRAPHIC CHARACTERISTICS OF SAMPLE

The demographic characteristics of the sample of 171 respondents are shown in Table 2.

On average, manufacturers employed more people (M=7.30) then did wholesalers (M=5.39) but on average manufacturers have been operating for over three years less (M=13.45) than wholesalers (M=16.72 years). Overall, the average age of the business for both wholesalers and manufacturers shows a reasonable period of operation given the very high levels of small business failure reported in the media. These data indicate that wholesalers and manufacturers in the region are reasonably stable and appear to be sustainable businesses over a medium to long-term timeframe (although the high standard deviation should be noted).

RESULTS OF FACTOR ANALYSES

All factor analyses were conducted using principal axis factoring (PAF). Oblique rotation techniques were used to allow for the known relationships among these core CBIS success factors (Seddon and Kiew, 1996). Scree plots and the eigenvalue root one rule were used in combination to

	Manufacturers		Wholesalers		Total	
Item	***M***	***SD***	***M***	***SD***	***M***	***SD***
1. How many people does your business employ, including the proprietor(s)?	7.30	9.15	5.39	3.66	6.54	7.43
2. How many years has the business been established?	13.45	8.81	16.72	10.71	14.77	9.70
3. If not the original owner, how many years has the business been owned by the current proprietor?	11.36	7.94	11.59	6.57	11.54	7.57
4. When did your business start using its first computer-based information system?	6.86	4.06	7.77	3.93	7.23	4.05
5. When did your business start using its most recent computer-based information system?	4.10	2.70	4.31	2.67	4.18	2.62

Table 2: Demographic Items

determine the number of factors to extract. In addition to these overall criteria, all factors to be reported in the sections below met the following criteria for retention:

- items defining the various factors all had communalities greater than 0.25 (that is 25% or more of their variance is explained by the underlying factors);
- all item loadings were greater than 0.30 (Tabachnik and Fidell, 1996);
- all factors were clearly interpretable (Gorsuch, 1974).

For the purposes of these analyses, in order to maintain a favourable ratio for cases to variables, the three sections of the questionnaire were factor analysed separately. The first section comprised the Information Quality, System Usage Characteristics (Seddon and Kiew: System Quality), and Perceived Usefulness variables that Seddon and Kiew described as the determinants of User Satisfaction. The next section comprised the 15 System Importance items, a construct introduced by Seddon and Kiew and considerably expanded in the present study. The third section comprised the three outcome items intended to measure User Satisfaction. Splitting up the questionnaire in this manner does not allow one to check for factorial complexity, but with an anticipated reduced item set that aim can be achieved in a follow-up validation study.

The results of the factor analyses are set out below.

DETERMINANTS OF CBIS SUCCESS

There were 22 items included to measure determinants of CBIS Success. Various preliminary analyses focussing on multicollinearity and communality problems (Heywood cases) led to the deletion of seven of these items. The intercorrelation matrix formed from the remaining 15 items was factor analysed using the principal axis factor (PAF) routines from SPSS for Windows.

Item Description	CBIS Factors			
	Information Quality	***System Usefulness***	***System Usage Characteristics***	***System Complexity***
The system provides me with sufficient information	.94	-.14	.01	.01
The system provides reportsthat seem to be just about exactly what I need	.78	.01	.01	.01
The system is accurate	.75	.01	-.01	-.01
The system provides me with up to date information	.75	.17	-.10	-.01
The information I get from the system is clear	.66	-.01	.20	.01
Using the system increases productivity	-.01	.93	.01	-.01
Using the system saves me time	.01	.88	-.01	.01
Using the system improves job performance	-.01	.84	.01	-.01
The system is easy to learn	-.01	.01	.86	.01
System is easy to use	.14	.01	.77	.01
It is easy to get the system to do what I want	.01	.10	.69	-.01
The system is complex	.01	.01	-.01	.75
It is expensive to operate and use the system	-.01	.01	.01	.60
Percentage of Variance	**47.07**	**12.50**	**8.98**	**7.57**

Table 3: Factor Pattern Matrix for CBIS Success Items

Bartlett's (1950; 1951) test of sphericity ($\chi^2(190)=2452.65$, $p<.001$) and Kaiser-Meyer-Olkin's MSA (0.90) indicated that the items were suitable for factor analysis. Four factors in the final solution had eigenvalues greater than 1 and accounted for 76.13% of variance in the item set. Reliability analysis of the scales formed on the basis of the factor analysis suggested that there was very little redundancy with just two items deleted as a consequence of these analyses. The factor pattern matrix for the remaining 13 items is shown in Table 3.

The first factor has been labelled *Information Quality* and taps the validity of information provided by the CBIS and the relevance of this information to the organization's information needs. This five-item factor corresponds with the 10-item scale of the same name employed by Seddon and Kiew (1996). The second factor, *System Usefulness*, is related to gains in terms of efficiency and effectiveness resulting from CBIS usage: For example, increases in productivity and job performance resulting from usage of the CBIS. The items used to tap this factor are almost identical

to those used by Seddon and Kiew in their System Usefulness Scale. The third factor, *System Usage Characteristics*, describes the ease of system use, depth of learning required, and the adaptability of the system to organization-specific requirements. Again, the factor has a counterpart in the work of Seddon and Kiew who employed a seven-item scale labelled *System Quality*.

The final factor, which has been labelled *System Complexity*, consisted of two items that measured attributes related to the expense and complexity of using the system. However, this factor was not used in further analysis for the following reasons:

- the first three factors accounted for over 68% of the variance;
- the three-factor solution was supported by the scree plot; and
- the complexity factor did not correlate with the other three factors representing CBIS Success, suggesting that it is not part of the overall CBIS Success network.

The factor correlation matrix showed that Information Quality, System Usefulness, and System Usage Characteristics dimensions were all moderately correlated (between 0.51 and 0.58) indicating that the three factors may themselves be linked by a higher order factor, the overarching CBIS Success construct.

ANALYSIS OF CBIS IMPORTANCE ITEMS

There were 15 items selected for inclusion in the survey as being representative of *CBIS Importance* in small business. The MSA (0.78) and Bartlett's test of sphericity ($\chi^2(78)=703.11$, $p<.001$) on the correlation matrix for the set of items that represent *CBIS Importance* showed that this set of items was suitable for factor analysis.

Item Description **Factor**			
	Importance of Accounts	**Importance of SOHO**	**Importance of Management Applications**
Invoicing	.82	.01	.13
Combined Acs receivable and Acs payable	.78	-.01	.01
Inventory Stock Control	.61	-.12	-.16
Payroll	.50	.12	-.32
General Accounting	.43	.01	.01
Electronic Funds Transfer Banking System	.36	.01	-.22
Word Processor	.01	.79	.12
Desk Top Publishing	-.01	.60	.01
Spreadsheet	-.01	.55	-.21
Combined email and web responses	.16	.55	-.01
Project Management	-.01	.01	-.80
Production Development Planning	.01	-.01	-.70
Scheduling/Calendar	.01	.16	-.65
Percentage of Variance	**30.70**	**16.17**	**10.68**

Table 4: Factor Pattern Matrix for CBIS Importance Items

	Factor 1	2	3
Importance of Accounts	1.00		
Importance of SOHO	.17	1.00	
Importance of Management Applications	-.33	-.37	1.00

Table 5: Factor Correlation Matrix

Examination of the correlation matrix revealed two pairs of items with high collinearity. The high correlation between "*Accounts payable*" and "*Accounts receivable*" (0.92) and "*Internet*" and "*Email*" (0.82) suggests that respondents did not conceptually distinguish between these items. It was acknowledged that in terms of CBIS Importance, the two items were equivalent measures and so they were combined. In each case, the means of the two items were used to form two combined items, namely "*Combined accounts receivable and accounts payable*" and "*Combined email and web responses*". This technique is known as item parcelling (West *et al*, 1995). The PAF routine from SPSS was then used to assess the underlying structure of the 13 by 13 item correlation matrix. The resulting factor pattern matrix is shown in Table 4.

The first *CBIS Importance* factor described the accounting software applications (*Importance of Accounts*) of the small business' CBIS. The second factor represents the productivity applications normally classified as the "small office home office" suite of applications (*Importance of SOHO*). The third factor explains those software applications that support management and/or planning functions (*Importance of Management Applications*). The items that load strongly on each factor provide a description of coherent and related values that can be grouped under a readily interpretable descriptor.

The factor correlations in Table 5 show there was not much overlap among the three factors, suggesting that they should be treated as independent constructs.

CBIS USER SATISFACTION

There were three items selected for inclusion in the survey as being representative of *CBIS User Satisfaction* in small business. The MSA (0.64) and Bartlett's test of sphericity ($\chi^2(3) = 223.23$, $p<.001$) showed that these three items were suitable for factor analysis. The single factor determined from the analysis accounted for 73.2% of the variance in the item set. Reliability analysis, however, indicated that greater homogeneity would be achieved if the item "*How often do you require vendor support?*" was deleted. Accordingly, this item was dropped leaving a two-item User Satisfaction scale:

1) *To what extent do you feel the system meets the information processing needs of the business?;* and
2) *Overall, how often are you satisfied with the system?*

FACTOR SOLUTION SUMMARY

The factors extracted from the analysis of the items included in the Determinants of CBIS Success Questionnaire were mostly in accordance with expectations. The outcomes of the exploratory factor analysis supported earlier work by Seddon and Kiew (1996) and provided a more in-depth validation of a questionnaire that can be used across a wide range of settings. A comparison of the findings from both studies is provided in Table 6.

As can be seen from Table 6, the reliability coefficients were less than those obtained by Seddon and Kiew but they still fell within acceptable bounds (Nunnally and Bernstein, 1994) and were

Scale Name	*Observations*	*No. of Items*	*Cronbach α*	*M*	*SD*
Information Quality	100	10	0.95	4.66	1.29
	169	5	0.91	5.24	1.07
System Usefulness	101	6	0.99	3.92	1.87
	169	3	0.91	5.01	1.43
System Quality	101	7	0.94	4.21	1.46
System Usage Characteristics	169	3	0.85	4.86	1.21
System Importance*	100	5	0.89	4.76	1.42
Importance of Accounts	169	6	0.78	4.30	1.79
Importance of SOHO	169	4	0.73	2.81	1.63
Importance of Mgmt Apps	169	3	0.78	1.16	1.53
User Satisfaction*	101	4	0.92	4.67	1.58
	169	2	0.86	5.47	1.00

Key:

* Measured with different variables in each study

Statistics from the study by Seddon and Kiew (1996)

Statistics from the current study

Table 6: Comparison of the Results of this study with the Study of Seddon & Kiew (1996)

achieved with fewer items, meaning that time savings can be effected with these revised scales. Obviously this is not true if the expanded System Importance scale is used, but we are anticipating that researchers will adapt this scale to suit their needs.

DESCRIPTIVE STATISTICS FOR DERIVED SCALES

The reduced computer user satisfaction questionnaire can be found in Appendix A. Descriptive statistics for each of the scales that form this questionnaire are shown in Table 7.

Scale (n = 169)		**No. of Items**	**M**	**SD**	α
CBIS Importance	Importance of Accounts	6	4.30	1.79	0.78
	Importance of SOHO	4	2.81	1.63	0.73
	Importance of Management Applications	3	1.16	1.53	0.78
CBIS Success	Information Quality	5	5.24	1.07	0.91
	System Usefulness	5	5.01	1.43	0.91
	System Usage Characteristics	3	4.86	1.21	0.85
User Satisfaction	User Satisfaction	3	5.47	1.00	0.86

Table 7: Descriptive Statistics for Derived Scales

The means were formed by adding the individual items in each scale and then dividing by the number of items in the scale. This technique allows easy comparison between scales because it places them on a common metric where the maximum possible score was 7.0 and the minimum possible score was 1.0.

The presentation of the means allows a first glance at the main outcome variables in this study. A mean of 5.47 for *User Satisfaction* suggests that most respondents were reasonably satisfied with their CBISs. Mean scores of 5.24 for *Information Quality*, 5.01 for *System Usefulness*, and 4.86 for *System Usage Characteristics* also supported the notion that most respondents felt their CBISs were successful.

The mean scores of the scales comprising CBIS Importance indicate that some functions were more important than others. The highest score was obtained for accounting functions with a mean just above the midpoint of the scale ($M = 4.30$). Mean scores for SOHO applications ($M = 2.81$) and management applications ($M = 1.16$) were much lower, suggesting that these latter functions are unimportant (both being below the scale midpoint) and of less importance than applications that support accounting functions. Paired t-tests indicated that the difference between Accounts and SOHO was significant ($t(168)=8.97$, $p<.01$), as was the difference between Accounts and Management Applications ($t(168)=221.75$, $p<.01$), and SOHO and Management Applications ($t(168)=12.11$, $p<.01$).

GROUP DIFFERENCES ON SCALES

Checks were conducted to ascertain whether the descriptive statistics in Table 7 were characteristic of the whole sample or whether there were differences among sections of the sample. Differences on such variables as size of company would limit the ability to generalise the findings. Information that could be used to classify the company into different types was collected from the demographic items and consisted primarily of questions designed to assess the age of the organization and its experience with computer technology.

All of these items yielded continuous data so Pearson product-moment coefficients were suitable for determining whether relations existed between individual items and any of the scales discussed above. Using an alpha level of .001 to compensate for the fact that there were many correlations to be checked and that the analyses involved individual items (which are less reliable than aggregates of items, i.e., scales), *Total Staff* was significantly correlated with *Importance of Accounts* (.40), and *Importance of Management Applications* (.47). Thus, the larger organizations tended to have a greater need for accounting software and management applications. These findings are in accordance with expectations. It should be noted, however, that the effect size is moderate in each case, not amounting to more than 22% of shared variance.

There were no other significant ($p < .001$) relationships between scales and items designed to collect demographic information.

CONCLUDING REMARKS

This study has provided evidence for the factorial validity of a short questionnaire that can be used to measure the level of perceived success of Computer Based Information Systems in small business, as judged by user satisfaction ratings. The shortness of the questionnaire (13 items) means that it can be administered quickly. Its brevity is also an advantage in that it can be integrated into a longer questionnaire seeking information on other aspects of CBIS Success.

One possible extension of the questionnaire involves the collection of data on computer/business functions that are considered important in particular settings. Seddon and Kiew (1996) suggested this possible extension when they included an item relating to the importance of departmental

accounting functions. We have taken that concept further and shown that it is possible to list a range of business activities that can be addressed via computer software and that items associated with particular functions define higher level dimensions (e.g., accounting, SOHO, management applications) when subjected to factor analysis.

Seddon and Kiew suggested that the importance of various business activities may moderate user satisfaction ratings. We did not examine that possibility here. Instead we concentrated on improving the measurement operations for assessing the importance of a wide range of business functions and showed that reliable and valid scales can be developed for such functions as accounting, SOHO, and management applications. In future research, the relations among all scales will be examined with a view to determining their role in CBIS success. The model of CBIS success proposed by Seddon and Kiew will be tested using the factors derived from the current study. Future research will also focus on the possible moderating effect of various demographic variables on user satisfaction. We tested for effects on number of employees, years established, and experience with technology. The analyses indicated that some relationships are present but that these relationships concern the importance attached to different functions rather than user satisfaction.

REFERENCES

ABS (1995): *ANZSIC Coder*, ABS Catalogue No. 1290.0, Version 1994/1, Canberra, Australian Government Printing Service.

BARTLETT, M.S. (1950): Tests of significance in factor analysis, *British Journal of Statistical Psychology*, 3(1): 77–85.

BARTLETT, M.S. (1951): A further note on tests of significance in factor analysis, *British Journal of Statistical Psychology*, 4(1): 1–2.

CHAU, P. Y. C. (1994): Selection of packaged software in small business, *European Journal of Information Systems*, 3(4): 292–302.

CHEN, J. C. (1993): The impact of microcomputers on small business: England 10 years later, *Journal of Small Business Management*, 31(3): 96–102.

COMREY, A. L. (1988): Factor-analytic methods of scale development in personality and clinical psychology. *Journal of Consulting and Clinical Psychology*, 56(5): 754–761.

DAVIS, F. D. (1989): Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13(3): 319–340.

DELONE, W. H. and McLEAN, E.R. (1992): Information systems success: The quest for the dependent variable, *Information Systems Research*, 3(3): 60–95.

DOLL, W. J. and TORKZADEH, G. (1988): The measurement of end-user computing satisfaction. *MIS Quarterly*, June: 259–274.

GORSUCH R.L. (1974): *Factor analysis*, Philadelphia : W.B. Saunders Company.

GORSUCH, R. L. (1997): Exploratory factor analysis: Its role in item analysis. *Journal of Personality Assessment*, 68(3): 532–560.

HEIKKILA, J., SAARINEN, T. and SAAKSJARVI, M. (1991): Success of software packages in small business: An exploratory study. *European Journal of Information Systems* 1(3): 159–169.

IVES, B., OLSON, M.H. and BAROUDI, J.J. (1983): The measurement of user information satisfaction. *Communications of the ACM* 27(10): 785–793.

IVES, B. and OLSON, M.H. (1984): User involvement and MIS success: A review of research. *Management Science* 30(5): 586–603.

LEES, J. D. (1987): Successful development of small business information systems. *Journal of Systems Management* 25(3), 32–39.

MACGREGOR, R. C. and BUNKER, D.J. (1996): *The Effect of Priorities Introduced during Computer Acquisition on Success with Information Technology in the Small Business Environment*. IRMA International Conference: IT Management and Organizational Innovations.

NUNNALLY, J.C. and BERNSTEIN, I.H. (1994): *Psychometric Theory*, 3rd Edition, New York: MacGraw Hill.

RAYMOND, L. (1985): Organizational characteristics and MIS success in the context of small business, *MIS Quarterly*, 9(1), 37–52.

SEDDON, P. B. and KIEW, M.Y. (1996): A partial test and development of DeLone and MacLean's model of IS success. *Australian Journal of Information Systems* 4(1).

SEDDON, P.B., and YIP, S-K. (1992): An empirical evaluation of user information satisfaction (UIS) measures for use with general ledger accounting software", *Journal of Information Systems* Spring, 75–92.

TABACHNICK, B.G. and FIDELL, L.S. (1996): *Using Multivariate Statistics*, 3rd Edition, Harper Collins College Publishers, California State University: Northridge.

THONG, J.Y.L. (1999): An integrated model of information systems adoption in small business, *Journal of Management Information Systems*, 15:4, Spring.
THONG, J.Y. and YAP, C.S. (1995): CEO characteristics, organizational characteristics, and information technology adoption in small business. *Omega – International Journal of Management Science* 23(4): 429–442.
WEST S.G., FINCH J.F. and CURRAN P.J. (1995): Structural equation modeling with non-normal variable, in HOYLE R.H. (eds), *Structural Equation Modeling: Concepts, Issues and Applications*, 56-75, Thousand Oaks, CA: Sage.
ZAICHKOWSKI J.L. (1985): Measuring the involvement construct, *Journal of Consumer Research*, 12, 341–352

APPENDIX 1 – A SHORT COMPUTER USER SATISFACTION QUESTIONNAIRE

Information Quality…	***Strongly Disagree***						***Strongly Agree***
Information I get from the system is clear	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
The system is accurate	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
The system provides me with sufficient information	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
The system provides me with up-to-date information	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
The system provides reports that seem to be just about exactly what I need	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

System Usefulness…	***Strongly Disagree***						***Strongly Agree***
Using the system increases productivity	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Using the system saves time	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Using the system improves job performance	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

System Usage Characteristics…	***Strongly Disagree***						***Strongly Agree***
The system is easy to use	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
The system is easy to learn	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
It is easy to get the system to do what I want it to do	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

Overall satisfaction…	***Never***						***Always***
Do you feel the system meets the information processing needs of the business?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Overall, how often are you satisfied with the system?	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

NB. These 13 items form the main part of the satisfaction questionnaire. The Importance of CBIS Functions scale listed overleaf is an additional section that can be adapted to suit the requirements of individual businesses.

Importance of CBIS Functions…..

How important is each of the information systems technologies listed below to your business' operations?

Software	***Not Important*** ..... ***Critical***						
Word Processor(s)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Spreadsheet(s)	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Desk Top Publishing	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Email	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Internet	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Project Management	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Scheduling/Calendar	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
General Accounting	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Accounts Payable	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Accounts Receivable	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Invoicing	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Inventory/Stock Control	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Production/Development Planning	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Payroll	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7
Electronic Funds/Banking System	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7

BIOGRAPHICAL NOTES


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Bruce Armstrong received his PhD from the University of Western Sydney. He is currently lecturing with the School of Multimedia and Information Technology at Southern Cross University at their Coffs Harbour Campus. His areas of interest include the use of information in regional small business, use of the internet and computers in regional Australia, and management of information on regional development indicators. He is a member of the steering committee and a coordinator of the Business Mid North Coast project, the Business Enterprise Register project and the CoastCall project. He is also a member of the Centre of Economic and Community Development and the Centre for Aged Services Learning and Research Collaboration.


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Dr Don Dingsdag has been an academic in occupational safety and health for more than twenty years and is fully conversant with the nature of risk assessment in industrial safety as well as in environmental management. For more than ten years Don has also investigated, assessed and evaluated many critical incidents. He is also a safety systems adviser in the construction and energy industries as well as in the coal mining industry. He is the managing director and senior consultant of Safety Risk Management Auditing Pty Ltd, an organisation specialising in safety management, workplace accident investigation, factual investigation, expert witness reports and risk management in Australia.


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Julian Dimbleby is a lecturer in the School of Multimedia and Information Technology at Southern Cross University, Lismore Campus. He is also the Director of International Programmes within the school and oversees courses run in China, Hong Kong, Malaysia, India, Indonesia, South Korea and the United Arab Emirates. He teaches topics in systems analysis and design, information resources management, object oriented design, and information systems project management. His research interests include information system success in small business, tools and techniques used in systems analysis and design and automated assessment systems.