A model and instrument for measuring small business user satisfaction with information technology

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Abstract:
Measurement of the value of computing in very small businesses has been largely ignored in the MIS literature. This article develops a comprehensive model for examining the satisfaction of small business users with information technology (SBUSIT). It is argued that current models are not applicable as they are targeted primarily towards either the traditional data processing or end-user computing environment. This study develops and statistically validates the SBUSIT model. The validated model and an accompanying instrument are provided. It is noteworthy that many new factors and specific items distinguish the model from current ones.
Keywords: Computer satisfaction; IT satisfaction; Instrument; Reliability and validity; Small business computing; User satisfaction; Very small businesses

Article:

1. Introduction

While information technology (IT) is being used extensively in large and medium sized organizations, its use is still in embryonic stages in many small businesses. Estimates of small business use of computers are relatively low, and range from 27% to 68% depending on location, size, and nature of the businesses surveyed [16, 22, 30]. Representative recent studies dealing with small business experience with management information systems (MIS) and IT include [1, 11, 13, 17, 19, 23, 28, 31, 33].

In practically all MIS studies of small businesses, the companies studied are similar to medium and large organizations. The American Small Business Administration (SBA) classifies a firm as small if it has up to 500 employees. This allows considerable latitude, as the organizations reported in past studies have a formal MIS department, and even a community of end-users, similar to their larger counterparts. In order to focus on "truly" small businesses, we have restricted the size of small businesses here to a maximum of 100 employees, following the example of Nazem [22].

A serious investigation of IT's impact on small businesses is warranted as these businesses are extremely important to the United States economy. Carnevale [5] pointed out that five out of every six paychecks in America come from firms with less than 1,000 employees and that two-thirds of those work for firms with less than 100 employees. Pritchard [27] found that firms with fewer than 500 employees added all of the net new jobs in the U.S.A. from 1988 to 1991.

Ideally one would like to evaluate IT impact based on direct measures, such as costs and benefits, productivity improvements, impact on decision making, and competitive advantages. Because of difficulty in measurements, IS researchers have used surrogate measures. A common one is "user satisfaction" with technology [2, 9, 12, 15]. These measures have received widespread acceptance. We argue that current measures for user satisfaction are not directly applicable to the small business computing environment. Therefore, we develop the surrogate measure "Small Business User Satisfaction with Information Technology", or SBUSIT, and an associated instrument. In both, we are driven by two primary goals: comprehensiveness in measuring the impact on a wide range of small businesses, and rigor in measurement.

2. The small business user IT satisfaction (SBUSIT) construct

In order to understand the small business IT environment, one needs first to examine the environments in large organizations. There are two in large organizations: traditional data processing and end-user computing. Figures 1 and 2, modified from [12], represent these two.[1] In the traditional DP mode, the user interacts with the computer indirectly, through the systems staff (i.e., analysts and programmers) or through the operations staff. In the end-user environment, the users (typically, managers and staff analysts) interact directly with the computers through application software. They typically also have access to a support group, or an information center [6]. In both environments, there is usually a management information systems (MIS) department. It is normally the MIS department that deals with outside organizations, such as vendors, consultants, and education/ training firms.

The small business computing environment as shown in Figure 3 is quite different. Given limited resources, the small business user is the owner or manager, who also becomes the specialist in various facet of IS. He/she is the end-user, systems analyst/programmer, operator, etc., although not very well trained or adept in any of these roles. This person also has to deal with entities external to the organization (i.e., vendors, consultants, educators, trainers). Since this person deals with the entire spectrum of IT, we have chosen the term: “satisfaction with information technology” in our work.

TRADITIONAL MIS ENVIRONMENT

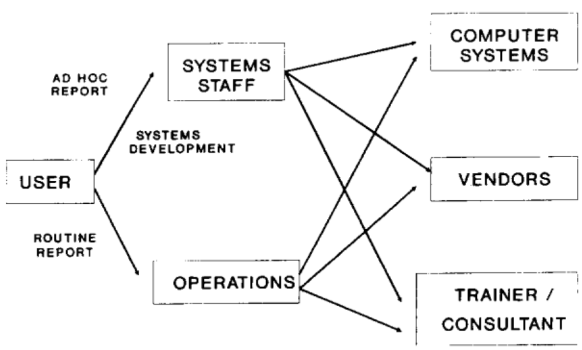

Fig. 1. Traditional MIS environment.

END - USERS COMPUTING ENVIRONMENT

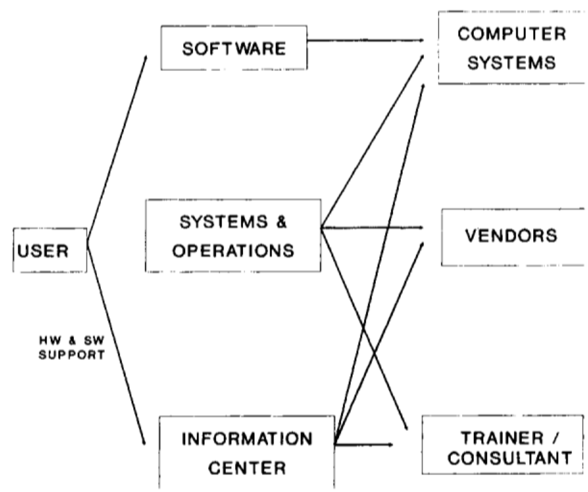

Fig. 2. End-users compuuting environment

SMALL BUSINESS USER ENVIRONMENT

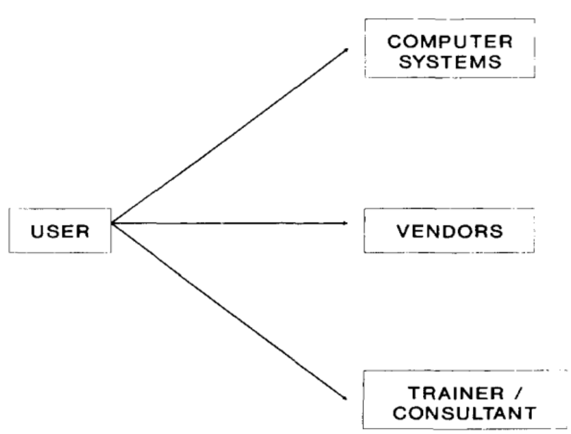

Fig. 3. Small business user environment.

In order to define the SBUSIT construct, the Bailey and Pearson [2], and Ives et al [15] instruments were first examined. The Ives et al. instrument was designed for the traditional data processing environment, and recommended three major factors: EDP staff and services, information product, and user knowledge/ involvement, and also identified items for each factor. Clearly, EDP staff and services is inappropriate for the small business environment. Other factors from these instruments were not directly applicable to our model, but provided useful suggestions for new items. The "ease of use" factor was recognized in the Davis instrument [9], and was explored in detail. Doll and Torkzadeh's study [121 culminated in the identification of five factors: information content, accuracy, format, ease of use, and timeliness. Our preliminary model included these without any changes. One additional factor: "productivity" was included to recognize the time and resource constraints placed on the small business user.

Some factors and items not included in the current instruments are significant to the small business user. As noted earlier, the small business user is in the dual role of an end-user and a technical/systems person. Six additional factors were included to acknowledge the technical/systems role as well as interaction with entities outside the organization; these are: hardware adequacy, software adequacy, system security & integrity, documentation, vendor support, and training & education. These factors have been discussed in MIS literature [10, 24, 25] and small business studies [1, 21, 22, 29]. Finally, eleven global items were included for measuring overall satisfaction. These items were also used for verifying the construct and criterion-related validity of the instrument. Doll and Torkzadeh [12] used two global items in their study, but their choice was arbitrary. A large number was included to allow us to extract a validated subset.

3. Research methods

3.1. *Initial instrument preparation*

A preliminary list of items was prepared as outlined above. It was then subjected to pre-pilot testing with graduate students and local Small Business Development Center[2] (SBDC) officials. As expected, certain items were dropped, some were added, some were combined, and some others were reworded. The details of this process are unnecessary, in our opinion, for this article. This review led to a new instrument constituting a total of 48 items, grouped in thirteen variables/factors (see appendix A). Of these, only 14 are taken directly from previous instruments. The first twelve sets represent specific aspects of satisfaction and constitute 37 items; the last set "overall evaluation" has 11 global items that measure overall satisfaction. We refer to this as the 48 item instrument.

A general comment from the reviewers of the instrument was that several items were repetitive, and that they paraphrased the same underlying concept.

3.2. *Pilot study*

The model was pilot tested in a survey of 100 local small businesses. The purpose of this test was to establish the basic soundness of the instrument before embarking on a full study. A secondary purpose was to eliminate logically duplicative items; i.e., the ones that were aspects of the same underlying concept.

Only small businesses that owned computers were asked to complete the instrument. Nineteen completed and returned the instrument. Correlation coefficients were examined for all pairs of items within each factor. In pairs, where correlation was significant at the 0.005 level, one item was eliminated on the basis of improving instrument readability. The low level of significance was chosen for stringency in elimination, as we were looking for "duplicates" and not just related items. Related items that represent a factor must be retained. On this basis, item HA1 in the hardware adequacy category, item IC1 in the information content category, and item IA1 in the information accuracy category were eliminated. In addition, the correlation between items IC2 and IC4 is significant at the 0.05 level. Closer examination and discussion with SBDC staff pointed to the similarity of the two items; so item IC4 was combined with IC2, and IC2 was rephrased as follows:

"The information content from the computer system meets your needs."

Furthermore, item PR2 of the productivity category had a high correlation with PR3, with a p value of 0.124. On this basis alone, it could not be eliminated. Further examination showed that PR2 had an extremely low correlation (0.0119) with the total of all items (construct validity). It was therefore eliminated at this early stage.

It is worth reiterating that the purpose of the pilot was to verify the basic soundness of the instrument and keep eliminations to a minimum. The reliability of the instrument was considered adequate at 0.89 as measured by Cronbach's α^3 [8]. In addition, all items correlated in the positive direction both with the total item score and a composite of global items. This confirmed that all questions are stated as positive statements according to the guidelines given by Zmud et al. [34].

Summarizing the pilot analysis, four items were eliminated completely (HA1, IC1, IA1, and PR2), and IC4 was combined to IC2. The resulting instrument had 43 items.

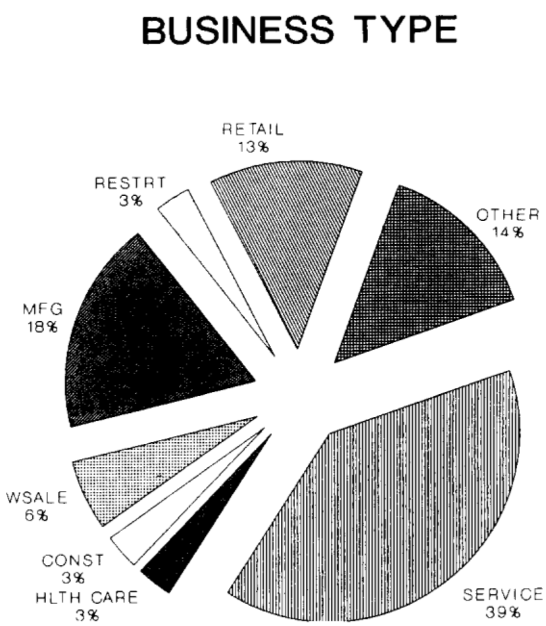

Fig. 4. Business type.

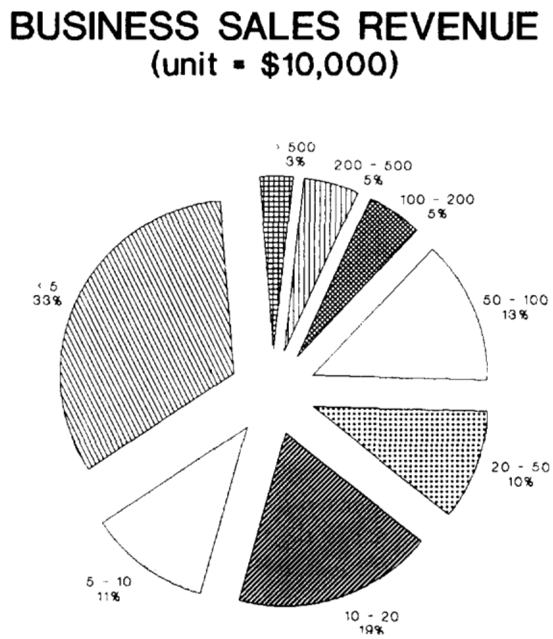

Fig. 5. Business sales revenue.

3.3. The full study

The 43 item instrument, packaged as a questionnaire, was administered to a random and representative sample of small businesses in the state of Tennessee. This sample was provided by the SBDC. The businesses were located in both rural and urban settings, thus providing a reasonably balanced spectrum. The owner/manager, or the person responsible for operating the computers, was asked to complete the questionnaire; it was to be completed only if the business owned any computers. A self-addressed, stamped return envelope was included with the mailing. The mailing went to 1460 small businesses, who had contact with the SBDC during the last three years. In order to improve the response rate, a follow-up letter was sent after four weeks to those who had not responded.

Small businesses are known to have a high failure rate. As such, 107 questionnaires were returned undelivered, in effect reducing the number surveyed to 1353. Of these, 108 were returned completed, i.e., a 8% response rate. This is however misleading, as only those owning computers were required to complete the instrument. Estimates for small businesses using computers range from 27% to 68%; therefore, our response rate is effectively between 12% and 30%. In any case, the sample size is adequate for analysis.

Finally, because we wished to limit our analysis to businesses with no more than 100 employees, eight more companies were eliminated, bringing the sample size to an even 100. The businesses in the final sample are indeed small, with the median number of employees being 4. They represent a broad cross-section in terms of type and location. As shown in Figure 4, 39% of the businesses are in the service industry. The next largest groups are in manufacturing and retail. 70% in urban areas, while 30% are in rural areas. The annual sales range from less than $50,000 to over five million; the median is in the $100,000-$200,000 range (see Figure 5).

4. Analysis and results

The analysis was conducted in several stages. First the initial reliability of the whole instrument, as well as each variable, was assessed. Second, the global items were analyzed to select the best measures of overall IT satisfaction. These selected items, are termed the "criterion items." Next, the construct validity of each item was examined in relation to the overall construct, and some items were eliminated. Items were further subjected to validity assessment based on their relationship with their own variables. They were then examined for convergent and discriminant validity, as well as concurrent validity. Factor analysis was conducted to corroborate the basic soundness of the final variable set. In the end, the final set of items was re-examined for overall reliability as well as for reliability by different business characteristics.

4.1. Initial reliability

The internal consistency method was used to verify model reliability. Cronbach's α was computed for the entire model as well as for each of the multi-item variables. Of course, α cannot be computed for single-item variables (e.g., information accuracy). The reliability coefficient for the 32 item instrument (i.e., without the 11 global items) was 0.91. The reliability coefficients for the individual variables range between 0.53 and 0.91 (Table 1). These scores are high enough to warrant further validity investigation.

Subsequent validity analysis is targeted to make the instrument compact and more reliable by eliminating redundant items from the model.

Table 1
Cronbach's α reliability coefficients for the 32 + 11 item model
(Number of items for each variable shown in parentheses)

Variables	Cronbach's
1. Hardware adequacy (4)	0.53
2. Software adequacy (4)	0.57
3. Information content (2)	0.81
4. Information accuracy (1)	—
5. Information format (2)	0.78
6. Ease of use (4)	0.90
7. Timeliness (2)	0.77
8. Security and integrity	0.58
9. Productivity (2)	0.91
10. Documentation (2)	0.64
11. Vendor support (2)	0.81
12. Training and education (5)	0.68
13. Overall evaluation - global items (11)	0.87
Entire instrument (32 group items)	0.91

4.2. Global items

The global items serve two purposes: they are helpful in analyzing the construct validity of the instrument and they can be used to obtain a quick overall measure of satisfaction prior to detailed analysis. Two global items were used by Doll and Torkzadeh [12] to measure overall satisfaction and success, and were presumed to be valid measures.

In order to generate valid measures, we used Doll and Torkzadeh's two items plus nine others, for a total of eleven, and subjected them to validity analysis. The extent to which an item correlates with the total was examined. Actually, each item was correlated with the total of 11 items minus the item score, in order to avoid spurious part-whole correlation [7].

Items were eliminated if their correlation with the corrected-item total was less than 0.65. There are no accepted standards for such cutoffs: the choice is based primarily on judgment. We used relatively high correlation coefficients in order to yield a few highly correlated items. The purpose of the global items is to construct validation and to provide an overall measure of satisfaction, details or an excessive number of items are not necessary. With this cutoff, seven global items are eliminated and only OE1, OE3, OE7 and OE10 remain (correlation coefficients= 0.76, 0.75, 0.68, 0.66 respectively). It is interesting that items OE1 (system is successful) and OE3 (you are satisfied with the system) are the same ones that were used by Doll and Torkzadeh. Item OE10 (the system has increased the profitability of the business) had the lowest item-total correlation of the four. Subsequent discussion with selected small businesses and business faculty led us to conclude that profitability is not directly IT related and depends on other business factors. Therefore, this item was dropped from the global items.

Thus, there are three global items: OE1, OE3, and OE7. The instrument at this stage has 32 specific variable items plus 3 global items.

4.3. Overall construct validity

The validity of the 32 items was examined with respect to the overall construct. Two methods were employed. The first examined the extent to which a particular item correlated with the item total; the item total being the sum of the 32 item scores minus the particular item score. In the second, a measure of criterion-related validity [18] is examined to identify items that are not closely related to overall satisfaction. The overall satisfaction is called the criterion scale. The sum of the three global/criterion items was used as the criterion scale. The correlation coefficient between each item and this three-item criterion scale provided a measure of criterion-related validity.

Items were eliminated if their correlation with the corrected item total or the three-item criterion scale was below 0.4. In effect, the retained items correlate strongly with the overall construct (at p value <0.01). Again these cutoffs are judgmental and somewhat arbitrary, nevertheless they are comparable to cutoffs used by researchers for similar purposes, e.g., [12, 15, 20]. The cutoffs are high enough to make sure that the retained items are adequate measures of the overall construct. A total of nine items were dropped at this stage, leaving 23 items, and resulting in a (23+3) instrument. Specifically, the items deleted are: HA2, HA3, HA4, HA5, SA3, VS1, TE1, TE2, and TE5. All items from the "Hardware Adequacy" category were dropped, in effect removing this variable from the model.

4.4. Item-variable correlation

The "item-variable correlation" of an item is obtained by computing its correlation with the corrected item total of the group. The purpose is to retain only the highest correlated items within each group. Again, items would be removed if the correlation is less than 0.4 (p value >0.01). On this basis, one item: SA4 is removed from its group, i.e., "software adequacy". Its correlation with the corrected group score is only 0.253. The question of whether to eliminate it entirely from the instrument is more involved. Contrary to the automatic removal of such items, as in [20], we believe that this decision needs to be made based on whether the item represents a new subdomain of the construct and its relationship to the overall construct. A re-examination of the item indicates that it does represent a new subdomain, and its correlation with the corrected total of all items in the construct is 0.41, higher than the cutoff we have been using. The item is therefore retained. The item reads: "the software can be easily modified, corrected, or improved". Therefore, the item has been renamed SM1 and appropriately placed under a new variable name: Software Maintenance.

The remaining item-variable correlation coefficients are quite high, suggesting that the items are significantly correlated with the construct subdomains. Only two correlations are in the 0.41 to 0.5 range, the rest are in the range of 0.51 to 0.86. The resultant instrument has 23+3 items, and there are a total of 12 variables again.

4.5. Convergent and discriminant validity

The multitrait-multimethod matrix (MTMM) approach [4] was applied to evaluate the convergent and discriminant validity of the model as shown in Figure 6. Convergent validity tests whether the correlations between measures of the same group/ variable are higher than zero and large enough to proceed with discriminant validity analysis. Here, for every single variable, the correlations in the validity diagonal (i.e., items of the same variable) are higher than zero (p<0.000). The smallest within-variable correlations for multi-item variables are SA: 0.58, IC: 0.70, IF: 0.65, EU: 0.58, TM: 0.65, SI: 0.42, PR: 0.82, DC: 0.45, and TE: 0.59.

Multitrait - Multimethod Correlation Matrix

	SA1	SA2	SM1	IC2	IC3	IA2	IF1	IF2	EU1	EU2	EU3	EU4	TM1	TM2	SI1	SI2	PR1	PR3	DC1	DC2	VS2	TE3	TE4
SA1	100																						
SA2	58	100																					
SM1	21	24	100																				
IC2	65	57	32	100																			
IC3	60	60	19	70	100																		
IA2	21	31	28	39	47	100																	
IF1	26	33	12	34	49	48	100																
IF2	26	46	21	48	50	39	64	100															
EU1	24	34	42	36	26	21	18	29	100														
EU2	32	34	35	32	27	19	20	22	84	100													
EU3	25	24	47	37	31	21	17	27	73	74	100												
EU4	23	26	35	28	18	31	32	18	69	72	58	100											
TM1	34	34	17	49	46	42	48	31	25	29	20	35	100										
TM2	22	27	20	34	42	39	50	29	13	21	09	35	65	100									
SI1	25	39	20	26	39	28	39	31	24	19	10	27	35	57	100								
SI2	25	48	25	48	46	44	19	32	24	17	16	13	27	31	42	100							
PR1	25	26	06	24	32	34	35	22	34	41	27	40	31	26	17	22	100						
PR3	22	28	-03	18	32	36	32	24	36	44	24	37	30	23	11	20	81	100					
DC1	40	43	26	48	43	34	11	30	39	43	34	33	36	22	20	42	42	48	100				
DC2	34	32	30	34	28	22	04	22	11	12	15	07	23	17	24	40	05	10	45	100			
VS2	17	44	25	38	29	28	11	26	14	14	12	12	19	34	31	44	26	29	43	37	100		
TE3	37	47	23	46	41	25	25	34	29	28	37	12	21	09	13	36	21	22	37	30	35	100	
TE4	24	45	27	38	44	23	18	27	31	28	30	15	24	14	16	25	35	34	36	06	41	59	100

Fig. 6. Multitrait-multimethod correlation matrix.

In the MTMM approach, discriminant validity for each item is tested by counting the number of times (k) that the item correlates higher with items of other variables than with items of its own variable. For example, the lowest own-variable correlation for EU1 is 0.70, and this correlation is higher than EU1's nineteen correlations with items of all other variables, i.e., k=0. Campbell and Fiske (1959) suggest that, for discriminant validity, the value of k should be less than 50% of the potential comparisons. An examination of Fig. 6 shows that there are zero violations of the discriminant validity condition. In fact, k=0 for eighteen items, k=1 for three items, k=2 for one time, and k=6 for one item (namely, SI2).

Having met the requirements of convergent and discriminant validity, the instrument is "final"[4]. It consists of 23 specific items and three global items. The final instrument is included in Appendix B. Before reporting its final reliability, its validity is further demonstrated on the basis of concurrent validity and factor analysis.

4.6. Concurrent validity

Concurrent validity is assessed by correlating the scores on the entire instrument (i.e., the SBUSIT score) with scores on other variables, where all variables are measured at the same time 021. The SBUSIT score was computed by totaling the 23 instrument items. It was expected that those with higher levels of computer skills and greater personal experience with computers will have higher levels of satisfaction. The following two hypotheses were tested:

Hypothesis 1 *There will be a positive relationship between (self-reported) computer skills and the SBUSIT score.*

Hypothesis 2 *There will be a positive relationship between number of years of personal experience with computers and the SBUSIT score.*

Using correlation analysis, hypothesis H1 is supported (p= 0.029). There is only mild support for the second hypothesis (p= 0.115). Support of the first hypothesis is more meaningful as the correlated variable is a direct measure of computing knowledge and skills. In essence, the instrument meets the requirements of concurrent validity.

4.7. Factor analysis

Sample size limitations[5] prevent a full-scale examination and interpretation using factor analysis. For this reason, factor analysis was conducted primarily to confirm the overall soundness of the instrument, and not for a detailed analysis. The data was examined using principal components analysis as the extraction technique and varimax as the method of rotation.

Without specifying the number of factors, six factors emerged with eigenvalues greater than one and accounted for 70% of the variance. Items within each factor were identified by examining the rotated factor matrix, and selecting primary factor loadings greater than 0.60. The high cutoff for the loadings was used to increase the power of the tests. Based on the constituent items, the six factors were interpreted as ease of use, software and information content, productivity, timeliness, format, and training. These factors matched closely with six of the twelve factors in the instrument with similar labels.

As the instrument has twelve variables, factor analysis was conducted after specifying twelve factors. These explained 88% of total variance. Again, constituent items for each factor were selected based on primary factor loadings greater than 0.60. Such factors can be labeled for ease of use, software adequacy/information content, productivity, timeliness, information format, training and education, information accuracy/preventing user errors, system documentation, data security, vendor support, software maintenance, and user documentation. These factors have a remarkable correspondence with the instrument. All of the variables are represented in the twelve factors, and nine of them have a direct one-to-one correspondence (software adequacy and information content are combined into one factor, and documentation is split into two factors). Furthermore, factors are conceptually clean, in that all secondary loadings are less than 0.45; thus items in the factors are mutually exclusive. Also each of the 23 items is represented in one of the twelve factors.

4.8. Final reliability

Table 2 shows the reliability of the 23 item final instrument as well as the reliability coefficients for the revised variables. The overall reliability of the instrument is 0.91 which is the same as of the initial model. It is noteworthy that of the total twenty six items (23 specific and 3 global items), only eleven are directly included in existing satisfaction instruments. This observation once again corroborates the distinctiveness of the small business construct.

The reliability of the instrument was further evaluated by the following business characteristics: type of business, annual sales revenue, profitability, and business location. As reported in Table 3, the instrument appears to have more than acceptable reliability for all of the characteristics. The reliabilities are consistently close to the overall reliability of 0.91, and there is very little variation among the individual reliabilities.

Table 2
Cronbach's α reliability coefficients for the 23 + 3 item model
(Number of items for each variable shown in parentheses)

Variables	Cronbach's
1. Software adequacy (4)	0.72
2. Software maintenance (1)	—
3. Information content (2)	0.81
4. Information accuracy (1)	—
5. Information format (2)	0.78
6. Ease of use (4)	0.90
7. Timeliness (2)	0.77
8. Security and integrity (2)	0.58
9. Productivity (2)	0.91
10. Documentation (2)	0.64
11. Vendor support (1)	—
12. Training and education (2)	0.74
13. Overall evaluation - global items (3)	0.87
Entire instrument (23 group items)	0.91

Table 3
Scale reliability by business characteristics

	Cronbach's α
All businesses	0.91
Business Type:	
Service	0.92
Non-service	0.90
Manufacturing	0.88
Annual sales:	
<$100,000	0.91
between $100,000 and $500,000	0.92
>$500,000	0.88
Profitability	
Profitable	0.92
Breaking even or losing money	0.88
Location	
Urban	0.91
Rural	0.91

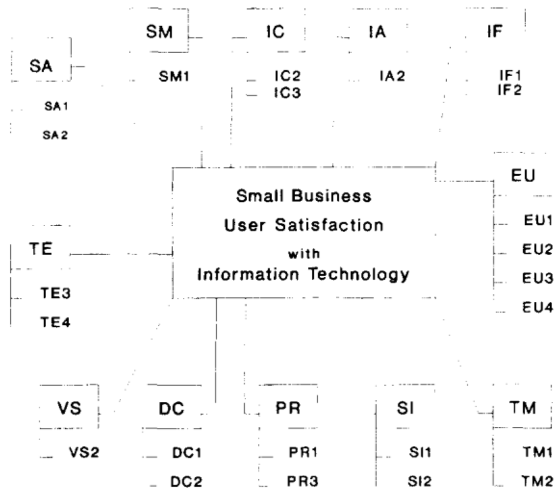

Fig. 7. A model for measuring small business user satisfaction with Information Technology.

5. A comprehensive model for measuring IT satisfaction

Based on previous analysis, a comprehensive model for measuring small business user satisfaction with information technology is provided in Figure 7, and its instrument is furnished (appendix B). It is clear that the SBUSIT construct is significantly different from the traditional **DP** environment. In essence, the model can be characterized as containing three distinct components: the first similar to end user computing, the second with elements of traditional DP environment, and the third made up of special small business computing characteristics.

6. Limitations

Nunnally [26] has suggested a minimum reliability standard of 0.80 for basic research and 0.90 for applied settings that involve critical decision making. We believe that our final instrument, with its overall reliability of 0.91, represents progress towards the development of a standard instrument for measuring the small business user satisfaction with IT. Besides having undergone extensive validation, the instrument is both comprehensive and concise.

Nevertheless, we point out three limitations of our work that could be addressed in future studies. First, while we conducted preliminary factor analysis, a much larger sample is required for greater precision. Such analysis would validate the existing underlying domain structure, and may even be able to refine it. Second, the test-retest reliability of the instrument should be evaluated. Test-retest reliability examines the stability of a construct over time [32]. It is examined by comparing the scores of the same set of subjects at two different time periods.[6] Third, in our study, it was impossible to determine a priori which items would remain in the final instrument; as a result, there are some variables with only a few items. While two-item measures have been used [12, 15, 20], some may be less than comfortable with single-item measures. We have three such variables.[7] Future efforts may attempt to add more items to such variables.

7. Conclusions

Current models of user satisfaction are targeted towards the traditional data processing environment or the end-user environment. We contend that the small business computing environment departs significantly from these two environments. In this study, we have identified, measured, and operationalized the underlying variables that constitute small business user satisfaction with information technology (SBUSIT). Having empirically validated the SBUSIT model/instrument and critically tested the associated reliabilities, we believe that this article represents significant progress towards the development of a standard measure of the SBUSIT construct. More-over, the instrument is short, easy to use, and appropriate for both practical and research purposes.

We advocate that practitioners and researchers use the instrument in various applications. The greatest utility of the model is in the administration of the instrument to measure the satisfaction with IT in a small business. The instrument provides not only an overall assessment but also the capability to analyze the aspects of IT that are most problematical. Further, the generality of the instrument provides a common framework for comparative analysis across several small businesses. If the instrument is periodically administered to a representative set of companies, and the results are made public, then a small company would be able to assess its relative position, and take necessary corrective actions. Another application of the instrument would be to determine the independent and contextual variables that impact IT satisfaction, e.g., length of experience in IT, use of standard methodologies and tools, the use of consultants, etc. Finally, we expect that regulatory and supportive organizations (e.g., small business administration, small business centers, consultants, independent companies) would find the instrument useful in assessing the small business environment and addressing their needs.

Appendix A. Original model used in pilot study

Scale: 5=strongly agree, 4=Agree, 3=Neutral, 2: Disagree, 1-=Strongly disagree
Indicate your level of agreement with the following statements:

I. Hardware adequacy (HA)

1. The computer hardware is adequate for your needs.
2. The computer is available for use when needed.
3. The computer hardware is adequate to process your work.
4. The present computer hardware can be expanded to include additional hardware.
5. Most available equipment in the market place can easily be added to your current equipment.

II. Software adequacy (SA)

1. The software that you have meets your needs.
2. The software is adequate to handle your processing needs.
3. Most available software in the market place will run on your present equipment.
4. The software can easily be modified, corrected or improved.

III. Information content (IC)

1. The system precisely provides the information you need.
2. The information content meets your need.
3. The system provides reports that are just about what you need.
4. The system provides sufficient information.

IV. Information accuracy (IA)

1. The system is accurate.
2. You are satisfied with the system's accuracy.

V. Information format (IF)

1. The output (e.g. reports) are presented in a useful format.
2. The information presented is clear.

VI. Ease of use (EU)

1. The system is user friendly.
2. The system is easy to use.
3. The system is easy to learn.
4. The system is easy to access.

VII. Timeliness (TM)

1. You get the needed information in time.
2. The system provides up-to-date information.

VIII. Security and integrity (SI)

1. The system provides for the security of data.
2. The system includes features for preventing and reducing user errors.

IX. Productivity (PR)

1. The system has improved your productivity.
2. The system does not slow you down in your other business activities.
3. The system lets you do more work than that was previously possible.

X. Documentation (DC)

1. Good manuals/procedures exist to aid in running and using the system.
2. Good manuals/procedures exist to fix the system if it breaks down.

XI. Vendor support (VS)

1. There is help available from vendors in case of hardware malfunction.
2. There is help available from vendors in case of software errors.

XII. 'Training and education (TE)

1. There is no need to train and educate staff members for fully utilizing the system.
2. You or the staff have been able to undergo training and education in order to fully utilize the system.
3. The quality of training has been superior.
4. There is easy access to training and education facilities to help in utilizing the system.
5. Training courses are available from the company you purchased the hardware and/or software from.

XIII. Overall evaluation (OE)

1. The system is successful.
2. The system is used for an appropriate amount of time.
3. You are satisfied with the system.
4. The system is of high quality.
5. The system is reliable.
6. The system is inexpensive to use.
7. The system has met your expectations.
8. The systems helps in generating more business.
9. The system allows more flexibility in task scheduling.
10. The system has increased the profitability of the business.
11. You have confidence in your ability to accomplish tasks on the system.

Appendix B. The final model

Scale: 5=Strongly agree, 4=Agree, 3=Neutral, 2=Disagree, 1=strongly disagree

I. Software adequacy (SA)

1. The Software that you have meets your needs.
2. The software is adequate to handle your processing needs.

II. Software maintenance (SM)

1. The software can easily be modified, corrected or improved.

III. Information content (IC)

1. The information from the computer system meets your needs.
2. The system provides reports that are just about what you need.

IV. Information accuracy (IA)

1. You are satisfied with the system's accuracy.

V. Information format (IF)

1. The output (e.g. reports) are presented in a useful format.
2. The presented information is clear.

VI. Ease of use (EU)

1. The system is user friendly.
2. The system is easy to use.
3. The system is easy to learn.
4. The system is easy to access.

VII. Timeliness (TM)

1. You get the needed information in time.
2. The system provides up-to-date information.

VIII. Security and Integrity (SI)

1. The system provides for the security of data.
2. The system includes features for preventing and reducing user errors.

IX. Productivity (PR)

1. The system has improved your productivity.
2. The system lets you do more work than was previously possible.

X. Documentation (DC)

1. Good manuals/producers exist to aid in running and using the system.
2. Good manuals/producers exist to fix the system if it breaks down.

XI. Vendor support (VS)

1. There is help available from vendors in case of software errors.

XII. Training and education (TE)

1. The quality of training has been superior.
2. There is easy access to training and education facilities to help in utilizing the system.

XIII. Overall evaluation (OE)

1. The system is successful.
2. You are satisfied with the system.
3. The system has met your expectations.

Notes:

[1] A third environment is emerging where an organization outsources some or many of its IT activities to a vendor. The location and responsibility of the various functions shown in Figs. 1 and 2 then transfer to the vendor.

[2] The SBDC is funded and operated under a cooperative agreement with the American Small Business Administration, the state government, and participating colleges and universities.

[3] Cronbach's α measures the internal consistency of the items, or in other words the degree to which items in the model are homogeneous.

[4] By this, we mean that it is final based on current investigation and analysis.

[5] For factor analysis, there should be 10 times as many observations as there are items [18]. However, in practice as pointed out by Hair et al. [14], several researchers have used factor analysis when the ratio of the

number of observations to the number of items is much lower. Nevertheless, when dealing with a smaller sample size and a lower ratio, one has to be cautious in analysis and interpretation, as well as use lower levels of significance in order to increase the test's power [3].

[6] In anonymous response testing, conducting test-retest reliability in the usual way is impossible. We devised a different method which offers some evidence of test-retest reliability. We compared the scores from subjects in the pilot study with the scores from late responses of the full study. The two sets of responses were from the same overall population, and were three months apart. The null hypothesis was that the means of SBUSIT scores of the two groups of subjects are equal. The null hypothesis could not be rejected (p=0.765), thus lending support to test-retest reliability.

[7] For the variable "information accuracy", the user may add the item "the system is accurate". This item was eliminated in the pilot not because it was an invalid measure but because it appeared to be a "duplicate" of another item.

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