Determinants of computing in very small businesses

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Abstract:

This article focuses on computing in very small businesses (VSB). We have defined a business to be very small if it has less than 50 employees. They have been ignored in the mainstream MIS literature. However, given that small businesses constitute a significant portion of the U.S. economy and that computers are making widespread inroads into small businesses, a serious investigation is warranted. A model is proposed for computing in VSBs and the parameters are investigated in an empirical study that identifies relationships between business characteristics, individual characteristics, and the degree of computing. On an *a priori* basis, it is assumed that the most important factors related to VSB computing are: size of the business, age of the business, general education of the owner/manager, the computer knowledge of the owner/ manager, and the profitability of the business. The results generally support the assumptions. The model therefore provides a descriptive understanding of VSB computing; it can also be used in a prescriptive mode to induce desired changes in VSB computing.

Key words: Small business computing; Very small businesses; Discriminant analysis; End user computing

Article:

1. Introduction

It is ironic that while computers and information systems (CIS) are being extensively used in large and medium sized organizations, their use is still in embryonic stages in many small businesses, though they are extremely important to the U.S. economy in that they employ 55% of the nation's work force, produce 55% of all innovations, and account for 38% of the GNP (Baumback, 1981). Carnevale (1991) shows that five out of every six employees in America are in firms with fewer than 1,000 employees and that two-thirds of that group work for firms with fewer than 100 employees. Pritchard (1992) suggests that firms employing fewer than 500 people added all of the net new jobs in the U.S.A. from 1988 through 1991. Yet it is only recently that CIS have started to be used significantly in small businesses. Estimates of small business use of computers range from 27% to 68%, depending on location, size, and nature of the businesses surveyed (Schleich et al., 1990; Nazem, 1990). Issues related to small business use of CIS are beginning to emerge. Several recent studies have reported small business' experience with computers and information technology (Alpar and Ein-Dor, 1991; DeLone, 1988; Farhoomand and Hrycyk, 1985; Karasik, 1984; Lind et al., 1989; Nickell and Seado, 1986; Raymond, 1987; Stair et al., 1989: Will 1986). In practically all of these studies, the small businesses studied are similar to medium and large organizations. Many of the organizations have a formal MIS department and a community of end-users, similar to their larger counterparts.

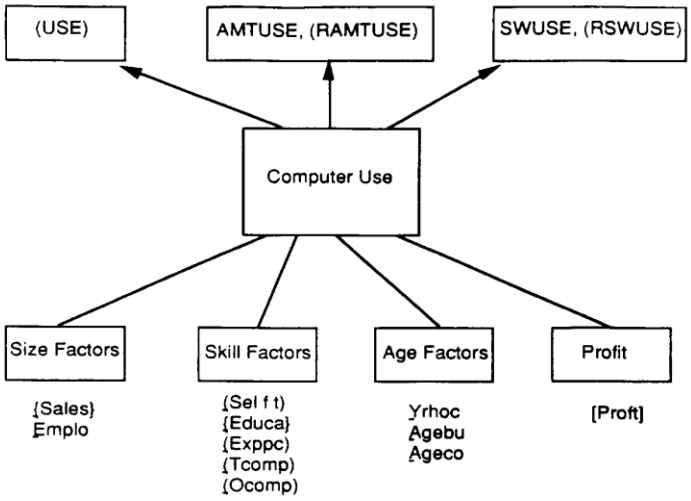
Our focus here is on the use of CIS by very small businesses (VSB). Such organizations have not been studied carefully or rigorously in the MIS literature. Although no precise definition exists, our reference is to businesses that: (a) have very few employees (a maximum of **50** employees was used to qualify a firm as very small), (b) do not have a formal organizational structure, and (c) do not have a formal IS organization/ department. In some instances, the owner/ manager may have to input, program (or purchase software), and be the analyst. Traditionally, such organizations have not made much use of information technology, which partly explains the paucity of research. However, in the past few years, the situation has changed and bottlenecks are being

removed. This is largely due to the advent of powerful personal computers (PCs), rapidly declining hardware and software prices, and the availability of ready-to-use user-friendly software packages. Another explanation is the "unglamorous" nature of the research, as it deals with many basic and perhaps mundane issues. We believe, however, that research into VSB use of computers is important.

2. The VSB computing environment

In order to understand the environment, it is instructive to examine the computing environment in large organizations. Actually, there are two environments: the traditional data processing (DP) and end-user computing. In the first, the user interacts with the computer indirectly, through an analyst/programmer or through operations. Much has been written about this environment (e.g., in Brancheau and Wetherbe, 1988; Davis and Olson, 1985; Nolan, 1979). In the end-user environment (Benson, 1983; Doll and Torkzadeh, 1988; Huff et al., 1988; Rivad and Huff, 1988; Rockart and Flannery, 1983), the decision-makers/ knowledge workers interact directly with the computers through application software. They typically also have access to a support group, the information center (Carr, 1988), which supports them with hardware and software related problems. In both environments, there is an MIS/ DP department that provides systems and operations support to the user in some manner, and it is the MIS department that deals with outside organizations, such as vendors, consultants, and education/ training firms. The user is generally isolated (more so in the traditional DP environment) from these outside groups.

The very small business computing environment is fundamentally different from the above two environments. Given the limited resources of the VSB, there is neither an MIS department nor an information center to support the small business user. Typically, the VSB owner/ manager is responsible for all CIS activities: he/ she is the end-user, systems analyst/ programmer, operator, etc., although not necessarily adept in any of these roles. Also, this user has to deal with entities outside the organization (e.g., vendors, consultants, educators, trainers). In essence, this user has very few resources or infrastructure to draw on, has to manage the business as the first priority, and at the same time may have to deal with the entire spectrum of information technology activities. This makes for a difficult role, and there is usually heavy reliance on turn-key systems and packaged software.



(a) The variables range from binary (0,1) to continuous. Continuous variables have no brackets. The other coding is:
( ) indicates that the variable is binary (0 or 1).
[ ] indicates that the variable is a 5 point scale or less but not binary.
{ } indicates that the variable is a point scale greater than five.

Fig. 1. The model for VSB's.

3. A model of computer use by very small businesses

Relevant literature (e.g. Ives and Olson, 1984; Montazemi, 1988) was reviewed in order to develop a model of computer use by very small businesses. A decision was made to keep the model parsimonious. We decided to use a one-stage model relating independent and dependent variables, without any intermediate variables. The

arguments in favor of the one-stage model are that this is an early study and the objective is to identify primary relationships. As more experience is gained, the model can be refined.

The dependent variable in the model is the "use of computers". The primary measure of use is a binary variable USE: whether the business is using computers (1) or not (0). Two secondary measures of use for those using computers are: AMTUSE (use in hours per day), and SWUSE (the number of software packages and/or information systems used by the business). Revised variables include: RAMTUSE, which measures whether or not the usage exceeds the mean of 4.55 hours; and RSWUSE, a binary variable, 1 if the firm used more than one software package.

Based on the literature and discussions with the local small business development center, several independent variables were formulated for investigation. We also drew from the models of Montazemi and Rivad and Huff, but excluded intermediate variables, factors associated with the data processing department and dealing with the structure of the organization — as they are largely inapplicable to very small businesses. The variables included for analysis and the hypothesized relationships are described below. In addition, the five models, one for each dependent variable, and the hypothesized relationships are shown in Figure 1.

A. Size Factors: The size of the business is estimated by the number of employees (Emplo) and the annual sales (Sales).

1. Number of employees (Emplo) is an integer.

2. (Sales) is a Likert scale variable with 8 categories.

B. Skill Factors: The owner/manager's computer skills should have a direct relationship with their desire to use computers. This factor has been used in studies of end-user computing. In order to assess skills, the following variables are considered:

1. (Selft) is a binary variable: does the manager have self taught computer skills.

2. (Educa) is a 7 point scale item that measures formal education: (1. 0-6 years, 2. 7-12 years, 3. some college, 4. college degree, 5. some graduate work, 6. master's degree, and 7. work beyond a master's degree).

3. (Exppc) is a binary variable: it is the manager's computer experience from a formal educational environment.

4. (Tcomp) is a binary variable: has the manager had training classes or seminars on computers.

5. (Ocomp) is a binary variable: has the manager had some training on computers other than those above.

B. Age Factors: The length of time the business has been in existence (Agebu) is an indicator of its growth and maturity. In a similar sense, the number of years that the individual has had a home computer (Yrhoc) or the number of years the business has had a computer (Ageco) should indicate a growth in skills and knowledge.

1. (Agebu) is an integer: the number of years that the firm has been in existence.

2. (Yrhoc) is the number of years that the individual has had a computer at home.

3. (Ageco) is the number of years that the business has had a computer.

D. Profitability of the Business (Proft): Profitability is measured on a 4-point scale ranging from "very profitable" to "losing money".

The literature suggests that as the business grows, the volume of paperwork, and transaction processing necessitates the use of computers. For many small businesses, acquiring computers rep-resents a major capital expense. Thus, size should have a favorable influence on computer use. Using this reasoning, the following hypotheses are postulated based on (Sales), (Emplo) and (Proft) as factors:

Hl: The greater the size of the business (SIZE), the greater the likelihood of using computers (USE).

H2: The greater the size of the business (SIZE), the greater the amount of computer use (AMTUSE).

H3: The greater the size of the business (SIZE), the greater the use of different software packages and/ or information systems (SW-USE).

The owner/manager's computer skills should have a direct relationship with their desire to use computers. This factor has been used in studies of end-user computing as well.

H4: The greater the computer skills of the owner/ manager (SKILL), the greater the likelihood of using computers (USE).

H5: The greater the computer skills of the owner/ manager (Skill), the greater the amount of computer use (AMTUSE).

H6: The greater the computer skills of the owner/ manager (Skill), the greater the use of different software packages and/ or information systems (SWUSE).

The length of time the business has been in existence (Agebu) is an indicator of its growth and maturity. It is likely that there will be higher use of computing technology by established businesses. The number of years computers have been used by the manager (Yrhoc) is a more direct measure of growth in computing. We expect it to have a strong relationship with the amount of computing. Of course, it does not make sense to relate (Yrhoc) to whether computers are being used or not. We, therefore, add the following hypotheses:

H7: The greater the age of the business (Age), the greater the likelihood of using computers (USE).

H8: The greater the age of the business (Age), the greater the amount of computer use (AMTUSE).

H9: The greater the age of the business (Age), the greater the use of different software packages and/ or information systems (SW-USE).

Finally, we anticipate that increased profit would result in increased usage of computers, therefore:

H10: The greater the profit of the business (PROFT), the greater the likelihood of using computers (USE).

H11: The greater the profit of the business (PROFT), the greater the amount of computer use (AMTUSE).

H12: The greater the profit of the business (PROFT), the greater the use of different software packages and/ or information systems (SWUSE).

4. Methodology

A comprehensive study of the patterns of computing of VSBs in one of the states in the USA was made under the auspices of the state's small business development center. A comprehensive instrument was developed to measure the computing patterns (hardware and software), computing problems, and related issues of these businesses. Since many of the VSBs do not have computers, a section was included for non-users. The instrument was pretested with MBA students, a development center consultant and pilot-tested with a small

sample of the targeted businesses. The questionnaire was modified as a result and then administered across the entire state.

A total of 950 questionnaires were mailed to businesses that had a recent contact with the development center (for counseling or training). Instructions requested that the questionnaire be filled out by the owner or manager of the VSB. Twenty questionnaires were returned undelivered (VSBs are known to have high failure rates), and 164 were returned completed, providing a 17.6% response rate. This response rate, although not very high, is comparable to many empirical studies reported in the MIS literature. Moreover, we checked the sample for non-response bias by comparing the sample characteristics with those at the development center. No significant difference was detected based on type of business, number of employees, and annual sales.

Of the 164 returned questionnaires, some were unusable and a few businesses were relatively large. We used a cutoff of 50 employees and sales levels over $5,000,000 to remove such businesses from the sample. After discarding such questionnaires, we were left with a total of 131 questionnaires; the analysis is based on the responses of these small businesses.

5. Analysis and results

5.1. Business demographics and computing characteristics

Before presenting the results, it is useful to examine the characteristics of the respondents. The median number of employees (Emplo) is 4, and 90% of the businesses have less than 20 employees. In addition, the businesses include a large range of type, location, sales volume and profitability (Figures 2, 3, and 4). A high percentage are categorized as service organizations with retailing the next largest. Approximately 60% of those reporting are thus in either retailing or service.

Approximately 76% of the reporting firms were urban. The majority of the firms categorized themselves as "profitable", but few considered themselves "very profitable". Approximately 60% had sales levels below $500,000. Approximately 25% of the managers reporting had home computers.

One major difference between VSBs and larger businesses is that not all VSB's use computers. Only 58.8% did in our study. However, it seems that the current use is significantly higher than just a few years ago. For example, Schleich et al. (1990) had reported that 27% of their population used computers. Other estimates of small business computer use are higher, but included all types of small businesses, not just VSB's. In our study, 50% of the non-users have plans to use them in the next two years and an additional 17% have plans to use them in the next five years.

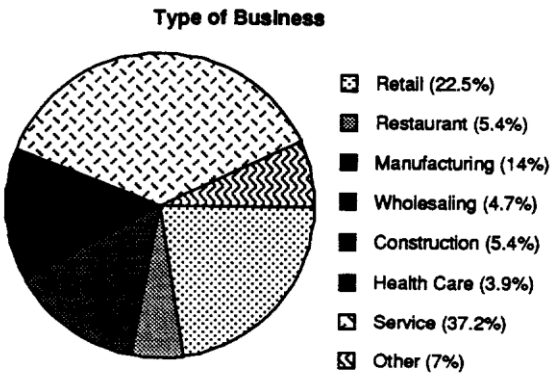


Fig. 2.

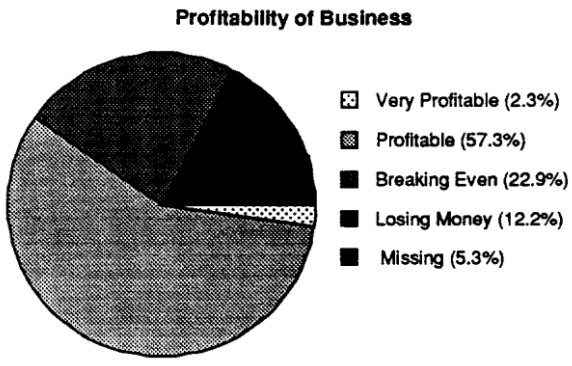


Fig. 3.

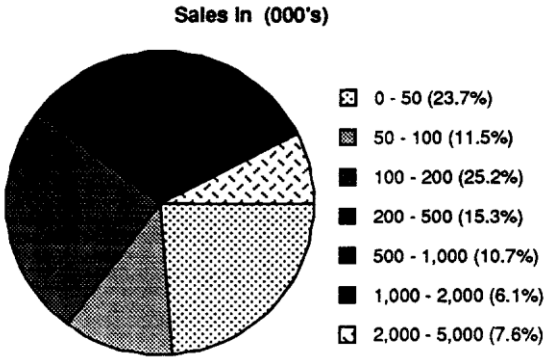


Fig. 4.

Table 1
Logistic regression estimate of USE

Variable	B	Significance
Sales	0.512	0.001
Self Taught (Selft)	2.547	0.000
Yrs. Computer at Home (Yrhoc)	0.756	0.046
Education (Educa)	0.413	0.021
Constant	−3.996	0.000

Classification table for USE

		Predicted		
		0.00	1.00	Percent correct
Observed		0	1	
0.00	0	37	11	77%
1.00	1	10	63	86%
			Overall	83%

It is interesting to note that, of those using computers, a vast majority rely on microcomputers (PCs), and most use only a single microcomputer (64.6%). On average, these businesses have used computers for three years, and the average use per day is about 4.5 hours. Generally, VSBs do not have a formal IS organization; in fact only one-third of them employed any technical staff at all (e.g., programmers or operators).

5.2. Model parameters

The procedure for validating our model was first to evaluate the primary dependent variable, i.e., the binary variable computer USE. This analysis is then followed by evaluating our secondary use measures: AMTUSE, RAMTUSE, SWUSE, RSWUSE. The general approach was to run regression analysis (stepwise or forced entry) for continuous (or stepwise continuous) dependent variables such as AMTUSE. Binary dependent variable (such as USE) hypotheses will be tested using logistic regression and discriminant analysis. For intermediate dependent variable hypotheses, such as SWUSE, discriminant analysis will be used. It is to be noted that there does not seem to be a major multicollinearity problem in the data set. The highest correlation between variables is .45 between Sales and Emplo with the next highest correlation being .30 between Sales and Agebu.

5.3. Model factors — use of computers (USE)

Table 1 presents the results of a logistic regression for the dependent variable USE. The significant variables in the logistic regression are Sales, Selft (self-taught computer skills), Yrhoc (years had computer at home) and Educa (amount of education) with levels of significance of .001, .000, .046 and .021 respectively. Emplo (number of employees) would be significant at a .10 level but we set the significance limit at .05. The coefficients are all positive and predict the event (computer use) as anticipated.

There is thus support for H1 with Sales as the Size variable but not for the number of employees Emplo (except at the .10 level). These results also support H4 in terms of the SKILL factors of Selft (self taught skills), and Educa (education level), but not for Exppc, Tcomp and Ocomp. There is support for H7 with Yrhoc (years had computer at home) as the AGE factor but not for Agebu or Ageco. The overall prediction rate is 82% with an 86% prediction rate for those using computers.

Table 2 presents a parallel analysis of the USE variable through discriminant analysis. Sales, Emplo (# of employees), Exppc (computer experience in school), Selft (self taught skills), Yrhoc (years had computer), Educa (education level), and Ageco (years business had computer) are all significant and positive with the exception of Exppc, which is negative (but low in the structure matrix).

There is support for H1 with both SIZE factors Sales and Emplo. There is support for H4 with SKILL factors Selft, Educa, with an inappropriate sign for Exppc and no support for Tcomp or Ocomp as SKILLS factors. There is support for H7 with Yrhoc and Ageco but not Agebu (business age). The overall classification rate is 87% with a 91% correct classification of firms using computers.

Table 2
Discriminant analysis prediction of USE

						Signif. between groups			
Wilks' Lambda			0.51755						
Equivalent F			15.0478			0.0000			
Vars entered			Wilks' Lambda			Standardized coefficients Func 1			
Sales			0.545			0.372			
Emplo			0.524			0.188			
Exppc			0.525			−0.177			
Selft			0.640			0.646			
Yrhoc			0.539			0.291			
Educa			0.547			0.360			
Ageco			0.563			0.421			
Canonical discriminant functions									
Fcn	Eigenvalue	Pct var.	Cum pct	Canonical corr	After fcn	Wilks' Lambda	Chisquare	DF	Sig
					: 0	0.518	76.073	7	0.000
1	0.932	100.00	100.00	0.695	:				
Canonical discriminant functions evaluated at group means (group centroids)									
Group					Func 1				
0					−1.181				
1					0.776				
Classification results									
Actual group			No. of cases		Predicted group membership				
					0		1		
Group 0			53		43		10		
					81.1%		18.9%		
Group 1			77		7		70		
					9.1%		90.9%		

Percent of "grouped" cases correctly classified: 86.9%.

The discriminant function seems to provide a better representation than the logistic regression, particularly for classifying firms that do use computers. H1 is supported with SIZE factors of both Sales and Emplo, H4 is supported with SKILL factors of Se1ft and Educa, and H7 is supported with AGE factors of Yrhoc and Ageco. In addition, the two analyses reinforce each other and both support the significance of SIZE, SKILL, and AGE factors. On the other hand, both analyses indicate that the factor Proft (profitability of business) is *not* significant in determining the use of computers.

5.4. Model factors — amount of computer use (AMTUSE, RAMTUSE)

Table 3 shows results of stepwise regression for the amount of computer use (AMTUSE) for those using computers at all. AMTUSE is a somewhat continuous (but truncated) variable. Since some criticism of stepwise procedures has existed in the literature, a forced regression analysis was also conducted (Table 4), but since the same variables are significant, only stepwise regression will be discussed.

Table 3
Stepwise regression for AMTUSE

Multiple R			0.476		
R Square			0.227		
Adjusted R Square			0.205		
Standard Error			2.901		
Analysis of variance					
	DF	Sum of squares	Mean square	F	Sign
Regression	2	172.768	88.384	10.262	0.0001
Residual	70	589.259	8.418		
Variable		B	Significance		
Ageco		0.380	0.002		
Sales		0.535	0.006		
(Constant)		0.898	0.262		

The F statistic is significant at the .0001 level. The significant variables are Ageco (years business had computer), and Sales with levels of significance of .0015 and .0056 respectively. All signs of the coefficients are positive, as anticipated.

Table 4
Forced regression of AMTUSE

Multiple R	0.544
R Square	0.296
Adjusted R Square	0.170
Standard Error	2.965

Analysis of variance

	DF	Sum of squares	Mean square	F	Sign
Regression	11	225.900	20.537	2.337	0.018
Residual	61	536.127	8.789		

Variable	B	Beta	Significance
Ageco	0.333	0.304	0.009
Sales	0.531	0.299	0.025
(Constant)	−0.055018		0.980

Insignificant variables not listed.

AMTUSE has no SKILL factors included so that H5 must be rejected for the continuous variable. H2 has support but only with the Sales variable for SIZE. H8 has support with Ageco as the AGE factor. The clear absence of both profitability and skill factors in determining the amount of computer use suggests that once a decision has been made to use the computers, only size and age factors influence their increased usage.
The fact that AMTUSE data was expressed in whole number of hours caused some concern. We therefore decided to use less-demanding non-parametric tests to reinforce our results. The variable RAMTUSE was formed; this measures whether the firm uses the computer more or less than the mean of 4.55 hours in the sample (i.e., heavy or light users). This classification allows us to use logistic regression and discriminant analysis procedures. Tables 5 and 6 display the results of this analysis.

The logistic regression in Table 5 indicates usage is positively affected by Sales and Yrhoc (years had computer at home) with significance levels of .006 and .039 respectively. The overall classification of the model is 73% correct. This result, however, is highly biased by the number below the mean, since the distribution is very skewed. The model correctly classified 87.5% of the below mean users and only 44% of those above (only 32% of all users were above the mean).

Table 5
Logistic regression for RAMTUSE (usage above mean = 4.55)

Classification Table for RAMTUSE

		Predicted		
		0.00	1.00	Percent correct
Observed		0	1	
0.00	0	42	6	88%
1.00	1	14	11	44%
			Overall	73%

Variable	B	Significance
Sales	0.448	0.006
Yrhoc	0.282	0.039
Constant	−2.672	0.000

If we use RAMTUSE as an indicator of the amount of computer use, then once again sales (representing business size) is a good indicator of amount of use (H2 is supported). H8 is also supported (i.e., AGE is also an indicator), however this time a different AGE variable is selected.

With discriminant analysis (Table 6), the significant variables are Sales, Yrhoc (years had computer at home), Tcomp (training in computers) and Ageco (years business had computer). All coefficients are positive as expected. The overall classification rate is 75% (slightly better than the logistic regression) and the number above the mean correctly categorized is 50% (substantially better than the logistic regression results of 44%). The discriminant analysis seems to provide a better representation than the logistic regression also.

In summarizing, discriminant analysis provides support for SIZE and AGE factors. In addition, it also provides support for one skill factor. Summarizing all of the "amount of use" factors, it can be said that the amount of use is largely governed by the size of the business and how long it has been in existence. The computer skills of the owner/ manager may have only marginal influence.

Table 6
Discriminant analysis of RAMTUSE (usage above mean = 4.55)

	Degrees of freedom		Signif. between groups	
Wilks' Lambda	0.73625	4 1	71.0	
Equivalent F	6.08984	4	68.0	0.0003

Vars Entered	Wilks' Lambda	Standardized coefficients Func 1
Sales	0.826	0.654
Yrhoc	0.769	0.418
Tcomp	0.750	0.273
Ageco	0.813	0.609

Canonical discriminant functions evaluated at group means (group centroids)

Group	Func 1
0	−0.426
1	0.818

Classification results

Actual group	No. of cases	Predicted group membership	
		0	1
Group 0	49	44	5
		89.8%	10.2%
Group 1	28	14	14
		50.0%	50.0%

Percent of "grouped" cases correctly classified: 75.3%.

5.5. Model factors — software use (SWUSE, RSWUSE)

Software use is pertinent to only those businesses that use computers. SWUSE is a truncated variable that can range from 0 to 8 different types of software usage. Since it is neither a continuous nor a binary variable, only discriminant analysis can be used and nine groups would be extremely difficult to distinguish. We therefore recoded the variable into 0 to 4 and more than 4 types of software usage; this led to 6 groups (0 to 5). Table 7 provides the results of the discriminant analysis.

Table 7
Discriminant analysis of SWUSE (non-binary)

F-statistic and significances between pairs of groups (df = 7, 61).

Group	Group 0	1	2	3	4
1	1.183				
	0.326				
2	1.856	1.818			
	0.093	0.100			
3	2.255	0.930	2.610		
	0.042	0.490	0.020		
4	1.946	1.082	1.010	1.966	
	0.078	0.386	0.434	0.074	
5	1.185	0.986	1.650	1.625	0.905
	0.325	0.450	0.139	0.145	0.508

Vars entered	Wilks' Lambda	Sig.	Standardized coefficients				
			Func 1	Func 2	Func 3	Func 4	Func 5
Emplo	0.848	0.046	0.506	0.498	0.123	−0.048	0.573
Proft	0.751	0.035	0.439	−0.388	0.423	−0.301	−0.190
Ageco	0.672	0.030	−0.185	0.612	0.290	0.152	−0.733
Tcomp	0.598	0.023	0.462	−0.564	0.096	0.792	−0.076
Educa	0.542	0.025	−0.646	0.133	0.277	0.199	0.540
Selft	0.495	0.029	−0.482	−0.312	0.232	−0.192	0.300
Yrhoc	0.453	0.034	0.005	0.226	0.684	−0.456	0.212

Classification results

Actual group	No. of cases	Predicted group membership					
		0	1	2	3	4	5
Group 0	15	8	0	3	2	0	2
		53.3%	0.0%	20.0%	13.3%	0.0%	13.3%
Group 1	10	2	5	0	1	1	1
		20.0%	50.0%	0.0%	10.0%	10.0%	10.0%
Group 2	14	2	1	9	0	1	1
		14.3%	7.1%	64.3%	0.0%	7.1%	7.1%
Group 3	9	1	1	2	4	1	0
		11.1%	11.1%	22.2%	44.4%	11.1%	0.0%
Group 4	15	4	0	3	0	7	1
		26.7%	0.0%	20.0%	0.0%	46.7%	6.7%
Group 5	13	4	0	1	0	4	4
		30.8%	0.0%	7.7%	0.0%	30.8%	30.8%

Percent of "grouped" cases correctly classified: 48.7%.

One of the possible five functions was significant. The significant variables were Emplo, Proft, Ageco (years business had computer), Tcomp (training in computers), Educa (level of education), Selft (self taught computer skills), and Yrhoc (years had computer at home). The discriminant functions clearly had difficulty distinguishing the following pairs of groups: 0 and 1; 0 and 5; 1 and 3; 1 and 4; 1 and 5; 2 and 4; 2 and 5; 3 and 5; and 4 and 5 (see F statistics between groups). Function 2 had negative coefficients for Proft, Selft and Tcomp with positive coefficients for all other variables. The low group centroid on function 2 for group 0 and much higher for groups 1, 3, 4 and 5 suggests that this function primarily separated group 0 (users of no software) from the other groups. Function 3 had positive coefficients for all variables. Its centroids were positive for groups 4 and 5, and negative for the rest. Thus this function identifies the heavy users of software. The overall percent correctly classified was 49%. While this classification is respectable for a six-way grouping, it is less than desirable for learning and prediction.

On introspection, we decided that our main thrust should be to determine if all VSBs were using the computer in a singular dimension (i.e., only for word processing or only for spreadsheet input, etc.) or in a multi-dimensional mode (i.e., more than one software use). Accordingly, we created the binary variable RSWUSE. Such a binary classification enabled us to use logistic regression (Table 8) and discriminant analysis (Table 9) procedures.

The logistic regression in Table 8 shows Emplo as the only significant variable with level of significance .026. The overall prediction rate is 68% with 100% of the multiple software users correctly categorized but only 4% of the singular package users correctly categorized. Thus support is provided only for H3 with Emplo as the SIZE factor.

Table 8
Logistic regression of RSWUSE

Classification table for RSWUSE

		Predicted		
		0.00	1.00	Percent correct
Observed		0	1	
0.00	0	1	23	4.17%
1.00	1	0	49	100.00%
			Overall	68.49%

Variable	B	Sig
Emplo	0.105	0.026
Constant	−0.045	0.904

The discriminant analysis in Table 9 indicates that Emplo, Selft (self-taught computer skills) and Ageco (years business had computer) are all significant in determining the use of the computer in a multi-dimensional manner. The overall correct prediction rate is 71% (compared to 68% for logistic regression) and the multi-dimensional user is correctly categorized 88% of the time.

Thus, overall, discriminant analysis appears to be a better overall indicator of the multi-dimensional use of software by small businesses.

Examining all of the software use results, some general observations can be made. Profit is not a factor in determining the extent of software use: at best it could be said to have a weak effect, as it was a significant variable in one of the three analyses. The other three factors *size, skill,* and *age* appear in various combinations in at least two of the three methods. They are therefore influencing factors. Of particular note is the resurgence of skill factors in determining the multidimensional use of software.

Table 9
Discriminant analysis of SWUSE

	Degrees of freedom		Signif. between groups	
Wilks' Lambda	0.850	3	1	71.0
Equivalent F	4.057		3	69.0	0.010

Variables in the analysis

Variable	Wilks' Lambda
Emplo	0.910
Selft	0.876
Ageco	0.894

Vars entered	Wilks' Lambda	Sig.	Standardized coefficients Func 1
Emplo	0.912	0.011	0.670
Ageco	0.876	0.010	0.578
Selft	0.850	0.010	−0.452

Canonical discriminant functions remaining in the analysis

Fcn	Eigenvalue	Pct of variance	Cum pct	Canonical corr	After Fcn	Wilks' Lambda	Chisquare	DF	Sig
					: 0	0.850	11.29	3	0.010
1	0.176	100.00	100.00	0.387	:				

Canonical discriminant functions evaluated at group means (group centroids)

Group	Func 1
0	−0.592
1	0.290

Classification results

Actual group	No. of cases	Predicted group membership	
		0	1
Group 0	25	9	16
		36.0%	64.0%
Group 1	52	6	46
		11.5%	88.5%

Percent of "grouped" cases correctly classified: 71.4%.

Table 10
Summary of hypotheses tested and results (significant variables are listed)

Dependent variable	Table	Meth. [a]	Size (Si)	Skill (Sk)	Age (A)	Profit (P)
USE	Table 1	LR	Sales	Selft Educa	Yrhoc	
USE	Table 2	DA	Sales Emplo	Selft Educa Exppc	Yrhoc Ageco	
AMTUSE	Table 3	SWREG	Sales		Ageco	
AMTUSE	Table 4	Forced	Sales		Ageco	
RAMTUSE	Table 5	LR	Sales		Yrhoc	
RAMTUSE	Table 6	DA	Sales	Tcomp	Yrhoc Ageco	
SWUSE	Table 7	DA	Emplo Tcomp	Selft Educa	Yrhoc Ageco	Proft
RSWUSE	Table 8	LR	Emplo			
RSWUSE	Table 9	DA	Emplo	Selft	Ageco	

[a] Methodology codes: (LR)–Logistic Regression; (DA)–Discriminant Analysis; (SWREG)–Stepwise Regression; (Forced)–Forced Entry Regression.

6. Conclusions

Table 10 provides a convenient summary of the hypotheses tested and the empirical results. Taking a holistic view provides an insightful pattern. First, profitability of the business is hardly ever a factor in determining the use, the amount of use, or type of use of computers in VSBs. The use is, however, influenced by size of the business, computing skills of the owner/ manager, and age of the business. But, once computers begin to be used in VSBs, the extent of their use is no longer influenced by the computing skills of the owner/ manager but

primarily by its size and age. Nevertheless, computing skills continue to affect the type of use of computers, i.e., the multidimensional use of software.

We have provided an exploratory study that identified factors influencing the use of computers by VSBs. It provides understanding of computing factors that are prerequisite to using and further exploiting information technology. The factors identified in this study should be properly addressed, in order to advance information technology in VSBs.

As a final note, we believe that the current trends, as evidenced in our study, clearly indicate that the widespread use of information systems and information technology in very small businesses is inevitable. It can no longer remain a neglected area. The obvious challenge is to man-age the inevitable growth.

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