
Assessing the Impact of Information Centers on End-User Computing and Company Performance

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As company investment in end-user computing (EUC) grows so does the need for the organization to provide end-user support and training; encourage resource sharing; establish mechanisms for management and operational control over data resources, systems quality assurance, and resource acquisition. To satisfy these needs, many organizations have established information centers (IC). ICs have been shown to be very dynamic organizations which are continuously evolving and vary dramatically from company to company in terms of location, resources available, and the types of services provided. This study surveyed 215 organizations to assess present shifts in EUC and IC activities, as well as the impact of IC performance on EUC overall company effectiveness and payoffs from EUC. The results show among other things that in many organizations the EUC support burden is being shifted to IS departments, to outsiders, and to the end-users themselves; that EUC support is indeed a requirement for overall EUC effectiveness and for the company to derive payoffs from the EUC investment.

The wide proliferation of end-user computing (EUC) has been widely reported [Van Kirk, 1995; Caginalp, 1994; Burrows, 1994; Igbaria, Pavri & Huff, 1989]. The explosion has happened in the United States as well as overseas [Anonymous, 1994]. The growth in EUC is a world-wide phenomenon occurring in Japan [Patton, 1995] as well as in Europe [Preston, 1994]. When Computerworld surveyed the 100 organizations rated as having the most effective use of computerized information systems, these organizations were found to already have, on the average, 35 PC/workstations per 100 employees, with the top 25 organizations having an average of 44 PC/workstations per 100 employees [Sullivan-Trainor, 1988].

As end-user computing becomes pervasive in most organizations, its diversity grows along different dimensions, including the types of applications, types of end-users, levels of end-user computer literacy, etc. Contrary to early expectations, end-users do not become independent, instead, they

increasingly demand better equipment, more training, coaching, consulting, technical support, etc. Many authors have recognized that the expansion in end-user computing activities within large organizations requires substantial investment in personnel and facilities for support [Igbaria, Guimaraes & Davis, 1995; Van Kirk, 1995; Guimaraes, 1986; Leitheiser & Wetherbe, 1986; Guimaraes, 1984a]. The large number of organizations that have established Information Centers (IC) attests to their importance in supporting end-user computing activities. The American Management Association [1988] reported that 58 percent of the large companies surveyed already had a discrete unit to support end-user computing.

Very clearly, ICs have evolved over time [Guimaraes, 1984b] and are continuing to change [Guimaraes & Igbaria, 1994]. The most recent (1990) survey by Crwth Computer Courseware has 65 percent of respondents reporting their IC's role as changing in some way. Respondents are evenly divided about whether their IC's role is rising or decreasing. Forty

percent reported some functions being shifted to other parts of the organization and that training, product specialists and application development are understaffed and overworked. Most organizations (58 percent) are keeping active IC organizations, 6 percent have disbanded their IC as inappropriate to their needs, 34 percent do not have one and presently have no plans for one, and 2 percent will establish an IC in the near future [Crwth, 1990]. It is widely held that one of the main motivators for the continued proliferation of EUC has been the length of the visible and invisible systems backlog within organizations. In an analogous fashion, some of the burden for end-user computing support is increasingly falling on IS and user departments, away from understaffed centralized IC [Crwth, 1990]. Similar interpretation of the Crwth survey is reported by Roberts [1991], and a dramatic impact of end-user computing on IS department objectives and organization has also been reported by others [Hildebrand, 1991; Juneau, 1991].

While the title for EUC support groups will vary from organization to organization, the term IC has become widely recognized. Despite its wide recognition, the term IC stands for EUC support groups performing a wide variety of tasks, organized as a separate organizational unit or located within MIS departments or user departments. Such variety in IC deployment alternatives naturally raises several questions: How are IC's changing in terms of their size and the tasks they perform? Are IC's an obsolete form of EUC support organization with fading importance and increasing risk of disbandment? What do users think about the effectiveness of the support provided by their IC? Based on these ratings, is there a "best way" to set up an organization's IC? What are the payoffs from EUC to the organization? Does IC performance have significant positive impacts on organizational EUC support and management? Most important, does effective EUC support and management provide improvements in company payoffs? The major objective of this study is to address these questions based on empirical evidence collected from a broad collection of business organizations.

Theoretical Background

This section outlines the study's basic hypotheses, the rationale for the proposed relationships, and the selection of measures used. As shown in Figure 1, the basic hypotheses in this study are: **(H1) IC performance is directly related to overall company EUC support and management effectiveness;** and **(H2) EUC support and management effectiveness is directly related to company payoffs from EUC.** The literature contains numerous reports which either implicitly or explicitly promote these hypotheses.

EUC Support and Management Effectiveness

As the level of EUC activities in an organization grows, so does the need for some types of control (i.e. acquisition

policies and procedures, sharing of resources, quality of systems and information) and end-user support [Igbaria, Guimaraes & Davis, 1995; Sherman, 1994; Lee, 1986; Zmud, 1983; Guimaraes, 1984b; Thompson, Higgins & Howell, 1991; Guimaraes & Ramanujam, 1986]. Leitheiser & Wetherbe [1986] proposed the notion of service support levels as "formal divisions of responsibility between end-users and MIS departments" as the basis for effectively managing EUC in organizations. The idea hopefully will lead to several advantages to the organization: freedom of choice for end-user managers, focusing of IS department's attention on providing service to end-users, reduction of "finger pointing", a structured approach for supporting end-users, incentives for end-users to follow established guidelines and procedures, and better means for coordinating EUC activities.

Starting in the early 1980s and steadily increasing, a variety of support mechanisms became available to the end-user community in many organizations, and the level of support was directly related to the level of control exercised by IS departments [Guimaraes & Ramanujam, 1986]. Information Centers were being strongly recommended as necessary for EUC management and support [Dotson, 1982; Guimaraes, 1984a, 1984b]. In those days, however, less than 60 percent of Fortune 500 companies, and less than 8 percent of all US companies, had "established a minimal set of microcomputer policies" [Zmud, 1983]. A list of EUC support and management activities was collected from the literature [Guimaraes, 1986] to provide a measure of how well an organization is performing in this area. The items include: resource acquisition, planning, management and control, LAN management, training, consulting, help desk, development with specific package and technical support/maintenance. The determinants and consequences of job satisfaction among IC personnel were studied by Guimaraes and Igbaria [1993], including a comparison of IC versus IS personnel in terms of the same variables [Guimaraes & Igbaria, 1992].

IC Performance

To provide the support needed for effective EUC, many organizations have established an IC [Guimaraes & Igbaria, 1994; Crwth, 1990]. On the other hand, in the last few years some organizations have disbanded their IC's [Crwth, 1990] thus suggesting an alternative way of managing EUC. This ambiguity needs to be promptly addressed since, as organization investment in EUC resources, activities and support increases, so does the need for assessing the IC's performance

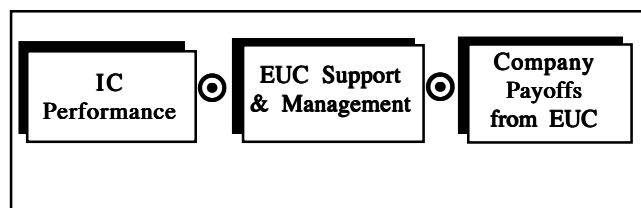


Figure 1: The Conceptual Mode

and its value to the organization. Some of the confusion is probably due to the fact that IC's have evolved over time [Guimaraes, 1984b; Magal, Carr & Watson, 1988] and can be quite different in terms of sophistication, size, location, modus operandi, and the variety of services provided to end-users [Guimaraes, 1986; Leitheiser & Wetherbe, 1986; Carr, 1987]. In this study, IC's are very broadly defined to include any formal group providing support for microcomputer-based EUC. For some analyses the characteristics of the IC and its location in the organization was considered.

The most comprehensive and well known attempt at creating a measure for IC performance is the collection of IC Critical Success Factors developed by Magal, et al. [1988]. These factors have been widely used by researchers [Guimaraes & Igbaria, 1994], and as discussed later, were used to measure IC success in this study.

Company Payoffs From EUC or EUC Success

Prior research has viewed EUC success from a variety of perspectives and has used varying definitions and measures of success [Guimaraes & Igbaria, 1994; Igbaria, 1990; Magal, 1991; Magal, et al., 1988; Rivard & Huff, 1988]. These various definitions have described success in terms of end-user satisfaction [Doll & Torkzadeh, 1988; Igbaria & Nachman, 1990; Magal, 1991; Rivard & Huff, 1988]; application level of usage [Ein-Dor & Segev, 1992; Igbaria, et al., 1989]; and system effectiveness [Amoroso & Cheney, 1991; Igbaria, 1990]. These measures of success focus on individual systems and, unless data can be collected on a representative set of systems per company, are unsuitable to assess EUC success from a company-wide perspective. Suitable measures for EUC's impact on the organization had to be found elsewhere in the literature.

Two concepts can effectively reflect the contribution of EUC to the overall organization and specifically to its strategic mission: the extent to which EUC helps improve the overall strategic management of the organization and accomplish key company objectives. Venkatraman and Ramanujam [1987] conceptualized both dimensions and used them to evaluate the success of planning systems. They rationalized the two constructs as follows: "While the degree of improvement in the system's CAPABILITIES reflects the 'means' or the process aspect of the concept of planning system success, OBJECTIVES, as a dimension, is intended to tap the 'end' or outcome benefits of planning" [p. 690].

As will be discussed later, this framework [Venkatraman & Ramanujam, 1987] has been used for measuring the impact of EUC capabilities to support the management of an organization. Individual end-users benefit from information technology to achieve both tangible and intangible objectives with a wide variety of applications. From a company perspective, the indicator for EUC success in this case is reflected in the extent of fulfillment of six key business objectives: enhancing management development,

predicting future trends, evaluating alternatives, improving short-term performance, improving long-term performance, and avoiding problem areas.

It is also important to examine the degree to which EUC helps the organization's strategic management. Together with the "objectives" component, they represent the ends and means (output and process) perspectives for evaluating EUC success. Thus, following the Venkatraman and Ramanujam [1987] rationale, EUC can be seen as a company-wide system that supports efficient and effective end-users operations and the strategic management of the organization. EUC's capability to support company management along the following twelve dimensions are measured in this study: anticipating surprises and crises, identifying new business opportunities, identifying key problems, fostering managerial motivation, enhancing the generation of new ideas, communicating top management's expectations throughout the organizational structure, fostering management control, fostering organizational learning, communicating line managers' concerns to top management, integrating diverse functions and operations, adapting to unanticipated changes, and enhancing innovation.

Research Methodology

Sampling Procedure

To fulfill the objectives of this study, a commercially available mailing list of 1500 companies was the target of a mailed questionnaire. The questionnaire was previously tested for content and readability with a group of two IS managers and three IC managers and five end-users. Before the questionnaire was mailed, a post-card was sent alerting the target respondents that the questionnaire was forthcoming. Approximately ten days after the questionnaires were mailed, reminder cards were sent out in an effort to maximize the response rate. A total of 177 questionnaires were returned providing a response rate of roughly twelve percent. From these, eleven questionnaires were discarded, nine for being incomplete and two for being filled out incorrectly, providing a usable sample of 156. Regarding reasons for non-response, a random phone survey of 30 non-respondents revealed that in most cases (14) the organization had no identifiable group supporting or managing EUC, in six cases the respondent complained about too many other surveys being received, in the other six cases company policy precluded employee participation in surveys without prior approval, and in the last four cases the individual could not be reached.

The relatively small response rate is reason for concern about the representativeness of the sample. Therefore questionnaires and a copy of a preliminary version of this report were mailed to a second sample of 200 randomly selected target subjects who did not respond to the survey. This second mailing produced 59 usable responses (29 percent response) for a total of 215 organizations participating in this study. T-

tests comparing the first and second samples along the major variables in this study and Chi-square tests based on industry sectors, company gross revenue, and on whether or not the company has an IC, revealed no significant biases between respondents and non-respondents. Based on these test results, if generalized over the entire sub-population of non-respondents, one may conclude that no non-response bias relevant to the study objectives exist. The relatively broad representation of companies in the sample described below further supports this assertion. One apparent sample bias is that 75 percent of the companies in this sample have “a formally recognized group responsible for supporting/managing EUC activities in the organization.” That is significantly higher than previously reported figures [AMA, 1988]. However, this bias enhances the objectives of this study rather than detracting from it.

As described below, in terms of industry sector, gross revenue, and IS budget, the sample contains a good representation of companies. In terms of their main job function the respondents fell into two main categories: 90 (41.9%) are IS managers and 125 (58.1%) are user department managers and others. Because of the widely held suspicion that MIS managers and end-users may have strong differences of opinion about EUC activities, the respondents were split into these two groups and all relevant variables were submitted to t-tests. No statistically significant differences were detected. A likely explanation is that the suspected differences have diminished significantly since earlier days of end-user computing when IS manager resistance or attempt to control EUC were more easily encountered. As the “somewhat high” average ratings for IC success factors suggest, company support for EUC is shown widely.

Sample Description

The organizations in the sample represent a wide variety of business sectors: manufacturing (53.3%), financial services (11.6%), transportation (5.5%), electric and gas utilities (4.5%), insurance (5.0%), merchandising (3.5%), and others (16.6%). The organizations’ gross revenues also cover a wide range and can be categorized as below 100 million dollars (12.8%), 100 to 300 million (13.8), 301 to 600 million (22.1%), 601 to 999 million (20.5), 1 to 5 billion (14.9%), and over 5 billion dollars (15.9%). IS budgets fall in the following categories: less than 5 million (17.6%), between 5 and 10 million (14.6%), 10.1 and 30 million (23.6%), 30.1 to 60 million (17.1%), 60.1 to 99.9 million (13.1%), and 100 million or over (14.1%).

Measurement

EUC Support and Management Effectiveness. As mentioned earlier, several items widely discussed in the literature as important activities for effective EUC were enumerated. These items include: resource acquisition, planning, management and control, LAN management, training, consulting, help desk, systems development with specific soft-

IC Critical Success Factors	Avg.	Std. Dev.
Promote organizational acceptance of IC concept	5.7	1.3
Engender top-management support	4.6	1.3
Gain end-user commitment to the IC concept	5.1	1.0
Provide adequate training for IC staff	3.6	1.3
Provide career paths for IC staff	4.9	1.2
Employ a competent staff	5.4	1.0
Define IC mission	4.3	1.2
Promote IC services	4.8	1.1
Provide services to distributed sites	4.1	1.1
Liaise with end-user departments	5.5	0.9
Provide end-user training	4.8	1.2
Communicate with users	5.3	1.2
Understand users’ business and problems	5.5	1.1
Promote users’ understanding of data processing	4.9	1.1
Manage end-user expectations	5.4	1.1
Respond to application requests	5.0	1.1
Establish formal criteria to prioritize work	4.9	1.1
Create positive atmosphere for users	4.9	1.2
Monitor and coordinate end-user application development	5.5	1.1
Control procedures to ensure that standards, policies, etc are adhered to	5.4	1.2
Develop reliable applications	5.5	1.0
Establish chargeback criteria	5.0	1.2
Standardize hardware and software	5.7	1.2
Improve system performance	5.3	1.1
Support software packages	5.5	1.1
Find cost-effective solutions	5.4	1.1

Factor Rating Scale: (1) Extremely low, (2) Very low, (3) Somewhat low, (4) Neither, (5) Somewhat high, (6) Very high, (7) Extremely high.

Table 1: IC Performance Ratings

ware tools, and technical support and maintenance. Respondents were prompted to add other items to the list and were asked to specify how well their organization as a whole had performed the particular activity using a scale which ranged from (1) extremely poorly, (2) very poorly, (3) poorly, (4) adequately, (5) well, (6) very well, and (7) extremely well. The average rating for these nine items represented the measure for organization EUC support and management effectiveness. The internal consistency reliability coefficient (Cronbach’s alpha) for this scale was .97.

IC Performance. The IC level of success was measured with the 26-item scale developed by Magal, et al. [1988]. The data collection instrument asked each respondent to indicate the level of their IC’s performance along each of the CSFs. A seven-point Likert scale was provided, with response options ranging from (1) extremely low to (7) extremely high. The average rating for each of these 26 items are shown in Table 1. According to Magal, et al. [1988], the measure of CSFs incorporates five groups of factors important to IC success: (1) commitment to the IC concept; (2) quality of IC support services; (3) facilitation of end-user computing; (4) role clarity; and (5) coordination of end-user computing. The five

Factor	Mean	S.D.	1	2	3	4	5
1. Commitment to the IC concept	4.98	0.80	1.00				
2. Quality of IC support services	4.99	0.84	0.68	1.00			
3. Facilitation of end user computing	5.23	0.86	0.52	0.82	1.00		
4. Role clarity	4.71	0.76	0.70	0.76	0.74	1.00	
5. Coordination of end user computing	5.12	0.85	0.65	0.78	0.80	0.84	1.00

All the correlations are significant at $p < .001$.

Factor Rating Scale: (1) Extremely low, (2) Very low, (3) Somewhat low, (4) Neither low nor high, (5) Somewhat high, (6) Very high, and (7) Extremely high.

Table 2: Intercorrelations Among Rating for the Five Critical Success Factors of IC

items in the group labeled commitment to the IC concept and role clarity group (also five items) had Cronbach's alphas of .75 and .72, respectively. The six items of quality of IC support services and facilitation of end-user computing had alpha reliability estimates of .85 and .89, respectively. Finally, the four items of coordination of end-user computing had an alpha of .81. Table 2 presents the matrix of intercorrelations among the five factors. In view of high average correlation among the factors, a second order factor analysis [Nunnally, 1978] was conducted to test for underlying homogeneity in the five factors. The results showed a single factor solution (eigenvalue of 3.79), which accounted for 75.7% of the explained variance. Therefore, the 26 items from the five factors were aggregated and averaged to create a composite measure of overall CSF for IC. The alpha reliability coefficient of the resulting 26-item scale was .98, thus confirming the homogeneity of the items and the appropriateness of combining them.

Company Payoffs From EUC or EUC Success. Eighteen items were adopted from Venkatraman and Ramanujam [1987] to measure the two individual dimensions of EUC payoffs--capabilities and objectives. The capabilities dimension was measured by twelve items, and the objectives dimension was measured by the remaining six items. Each item in the capabilities group was measured by a five-point Likert-type scale ranging from (1) it has been detrimental to (5) great improvement. Responses to the twelve items comprising this dimension were averaged to create a scale tapping the capabilities dimension of EUC success or company payoffs. The six items in the objectives group were measured by a five-point scale ranging from (1) entirely unfulfilled to (5) entirely fulfilled. Responses to those six points were averaged to create a measure for the objectives dimension of EUC success. The internal consistency coefficients for the capabilities and objectives scales were .80 and .71, respectively.

The hypothesis that the capabilities dimension would have a direct effect on the objectives dimension is corroborated ($r = .73, p < .01$). In contrast with the suggestions of Venkatraman and Ramanujam [1987], the high correlation indicates that we should not treat them as separate constructs, and should instead be combined into one dimension. A second order factor analysis [Nunnally, 1978] was conducted to test

for underlying homogeneity in the capabilities and objectives scales. The results show that one major factor (eigenvalue of 1.96) explained 73.2 percent of the variance. The high correlation and the results from factor analysis strongly support the conclusion that discrimination between the two dimensions cannot be made; therefore, the two dimensions together reflect a "super" construct and should not be considered as distinct dimensions. Also, some items in the two dimensions have shades of common meaning, so we can also argue intuitively that both dimensions are not distinct dimensions. For all subsequent analysis, the ratings on the entire set of 18 items were aggregated and averaged to produce a composite indicator of EUC success. The items were recoded such that high scores reflected improvement in the company's performance as a result of EUC. The alpha reliability coefficient of the resulting eighteen-item scale was .68 which is barely below the commonly accepted level of .70, further confirming the homogeneity of the items and the appropriateness of combining them.

Results

EUC Status Report

The IC Organizations. Most organizations participating in this study (75%) have a formally recognized group of people (Information Center or IC) responsible for supporting (training, help desk, etc.) EUC in the organization. The questionnaire used for this study explicitly defined EUC as activities of "non-MIS workers using computer facilities to support their work." The location of the ICs varied from company to company with 85 (53%) located within the MIS department, 27 (17%) within end-user departments, 35 (22%) as an independent organization unit, and 14 (9%) have been outsourced. Of the 54 organizations without an IC, twenty-nine (54%) are planning to form such a group. For the organizations with formal ICs, the following are the latter's average statistics: years in existence: 6.9 years; staff size: 8.0 persons; ratio of staff to users: 1 to 52; yearly budget: \$694,400.

Most respondents (75.2%) expect increasing budgets for their organization's ICs. For those ICs, the average yearly

ACTIVITY	MIS Dept.	GROUP				Separate IC
		IC within MIS Dept.	IC within End-User Dept.	Ind. End-User Dept. do their own	Outsiders	
Resource						
Acquisition	51.5 n=187	43.2 n=84	29.7 n=30	17.2 n=136	13.7 n=81	33.9 n=94
Planning	52.5 n=105	54.1 n=42	51.2 n=13	46.2 n=41	n=0	86.2 n=20
Mgmt. & Control	39.0 n=193	39.1 n=80	30.4 n=29	37.0 n=186	10.0 n=2	31.0 n=76
LAN Mgmt.	58.6 n=113	55.0 n=53	21.0 n=15	48.3 n=25	17.9 n=49	45.4 n=25
Training	37.3 n=169	41.8 n=81	43.2 n=28	45.8 n=69	31.3 n=93	52.5 n=44
Consulting	37.2 n=190	59.1 n=82	47.6 n=23	22.3 n=160	60.0 n=23	64.0 n=35
Help Desk	31.7 n=123	67.6 n=64	77.3 n=25	70.9 n=22	50.6 n=5	85.5 n=27
Development w/ Spec. Package	37.1 n=186	26.8 n=80	24.2 n=25	46.2 n=183	25.4 n=13	37.4 n=35
Tech. Support/ Maintenance	55.9 n=186	37.1 n=86	43.8 n=30	20.7 n=66	38.6 n=85	30.3 n=34

Note: Table cells contain average percentages, thus columns or rows will not add evenly to equal 100 percent.

Table 3: Identifying EUC Support/Management Task Responsibility

ACTIVITY	MIS Dept.	GROUP				Separate IC
		IC within MIS Dept.	IC within User Dept.	Ind. End User Dept. do their own	Outsiders	
Resource						
Acquisition	3.8 n=195	2.7 n=82	2.4 n=27	2.4 n=142	3.0 n=90	2.5 n=35
Planning	3.5 n=110	3.2 n=36	3.2 n=13	3.4 n=47	2.7 n=9	3.3 n=15
Mgmt. & Control	3.1 n=200	2.9 n=80	3.1 n=27	3.2 n=190	2.6 n=5	2.7 n=33
LAN Mgmt.	3.6 n=116	3.3 n=48	3.2 n=17	3.0 n=39	3.3 n=55	3.1 n=20
Training	3.1 n=197	3.2 n=76	3.3 n=25	3.5 n=70	3.4 n=89	2.8 n=31
Consulting	3.1 n=191	3.3 n=81	2.9 n=23	3.9 n=172	3.6 n=52	3.3 n=35
Help Desk	3.3 n=137	3.3 n=60	3.0 n=21	3.4 n=37	3.0 n=8	3.4 n=27
Sys. Dev. with Spec. Package	3.5 n=190	3.2 n=78	3.0 n=27	3.7 n=193	3.7 n=40	3.4 n=35
Tech.Support/ Maintenance	3.3 n=195	2.9 n=83	2.9 n=27	2.9 n=71	3.2 n=87	3.1 n=34

Rating Scale: 1=decreasing greatly, 2=decreasing, 3=neither, 4=increasing, 5=increasing greatly.

Table 4: Identifying Shifts in EUC Support/Management Task Responsibility

budget is approximately \$574,000 and it is expected to increase by approximately 5.9 percent on the average. For ICs being targeted for a budget decrease, the average budget is approximately \$1 million and the average budget decrease is expected to be approximately 7.7 percent. There are a few dramatic budget increases and decreases in the range of 15 to 30 percent; but, for most ICs the change is considerably milder. For approximately 90 percent of all ICs, the changes are below 14 percent.

Besides the IC staff or in lieu of the IC staff, most companies (93%) have reported other personnel informally engaged in EUC support activities. The number of people in this category varies dramatically from company to company with the average number being 21.1 with a standard deviation of 18.5 people. In most organizations (95%), the number of people is expected to increase by approximately 11 percent on the average with a few dramatic increases in the range of 30 to 60 percent.

Among others, a key IC task in many organizations is

user training. The number of end-users trained monthly by the IC provides a good measure of the IC user-support activity. In the 180 organizations with a valid response for this question, on the average 34 users were trained monthly. This number is expected to grow by an average of 4 percent with a few respondents reporting growth expectations of 25 percent or above. In 34 organizations, the number of users trained by the IC is expected to decline. For these organizations, the average number of users being trained per month is 50 and the expected percentage decrease is 10.3.

EUC Support/Management Task Responsibility. Table 3 shows the average percentage of each EUC support activity (task or service) being performed by each group. In the 187 organizations where the MIS department participates in the resource acquisition for EUC, on the average they perform approximately half of the total task (51.5%). On the average, MIS departments seem to provide a major portion of the service in the areas of resource acquisition, planning, LAN management, and technical support and maintenance. However, the IC is not far behind. For example, in the 27

Activities	Avg	Std. Dev.
Resource Acquisition (n=215)	4.7	1.3
Planning (n=215)	3.7	1.6
Management & Control (n=215)	4.3	1.3
LAN Management (n=140)	4.5	1.2
Training (n=215)	4.2	1.4
Consulting (n=203)	4.6	1.3
Help Desk (n=159)	4.4	1.2
Development with Specific Package (n=208)	4.6	1.4
Technical Support/Maint. (n=209)	4.5	1.4

Factor Rating Scale: (1) Extremely Poorly, (2) Very Poorly, (3) Poorly, (4) Adequately, (5) Well, (6) Very Well, (7) Extremely Well.

Table 5: Assessing Company Performance of EUC Support/Management Activities

companies with ICs located within user departments, on the average 43.8 percent of the technical support and maintenance is being provided by the IC. For some services, such as the help desk, in comparison with the MIS department, the ICs within user departments and within MIS departments on the average, provide 77.3 and 67.6 percent of the service, respectively. Outsiders on average perform 13.7 percent of the resource acquisition work for the 81 organizations using their services in this area, and they on average deliver 31.3 percent of the training for 93 of the firms surveyed.

Shifts in EUC Support/Management Task Responsibility. Table 4 shows average ratings for whether the performance of each particular activity by the different groups is increasing/decreasing. While the shifts within individual

organizations is in many cases more dramatic, on the average the primary responsibility for specific tasks is relatively stable. Nevertheless, some patterns can be gleaned from the table. MIS departments on the average are increasing the level of activity in resource acquisition (3.8), planning (3.5), and systems development with specific software packages available in their organization (3.5). User departments are also stepping up some activities such as planning (3.4), training (3.5), consulting (3.9), and systems development (3.7). Apparently, resource acquisition is on average being centralized under MIS departments and away from the other parties. The overall picture is that on average the burden of supporting and managing end-user computing is growing so fast that for some activities all groups will have increased workloads.

Company Performance of EUC Support/Management Activities. Table 5 indicates how well, on the average, the organization—as a whole—has, up to now, performed the EUC support/management activities. Except for planning, which has an average rating of 3.7, organizations are on average performing somewhere between adequate and well on the various activities. However, the relatively large standard deviations from the mean suggest that many organizations are doing poorly and need to assess their present performance along those activities and take measures to increase effectiveness.

IC Performance Ratings. Table 1 shows the average ratings for the ICs performance along each of the 26 dimensions previously defined. On the average, ICs are performing reasonably well. However, there is considerable performance differences from company to company. This suggests the need for organizations to increase IC personnel training and to attempt to learn from leading organizations by joining user

Key Capabilities	Mean Score	Std. Dev.
1. Ability to anticipate surprises and crises	2.9	0.7
2. Flexibility to adapt to unanticipated changes	2.9	0.8
3. Ability to identify new business opportunities	2.8	0.9
4. Ability to identify problem areas	2.7	0.8
5. Ability to foster managerial motivation	2.9	0.7
6. Ability to enhance the generation of new ideas	2.9	1.0
7. Ability to communicate top management's expectation down the line	2.9	0.7
8. Ability to foster management control	2.7	0.8
9. Ability to foster organizational learning	3.3	0.8
10. Ability to communicate line managers' concerns to top management	2.8	0.8
11. Ability to integrate diverse functions and operations	2.7	0.8
12. Ability to enhance innovation	2.7	0.9
Key Objectives:		
1. Enhancing management development	2.8	0.8
2. Predicting future trends	2.7	0.8
3. Short-term performance	2.8	0.8
4. Long-term performance	2.7	0.9
5. Evaluating alternatives based on more relevant information	2.9	0.7
6. Avoiding problem areas	2.7	0.8

Capabilities and Objectives Rating Scale:
 (1) It has been detrimental, (2) No improvement at all, (3) Little improvement, (4) Substantial improvement, and (5) Great improvement.

Table 6: Assessing the Impact (Payoffs) of EUC on the Organization

groups and other IC professional associations.

Impact of EUC on the Organization (Payoffs). Table 6 shows the respondents' opinions about the impact of EUC activities (payoffs) experienced by the organization along the 18 dimensions previously defined. The average payoff ratings are somewhat disappointing with all items except "fostering organizational learning" being rated somewhere between little improvement and no improvement at all. The encouraging news comes from the relatively large standard deviations showing that inter-company differences are significant, and that for many organizations, EUC activities have produced greater payoffs. Again, the significant inter-company variances suggest the need for lower performance organizations to attempt to bridge the gap by understanding the success factors to increase EUC payoffs to the organization.

Testing the Research Model

To build the crosstabulations shown in Table 7, based on the 33rd and 66th percentiles, companies were classified into low, medium and high in terms of EUC effectiveness, IC performance, and company payoffs. For all three crosstabulations, the relationship between the two variables involved is statistically significant at the 0.001 level or better. Table 7a shows a direct relationship between the ratings for EUC effectiveness and company payoffs. The Pearson's correlation coefficient for these two variables is 0.46, significant of the .01 level or better. Accordingly, we can say that EUC effectiveness can explain 21 percent of the variance in company payoffs from EUC. The evidence suggests that to increase the benefits from the growing investment in EUC technology, organizations must continuously strive to improve performance in the EUC support and management activities outlined earlier.

The main hypotheses in this study graphically shown in Figure 1, have been corroborated. Table 7b shows a direct relationship between IC performance ratings and company EUC effectiveness ratings. The Pearson's correlation coefficient for these two variables is 0.56, significant of the .01 level or better. Accordingly, we can say that EUC effectiveness can explain 31 percent of the variance in company payoffs from EUC. It suggests that an effective IC plays a very important role in increasing the effectiveness of EUC activities in an organization. Standard t-tests comparing EUC effectiveness for separate ICs versus ICs located within IS or user department revealed no significant differences at the 0.01 significance level. These results indicate that as long as the organization has made the commitment to support and manage EUC activities, and is doing so effectively, the level of company EUC effectiveness is on the average roughly the same.

Table 7c indicates a direct relationship between IC performance and company payoffs from EUC activities. The Pearson's correlation coefficient for these two variables is 0.42, significant of the .01 level or better. Accordingly, we can say that EUC effectiveness can explain 18 percent of the

a) Between EUC Effectiveness and Company EUC Payoffs

PAYOFFS:	EUC EFFECTIVENESS:			Row Totals
	Low	Medium	High	
Low	33	14	12	59
Medium	10	17	16	43
High	10	21	56	87
Column				
Totals	53	52	84	189

b) Between IC Performance and EUC Effectiveness

EUC EFFECTIVENESS:	IC PERFORMANCE:			Row Totals
	Low	Medium	High	
Low	19	14	0	33
Medium	15	31	10	56
High	7	26	48	81
Column				
Totals	41	71	58	170

c) Between IC Performance and Company EUC Payoffs

PAYOFFS:	IC PERFORMANCE:			Row Totals
	Low	Medium	High	
Low	21	18	4	43
Medium	8	16	13	37
High	9	32	41	82
Column				
Totals	38	66	58	162

Table 7: The Relationships Between The Major Variables

variance in company payoffs from EUC. The impact of IC performance is stronger (Pearson's correlation coefficient of 0.56) on company EUC effectiveness than on company payoffs from EUC (correlation coefficient of 0.42) probably reflecting the existence of a larger collection of factors relevant to company payoffs from EUC, besides IC and EUC effectiveness.

Conclusions and Managerial Recommendations

The level of EUC activity within most organizations continues to grow. This survey shows that organizations continue to invest resources to ensure that EUC activities are properly supported and managed. Most of the organizations surveyed are increasing their IC budgets. On the other hand,

organizations need to continue to struggle to establish more effective ways to support and manage EUC activities. Based on the results, several recommendations can be advanced.

The evidence from this study makes it clear that having some type of IC organization is linked to greater EUC effectiveness. Therefore, companies without a group of people dedicated to supporting and managing EUC activities should seriously consider establishing one. The question of which IC form to implement does not seem very important. Instead, corporate managers should concentrate on the important issues presently surrounding their company's EUC activities, and their IC, in whatever form it is most suitable to the organizations culture and modus operandi.

ICs seem to be a relatively inexpensive and valuable investment. The average yearly IC budget for the companies surveyed is \$694,400 and that is a small price for organizations with gross revenues close to \$750 million (the sample average), if it will move the company from a 3.2 (poor performance) company EUC effectiveness rating (average for companies with no IC) to a 4.3 (adequate performance) average rating for companies with an IC. This is particularly important given the significant relationship between company EUC effectiveness and company payoffs from EUC.

To IS and IC managers, as well as end-user department managers, the study suggests the need for close cooperation. In large companies, the IC organization represents a small island of support and management for EUC. If there are too many players performing unrelated EUC activities throughout the company and no one with formal authority and responsibility to take inventory, integrate effort, facilitate resource sharing, and arbitrate disputes, there is likely to be considerable "re-inventing of the wheel" and unnecessary learning by trial and error. Organizations need an integrative mechanism which can look at EUC from a corporate perspective, look at user needs for support and training, look at resources available, establish mechanisms to share these resources and information about them, and ensure that the various EUC support and management activities outlined in this report are being effectively performed.

IC managers should look at the list of IC performance dimensions used in this study and assess their IC's performance along each dimension to possibly identify and correct deficiency areas. A survey of end-user opinions is likely to provide clues as to which IC services need to be improved. If the companies in this study are an accurate representation of the whole population, many companies need substantial improvement to catch up with companies performing more effectively along each dimension. This is particularly true in the area of training for IC staff which has the lowest average effectiveness rating and the highest inter-company variance.

The results from this study strongly suggest that user computing requires a great deal of support. Corporate managers can ignore the evidence presented and not establish an IC due to lack of resources or will; or for the same reasons, they

can disband the IC which has already been established. However, the users' needs for effective EUC will not go away in the foreseeable future. Sooner or later organizations will have to pay for the consequences of neglecting EUC support. Later is likely to be more expensive and the costs are increasingly higher as EUC environments move from a few microcomputers to widespread networks with large numbers of workstations, servers, databases, and entrenched bad habits.

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