Core Activities in End-User Computing: An Empirical Investigation of Content and Relationship to Job Performance

Øystein Sørebø
Gunnar E. Christensen
Tom R. Eikebrokk

Faculty of Education in Business Administration
Buskerud University College
Hønefoss, Norway
Email: oystein.sorebo@hibu.no

Abstract

It is generally agreed within information systems research that end-user computing (EUC) among professionals is critical to their job performance. The main assumption among IS-researchers is that software usage contributes to improved performance. This study suggests that end-user computing may influence job performance in a more comprehensive way than earlier assumed. To address this issue, a set of core activities in EUC has been identified. The influence of these EUC activities on job performance is tested in a study of 328 professionals. The results demonstrate that some of the proposed core activities have substantial impact on the job performance of professionals.

Keywords

GA03 end-user computing, GB03 user behavior, end-user computing success

INTRODUCTION

From its start in the late 1970s, end-user computing (EUC) has evolved tremendously. The ratio of computers to white-collar workers in the industrialized world is now approaching one to one. The growth in EUC is a global phenomenon, occurring in the US as well as in Europe, Asia and Australia. Reasons for this worldwide dispersion of PCs, end-user software and peripherals in companies are manifold but the overriding belief is that access to such resources will increase the individual productivity of white-collar workers.

When IS researchers investigate this assumed computer-productivity relationship, they normally focus on software usage per se. They typically investigate the relationship between usage and/or user satisfaction and performance (e.g., Gelderman 1998, Pentland 1989). Implicitly, there is an assumption about software usage being the crux of the matter in EUC. Undoubtedly, this is a reasonable assumption as long as the aim is to investigate the effects of usage on job performance. However, access to computers typically involves users in more activities than just software usage. In fact, a number of studies have demonstrated that end users are engaged in various activities, e.g., seeking support and/or providing support to co-workers. Our presumption is that such additional activities may have a profound impact on how well workers' professional job is performed.

Unfortunately, the literature is scarce on findings and information related to core EUC activities. Consequently, the development and evaluation of frameworks within which such activities could be described and structured, is called for. This is the first main objective of

this research. The second main objective is to investigate the effects of core EUC activities on the job performance of office workers.

CORE ACTIVITIES IN EUC

End-user computing is nothing exceptional or rare. It is definitely one of the most common and widespread activities being carried out in organizations today. As pointed out by Igbaria and Guthrie (1998:3): *"We are entering an age when every business transaction begins and ends with a computer operated, of course, by an end user."* Hence, the term *end-user computing* describes job situations in which (white-collar) workers utilize computers as supporting tools. By definition, IS professionals are not part of the end user community.

Generally speaking, research contributions in the EUC area tend not to discuss the nature of EUC in much detail. Therefore, we lack knowledge about EUC activities and how they are performed across organizations and types of end users. We have, however, come across three research contributions in which the potential *core elements* of EUC are described and discussed. Table 1 summarizes these findings.

Author(s)	**The tool-related element**	**The support-related element**	**The role-specific element**
Larsen (1991)	hands-on use	use of support functions	delegation of computer tasks
Brancheau & Brown (1993)	tool utilization	EUC support options	development process
Speier & Brown (1997)	user application characteristics	end-user support usage	end-user awareness of policies

Table 1: Core elements of end-user computing

The most common elements appear to be *tool-related* and *support-related*. Rephrased as activities (or behavior), these two groups of elements can be referred to as *tool utilization* and *support behavior*. In contrast to the behavioral concepts of tool utilization and support behavior, the *role-specific* element represents the actual type of end users (e.g. managers). Hence, tool utilization and support behavior as general behavioral elements represent what we consider to constitute the core activities of EUC. The concepts of tool utilization and support behavior will be further explored and conceptualized in the remainder of this work.

Tool utilization

Tool utilization is basically what EUC in a wider sense is all about, namely the utilization of different computer applications. More precisely, it can be described as a matter of utilizing software to solve the different tasks or problems that the user is confronted with. However, we do believe that tool utilization is much more than simply solving job tasks. As Soh and Markus (1995) and many others have observed, information technology can be used or utilized in both appropriate and inappropriate ways. Hence, in our efforts to conceptualize tool utilization, we think it is important to distinguish between *task-specific utilization* and *non-task specific utilization*.

Task-specific utilization would be strongly related to task accomplishment. IS researchers typically assign this meaning to all kinds of utilization without questioning it any further. Thompson et al. (1994) conceptualize utilization in this manner when they describe it as a matter of intensity (i.e. minutes per day), diversity (i.e. number of packages) and frequency (i.e. how frequently it is used).

In contrast to task-specific utilization, non-task specific utilization is a type of behavior that goes beyond regular task accomplishment. However, there exists some borderline cases, and hence, it is oftentimes difficult to sort out behavior that fits directly into one particular category (Guthrie & Gray 1996). Too much emphasis on document format in word processing may be a good example of this. In one respect, this may be considered an integral part of task accomplishment but in another respect it may turn into a behavior that goes well beyond task accomplishment.

In order to make the distinction between task-specific and non-task specific utilization clearer, we shall distinguish between utilization in conjunction with specific job tasks (i.e., communication and decision analysis) and utilization as the exploration of facilities and functions embedded in software. The latter refers to a kind of *experimental behavior* while the former refers to *purposeful behavior*, i.e., assuming that "doing the job" is equivalent to performing work tasks. Hence, non-task specific utilization essentially is unproductive time spent by users tinkering with software. Task-specific utilization is regarded as a rational activity and can be defined as productive time spent by users solving problems or performing job tasks.

Support behavior

Support behavior is closely related to tool utilization and specifically refers to the need for help or assistance in solving an emergent software problem or the need for information about software functions or facilities. When a need for assistance arises within the context of EUC, the role of the end user can be twofold. He or she is either *seeking support* or *providing support*.

Research has shown that end users seek support from a number of internal and external sources (George et al. 1990). However, Speier and Brown (1997) have pointed out, internal sources are the predominant sources of support in the context of EUC. These findings are corroborated by research on IT diffusion (Brancheau & Wetherbe 1990). Consequently, this research limits itself to internal support sources.

End users have potential access to a number of internal sources for support. According to Bowman et al. (1993), end users would (listed in order of frequency and importance) contact co-workers, read instruction manuals, visit help screens, and contact computer center staff. Frequently, the motivation for doing a search, beyond that of solving a problem, may be to increase the user's expertise. As demonstrated in marketing research, a result of extensive search for information may be an "information bank" which may constitute a potential source for dissemination to peers (Block et al. 1986). This leads us to the other support role of the end user, i.e., that of providing support.

The informal role of support provider in the context of EUC is well known within IS research (George et al. 1990). Recent research has demonstrated that most end users evaluate informal support as particularly important and useful (Govindarajulu & Reithel 1998). One reason for this is that such "super users" or colleagues typically have the requisite business and computer knowledge and therefore are in an ideal position with regard to providing business-related computer support to others. Research in the organizational behavior area have found that as much as 75 to 90 percent of all consultations between organizational members are initiated by the person who seeks help and not by the support provider (Kaplan & Cowen 1981). As a consequence of this, the support seeking end user not only initiates consultations but also maintains an informal network primarily as a precautionary measure.

HYPOTHESES

Both tool utilization and support behavior are secondary activities for white-collar workers who are not IS professionals. The primary activities are those that are directly related to the performance of professional work. Depending on how purposeful they are, tool utilization and support behavior as secondary activities may or may not support professional performance. This research is focusing on purposeful EUC activities, i.e., tool utilization and support behavior that support professional performance, and is therefore preoccupied with the issue of how each of the behavioral elements of EUC actually influence professional performance.

Task-specific tool utilization serves as a background operation for the execution of core tasks. Therefore, high levels of task-specific tool utilization reflect high levels of computer usage in conjunction with core tasks. As task-specific tool utilization is assumed to be an economic activity, it is expected to have a positive effect on job performance. More precisely, end users who commit a lot of work time and energy to such EUC activities are expected to perform better than end users who do not throw in the same amount of time and energy. Hence, the following hypothesis is offered:

H1: *End users' task-specific tool utilization has a positive effect on their professional job performance.*

Non-task specific tool utilization refers to a type of utilization that does not directly advance job performance. On the other hand, such utilization has the potential of satisfying individual curiosity and a desire to explore things (Guthrie & Gray 1996). Our purpose is to investigate how non-task specific tool utilization effects professional job performance. Non-task specific tool utilization means using time to explore software facilities and functions and therefore reduces the time that could be spent on task-specific activities. As such, non-task specific tool utilization is inappropriate because it consumes a lot of end users' available work time and energy at the cost of more important, job related activities. Therefore, we expect that non-task specific tool utilization, at least in the short run, would have a negative effect on job performance. The following hypothesis emerges:

H2: *End users' non-task specific tool utilization has a negative effect on their professional job performance.*

Support usage refers to the end users' utilization of intraorganizational sources in the event of hardware or software related problems. The most obvious measure of support usage is the *intensity* of search activities, i.e., the total amount of information acquired. However, support usage is not only a matter of information quantity. It is also a matter of diversity, i.e., the number of various sources from which information is acquired. Thus, there is a clear distinction between two dimensions of support usage, one related to the amount of information acquired and the other related to the end user’s choice between sources. In short, support usage can be expressed in terms of the *intensity* of search and the *direction* of search, respectively.

We believe that the direction of search is the most critical aspect of support usage. This is because we expect a one-source approach to be mainly directed toward colleagues while a multi-source approach includes a number of non-personal sources which tend to be quite time consuming to use. An end user that simply asks a colleague or calls the company's help desk, normally gets a quick answer. On the other hand, an end user who takes advantage of the help menu or acquires information in a “trial and error” fashion usually has to spend a lot of time before arriving at a solution. Our hypothesis is:

H3: *End users' support seeking via non-personal sources has a negative effect on their professional job performance.*

As pointed out in the previous section, support behavior is not only a matter of seeking support but also a matter of providing assistance to co-workers. Time estimates reported by Gibbs (1997) indicate that non-technical support providers spend from 4 to 10 percent of their time at work assisting co-workers solving computer problems. Therefore, providing support to co-workers consumes time at the expense of the support providers' own professional job tasks (Kirwin 1995). A consequence, according to Gibbs (1997), is that the annual costs associated with using a PC could be doubled. Hence, there are good reasons to believe that providers commit a lot of their work time and energy to support activities at the expense of their own professional activities. Therefore, we offer the following hypothesis:

H4: *End users' provision of computer-related assistance to co-workers has a negative effect on their professional job performance.*

METHODOLOGY

In order to test the four hypotheses, a field study was conducted in a large oil company. Both IS professionals and managers were excluded from the sample frame. IS professionals were left out because they are not real end users by definition. Managers, on the other hand, were left out because it was expected that they would not have time to fully participate. Thus, the risk of an unsatisfactory low response rate was prevented.

The measurement scales were polished and improved through semi-structured interviews and a subsequent pre-test among ten end users in the company. The semi-structured interviews resulted in important insights and knowledge about the company's IT practice, application portfolio, end users' support preferences, etc. The pre-test led to some minor adjustments of the measurement scales. The process of scale improvement has resulted in satisfactory content validity for all scales.

The questionnaire was distributed to a random sample of 500 administrative workers. A copy of the instrument can be found in the appendix. Eventually, 328 questionnaires were returned, representing a response rate of 66 percent.

Measures of core activities in EUC

A scale developed by Igbaria and Iivari (1998) was applied. The measure consists of four dimensions: actual daily use (time), frequency of use, use of different software packages, and use for different business tasks. The last dimension consists of eleven items and was consistent with the conceptualization of task-specific utilization.

No validated measurement scales exist for non-task specific utilization. As mentioned earlier, however, the main feature of the concept is software exploration, i.e., experimenting with functions, menus and facilities in available software. Based on this, four indicators or items were formulated.

Two relevant and validated scales for measuring support usage were found in the IS literature (Bowman et al. 1993, Govindarajulu & Reithel 1998). The main focus of these two scales differs somewhat. Bowman et al. (1993) call the variable "Type of support preferred" and measure perceived importance of different kinds of assistance across a set of applications. Govindarajulu and Reithel (1998), on the other hand, call the variable "Support" and measure support received from a particular source in conjunction with different problem categories (e.g., hardware and data support). In our opinion, the former scale measures an attitude, not genuine usage, and therefore does not serve our purpose particularly well. The latter scale presupposes 23 items per source. If we include at least four sources, the probability of a low

response rate will most likely increase considerably. Hence, none of these scales were found to be appropriate for our present purposes.

To measure the usage of various sources, a two-dimensional scale was developed. The first dimension is problem-related (technical vs. software) while the second is related to support source (IT expert vs. the help menu in the software). Semi-structured interviews with end users, together with interviews with IS staff, revealed quite a few common support problems within the company. In addition, the interviews identified four common support sources: help desk, colleagues, help menus and "trial and error". Based on these insights, a measurement scale was developed (see appendix).

No measurement scales exist for colleague support in IS-research. However, a measurement scale from research on opinion seekers (i.e. Flynn et al. 1996) was adopted and adjusted to the end user context.

Measure of job performance

A subjective self-report of overall job performance was employed in this research. Self-reports of this kind are relatively easy to administer and has been used successfully in a number of research studies (e.g., Babin & Boles 1996, Sujan et al. 1994). However, self-rating scales with very few items, like the one employed here, may be biased. This is because the end user tends to only take into account the perception of what he or she does well, instead of making a general and more balanced judgment of his or her job performance (Behrman & Perreault 1982).

All responses to the questionnaire were anonymous. Therefore, we will assume that end user respondents had minimal motivation to inflate the ratings of their own performance. Four indicators were formulated for the purpose of measuring job performance.

RESULTS

To test the four hypotheses presented earlier, data from 328 valid questionnaires were examined by structural equation modeling. In our analysis, as recommended by Anderson and Gerbing (1988), a two-step approach was followed. The first step includes the analysis of the measurement quality of the data. This step should be completed before the next step is carried out. The second step is the test of the hypothesized relationships between variables.

Measurement quality of data

The initial measurement model was evaluated using the guidelines provided by Anderson and Gerbing (1988). To meet the requirements of unidimensional measures, some items were deleted from the analysis. Deleted items are indicated in the appendix with asterisk (*).

Since the model has significant factor loadings for all the indicators (cf. Table 2), no cross-loadings, and no justified correlated error terms, the measures in the model have acceptable unidimensionality (Anderson & Gerbing 1988). Accordingly, the re-specified model meets the requirement of convergent validity.

The reliability of the research instrument is assessed by three measures: item reliability, composite reliability and average variance extracted (Bagozzi & Yi 1988). Table 2 presents the results of these three tests. Eight out of twenty-two item reliabilities were lower than the 0.50 cut-off value recommended by Bagozzi and Yi (1988), although all paths had significant T-values. Particularly, the support usage construct did not pass the 0.50 test. However, even if almost all items of the support usage scale missed the ideal cut-off value, one should be careful not to jump to conclusions.

	Factor loading	T-value	Error term	T-value	Item reliability	Average variance ext.	Composite reliability
Task-specific utilization:							
Item 2	0.60	11.54	0.64	12.09	0.36	0.52	0.86
Item 5	0.82	17.55	0.33	10.08	0.67		
Item 6	0.91	20.70	0.17	6.65	0.83		
Item 7	0.78	16.44	0.39	10.72	0.61		
Item 8	0.53	10.03	0.71	12.29	0.29		
Item 9	0.62	12.00	0.62	12.01	0.38		
Non-task specific util.:							
Item 1	0.90	20.41	0.19	7.72	0.81	0.77	0.91
Item 2	0.92	21.00	0.16	6.78	0.84		
Item 4	0.82	17.68	0.33	10.53	0.67		
Colleague support:							
Item 1	0.86	19.21	0.26	10.28	0.74	0.77	0.93
Item 3	0.83	18.11	0.31	10.88	0.69		
Item 4	0.90	20.67	0.19	9.00	0.81		
Item 5	0.91	21.27	0.16	8.22	0.84		
Support us.:							
Item 1	0.60	10.60	0.64	10.96	0.36	0.34	0.75
Item 2	0.76	14.22	0.43	8.30	0.57		
Item 5	0.63	11.35	0.60	10.58	0.40		
Item 7	0.48	8.16	0.77	11.83	0.23		
Item 8	0.50	8.71	0.75	11.67	0.25		
Item 10	0.49	8.40	0.76	11.76	0.24		
Job perfor.:							
Item 1	0.90	20.03	0.19	6.55	0.81	0.75	0.90
Item 2	0.85	18.29	0.28	8.97	0.72		
Item 3	0.84	18.19	0.29	9.08	0.71		

Table 2: Reliability information and test of convergent validity

	Task-specific utilization		Non-task specific util.		Colleague support		Support usage		Job performance		Average var. ext.
Task-specific utilization	1.0	-	0.33	*0.11*	0.38	*0.14*	0.23	*0.05*	0.47	*0.22*	0.52
Non-task specific util.	0.33[a]	*0.11*[b]	1.0	-	0.63	*0.40*	0.54	*0.29*	0.22	*0.05*	0.77
Colleague support	0.38	*0.14*	0.63	*0.40*	1.0	-	0.47	*0.22*	0.13	*0.02*	0.77
Support usage	0.23	*0.05*	0.54	*0.29*	0.47	*0.22*	1.0	-	0.13	*0.02*	0.34
Job performance	0.47	*0.22*	0.22	*0.05*	0.13	*0.02*	0.13	*0.02*	1.0	-	0.75

[a]: correlation. [b]: squared correlation

Table 3: Test of discriminant validity

It is in fact quite common to find that several measures of an estimated model have squared factor loadings below the 0.50 threshold. Particularly, when new items or newly developed scales are employed, a more suitable cut-off value may be 0.16 or 0.25 (Hulland 1999).

Additionally, the composite reliability tends to increase and, hence, measurement error decreases as the number of items in a combination increases (Churchill 1979). The latter is evident if we regard the composite reliability value for the support usage construct, which is considerably above the 0.70 cut-off value recommended by Nunnally (1978). Therefore, all items for the support usage scale, despite "modest" item reliability, were kept in the model to maintain the domain width of the construct.

Table 3 shows the correlations among the different constructs in the measurement model. Also, it reports the squared correlations. The right hand column in Table 3 shows the average variance extracted for each construct. A comparison of the average variance extracted against the squared correlation of the remaining constructs indicates adequate discriminant validity because each squared correlation is lower than the average variance extracted (Fornell & Larcker 1981).

Test of hypotheses

The results from the test of the structural model with its four relationships are shown in Table 4. Overall, this research does not provide empirical support for the research model as defined by the proposed hypotheses. However, all goodness-of-fit indices have values within the suggested margins for satisfactory fit. This suggests that the overall model makes sense.

Goodness-of-fit indices:
Chi-Square = 236.24 (p=0.036)
Degrees of Freedom = 199
RMSEA = 0.024, p(close fit) = 1.00
NNFI = 0.99
CFI = 0.99

	Task-specific utilization	**Non-task specif. utilization**	**Colleague support**	**Support usage**	**Squared Str. Correlation**
Job performance	0.48[a] (7.07)[b]	0.15 (1.80)	-0.15 (-1.98)	0.01 (0.15)	0.24
Significance level[b]	p<0.001[c]	p<0.05	p<0.025	n.s.	

[a]: Standardized regression coefficient. [b]: T-values. [c]: One-tailed test.

Table 4: Structural model

Three out of the four hypothesized paths have significant T-values. Task-specific utilization has a significant and considerable effect on job performance (0.48, p<0.001), and is consistent with what was expected from hypothesis 1. Non-task specific utilization has a significant effect on job performance (0.15, p<0.05), but this effect was contrary to what we expected and, hence, the test does not provide support for hypothesis 2. Colleague support has a significant but modest effect on job performance (-0.15, p<0.025). This finding supports hypothesis 4. Finally, support usage seems not to have any impact at all on job performance (0.01, n.s.) and, hence, hypothesis 3 is not supported. In sum, only hypothesis 1 and 4 are supported. Our findings will be discussed in more detail next.

DISCUSSION

It is common within the IS field to regard use of software as the only aspect of end user behavior to have a direct influence on job performance. This study has demonstrated that this probably is a too narrow view and that it should be extended to account for the fact that EUC is more than just purposeful software utilization. Our analysis produced several statistically significant relationships between the four core elements of EUC and job performance that lends support to such an extended view.

The positive relationship between task-specific utilization and job performance supports the common beliefs within the IS field about the contributions of personal computing in job contexts (Pentland 1989).

The positive relationship between non-task specific utilization and job performance came out contrary to what we expected. Because of the unproductive nature of non-task specific utilization, we expected it to be negatively correlated with end users' professional performance. While there may be several explanations for our counter-intuitive finding, a particularly plausible explanation is that non-task specific utilization stimulates learning processes and the user's level of confidence with computer usage (cf. Guthrie & Gray 1996). This means that the exploration of facilities and functions in software leads to improved software knowledge which in turn may lead to more effective utilization of software in the long run.

The negative relationship between co-worker assistance and job performance suggests that co-worker assistance may be a particularly ineffective support function viewed in a firm level perspective. Such a view is supported by time estimates that demonstrate that non-technical employees spend 4 to 10 percent of their time helping co-workers solving computer problems (Gibbs 1997). Hence, this may be a very expensive support function, particularly if professionals such as economists or lawyers take on the role of support providers. Therefore, this kind of informal support consumes work time at the expense of the providers' professional task execution (Kirwin 1995).

The findings from the present study must be considered in light of the study's limitations, in particularly the use of cross-sectional survey data. As is well known, the correlation design lacks the possibility to explicitly test directionality. However, this does not imply that the supported research model is completely devoid of support on causal relationships. Both the logic of the proposed theory and the application of SEM analysis[1] provide support for causal relationships. In spite of this conclusive statements about causality cannot be made since alternative explanations cannot be ruled out. At least one cannot disregard the possibility of reciprocal interaction among the factors studied. Further research, in particular experimental and longitudinal studies, is clearly needed to address these issues.

CONCLUSION

This study offers a framework for our understanding of how core activities in EUC influence job performance. The empirical test of the proposed framework provides the basis for several conclusions and recommendations for the management of EUC in organizations. In sum, the message to managers would be that EUC is more than just straightforward utilization of computer resources by individuals. They should be aware that EUC implies activities that may increase, as well as decrease, professional job performance. Managers should especially recognize that co-worker assistance might have a negative effect on the support providers' professional job performance. However, our knowledge about the effects of EUC is still too limited to draw clear conclusions and, hence, there is an obvious need for further research in this area. Also, it may turn out that our findings from one particular organization are context specific and therefore not possible to generalize to other contexts. Furthermore, it would be interesting to know if the negative effects of providing support to co-workers may be effected by computer training and better institutional support.

---

[1] LISREL analysis, like other structural equations modeling, provides powerful support for causal relationships relative to other techniques such as correlation and regression since all the relationships (including those in the measurement model as well as in the structural model) are tested simultaneously.

REFERENCES

Anderson J.C. and Gerbing D.W. (1988) Structural equations modelling in practice: a review and recommended two-step approach. *Psychological Bulletin*, 103, 411-423.

Babin B.J. and Boles J.S. (1996) The effects of perceived co-worker involvement and supervisor support on service provider role stress, performance and job satisfaction, *Journal of Retailing*, 72, 1, 57-75.

Bagozzi R.P. and Yi Y. (1988) On the evaluation of structural equation models, *Journal of the Academy of Marketing Science*, 16, 1, 74-94.

Behrman D.N. and Perreault W.D. (1982) Measuring the performance of industrial salespersons, *Journal of Business Research*, 10, 355-370.

Block P.H., Sherrell D.L. and Ridgway N.M. (1986) Consumer search: an extended framework, *Journal of Consumer Research*, 13, June, 119-126.

Bowman B., Grupe F.H., Lund D. and Moore W.D. (1993) An examination of sources of support preferred by end-user computing personnel, *Journal of End User Computing*, 5, 4, 4-11.

Brancheau J.C. and Brown C.V. (1993) The management of end-user computing: status and directions, *ACM Computing Surveys*, 25, 4, 437-482.

Brancheau J.C. and Wetherbe JC. (1990) The adoption of spreadsheet software: testing innovation diffusion theory in the context of end-user computing, *Information Systems Research*, 1, 2, 115-143.

Churchill G.A. jr. (1979) A paradigm for developing better measures of marketing constructs, *Journal of Marketing Research*, 16, Feb., 64-73.

Flynn L.R, Goldsmith R.E. and Eastman J.K. (1996) Opinion leaders and opinion seekers: two new measurement scales, *Journal of the Academy of Marketing Science*, 24, 2, 137-147.

Fornell C. and Larcker D.F. (1981) Evaluating structural equation models with unobservable variables and measurement error, *Journal of Marketing Research*, 18, 39-50.

Gelderman M. (1998) The relation between user satisfaction, usage of information systems and performance, *Information and Management*, 34, 1, 11-18.

George J.F., Kling R. and Iacono S. (1990) The role of training and support in desktop computing, In Kaiser, K.M. and Oppelland, H.J. (eds.), *Desktop information technology*, Elsevier, North-Holland.

Gibbs W.W. (1997) Taking computers to task, *Scientific American*, July, 64-71.

Govindarajulu C. and Reithel B.J. (1998) Beyond the information center: an instrument to measure end-user computing support from multiple sources, *Information and Management*, 33, 5, 241-250.

Guthrie R. and Gray P. (1996) Junk computing: is it bad for an organization?, *Information Systems Management*, Winter, 23-28.

Hulland J. (1999) Use of partial least squares (PLS) in strategic management research: a review of four recent studies, *Strategic Management Journal*, 20, 195-204.

Igbaria M. and Guthrie R. (1998) Editoral preface, Special 10th anniversary issue, end-user computing: clarity, change, choice, *Journal of End User Computing*, 11, 1, 3-4.

Igbaria M. and Iivari J. (1998) Microcomputer utilization patterns among managers and professionals: the case in Finland, *Journal of Computer Information Systems*, 38, 3, 28-43.

Jöreskog K.G. and Sörbom D. (1982) Recent developments in structural equation modeling, *Journal of Marketing Research*, 19, November, 404-416.

Kaplan E.M. and Cowen E.L (1981) Interpersonal helping behavior of industrial foreman, *Journal of Applied Psychology*, 66, 633-638.

Kirwin W. (1995) The true cost of personal computers, *Across the Board*, 32, 3, 15-19.

Larsen T.J. (1991) Managers' use of computers: end-user computing in perspective, *Proceedings of The Twenty-Fourth Annual Hawaii International Conference on System Science*, J.F. Nunamaker (ed.), IEEE Computer Society Press, 3, 145-152.

Nunally J.C. (1978) Psychometric theory. 2 ed. New York, McGraw-Hill.

Pentland B.T. (1989) Use and productivity in personal computing: an empirical test, *Proceedings of the Tenth International Conference on Information Systems*, December 4-6, Massachusetts, 211-222.
Soh C. and Markus M.L. (1995) How IT creates business value: a process theory synthesis. *Proceedings from the Sixteenth Conference on Information Systems*, Amsterdam, The Netherlands, December, 29-41.
Speier C. and Brown C.V. (1997) Differences in end-user computing support and control across user departments, *Information and management*, 32, 85-99.
Sujan H., Weitz B.A. and Kumar N. (1994) Learning orientation, working smart, and effective selling, *Journal of Marketing*, 58, July, 39-47.
Thompson R.L., Higgins C.A. and Howell J.M. (1994) Influence of experience on personal computer utilization: testing a conceptual model, *Journal of Management Information Systems*, Summer, 167-187.

Appendix: Item list used for data collection

Task-specific utilization; Compared with my colleagues I use my computer more frequently than them to: (1) Communicate with others*; (2) Plan various activities; (3) Identify problems/alternatives regarding decisions*; (4) Look for trends/tendencies within my field of responsibility*; (5) Make revisions and control various circumstances; (6) Control and rule activities; (6) Make decisions; (7) execute budgeting; (8) Write documents, reports, and so on; (9) Make presentations*; (10) Schedule meetings*; (i.e. from "a poor description" to "an excellent description"; seven points)
Non-task specific utilization; (1) I frequently experiment with the various functions in the software that I utilize (e.g. testing different layout alternatives in Freelance or WordPro); (2) I frequently try unknown functions in the different software packages that I utilize (e.g. the drawing function or the table function in WordPro/AmiPro); (3) I invest a lot of hard work in the experimentation of a suitable layout when I am writing a document in WordPro/AmiPro (or when I am making a presentation in Freelance)*; (4) I frequently experiment with the different menu facilities within the different software packages that I utilize; (i.e. from "a poor description" to "an excellent description"; seven points)
Colleague support; My colleagues: (1) Sometimes ask me about help in connection with their use of the computer; (2) Sometimes ask me about advice and ideas when they utilize one or more software applications*; (3) Ask me frequently about technical questions regarding their computer usage; (4) Use me sometimes as an adviser regarding their utilization of the computer; (5) Regard me as a reliable information source when it comes to software usage; (6) Approach me frequently to obtain assistance regarding their usage of the computer*; (i.e. from "a poor description" to "an excellent description"; seven points)
Self-support; What do you do when: (1) You don’t know how to send or receive an attachment through electronic mail; (2) You don’t know how to copy a table from word processing (or spreadsheet) to the presentation program Freelance Graphics; (3) There is enough paper in the printer, but you don’t receive any copy*; (4) your computer doesn’t boot*; (5) You don’t remember how to utilize a particular function (e.g. the table function in WordPro/AmiPro); (6) You don’t get access to a file or a catalogue in Lotus Notes*; (7) The mouse doesn’t work, e.g. you press the button and nothing happens; (8) You wish to auto-correct a word in WordPro/AmiPro, e.g. you wish that "sumer" should automatically be corrected to "summer"; (9) You wish to delete documents or catalogs that you don’t need any longer*; (10) You wonder how a software package (e.g. a spreadsheet) can be used to solve a new problem (e.g. a "what if" analysis); (11) You receive a document as an attachment through electronic mail, and run into problems with converting it to your own word processor*; (i.e. get in touch with the help-desk, get in touch with a coworker, utilize the help facility in the actual software, experiment on a solution)

Perceived job-performance; Compared with my colleagues: (1) I am more productive than the most of them; (2) I manage my work time in a more efficient manner; (3) I am more focused on the job I perform; (4) I invest more effort in doing my job as well as possible*; (i.e. from "a poor description" to "an excellent description"; seven points)

COPYRIGHT