

최종 사용자 전산에서 정보센터의 역할

이 성열* 강 신철**

Evolving IC's Role in End User Computing

End-User Computing (EUC) is one of the most significant developments in corporate computing in the 1980's. An information center (IC) supports EUC by providing end-users with technical assistance and consulting services.

This study investigates the effective management and implementation of an IC in an organization with respect to the three sociotechnical factors : characteristics of end-users, social relationships with the DP/MIS department, and 3) technological infrastructure of EUC.

An exploratory framework for managing IC is developed based on extensive literature review and results from interviews with IC directors of 17 large companies in the midwestern region in U.S.A.

I. Introduction

End-user computing (EUC) is one of the most significant developments in corporate computing in the 1980's. It is a rapidly growing segment of information systems (IS) activity. The capacity of users to have direct control of their own computing needs has come to be referred to as end-user computing (Davis and Olson, 1985).

Hackathorn (1987) defines EUC as an information processing activity in which the end user has direct personal control over all stages of the activity. End user computing is often referred to as programming by end users (Canning, 1981) or user development of computer-based applications (McLean, 1979; Rivard and Huuff, 1988).

An information center (IC) supports EUC

* 사회회계법인 경영자문부, 단국대학교 강사

** 목원대학교 전임강사

by providing end-users with technical assistance and consulting services so that an organization can fully utilize the benefits of EUC. It also establishes control by providing rules and guidelines so that the organization can minimize risks from EUC. Much of the previous research on the management of IC's have focused on the specific characteristics of IC's isolated from its sociotechnical environments.

There are three sociotechnical factors affecting the implementation of an IC. They are: 1) characteristics of end-users, 2) social relationships with the DP/MIS department, and 3) technological infrastructure of EUC.

The present study investigates the effective management and implementation of an IC in an organization with respect to the three sociotechnical factors.

An exploratory framework for managing an IC is developed, based on extensive literature review and results from interviews with IC directors of 17 large companies in the midwestern region in the U. S. A.,

The framework focused on the following issues:

- 1) How the evolving stages of EUC can be elucidated by characteristics of end-users and technological infrastructure,
- 2) How the role of an information center changes as EUC evolves through its stages in an organization,

- 3) How the relationship between an information center and MIS department changes as EUC evolves through its stages in an organization,

I. Previous Research

1. End-user Computing

Organizational efforts to modernize office works and dramatic advancement of computing technology have made EUC an eye-catching phenomenon over the past decade. Mclean(1979) explained the increasing interest in EUC as a solution for the massive application backlog in computer based information systems. Decreases in hardware cost and user-friendly software also contribute to the proliferation of EUC (Rivard & Huff, 1984; Rivard, 1987). The effective management of EUC is the primary current issue in the field of MIS and its future prospect is promising (Benjamin, 1982; Rockart & Flannery, 1983; Benson, 1983).

The definition of end-users is important in identifying characteristics of users in different stages of EUC.

Rockart and flannery's categorization (1983) is most comprehensive; nonprogramming end-user, command level end-user, end-user programmers, functional support personnel, end-user computing support personnel, and data processing programmers. End-users may be more narrowly defined as those persons who interact with a computer as part of

their job but are not programmers or analysts (Yaverbaum, 1988). In present study, end-user are defined as those who have direct control over their computing activities, but are not programmers or analysts.

Reduction of the application project backlogs and the application main-tenance load is identified as benefits from EUC (McLean, 1979; Rivard & Huff, 1984). Competitive advantage from implementing EUC (Henderson & Treacy, 1986; Gerrity & Rockart, 1986) is found to be a rationale for adopting EUC. Increased individual performance, increased learning, improved internal organizational effectiveness, the decreased fears, and the resolution of myopia, etc. are identified as benefits of EUC (Gerrity & Rockart, 1986)

Although EUC benefits organizations, it also causes problems.

Improper documentation, data backup, data integrity, and security are pointed out as problems of EUC (Benson, 1983; Guimaraes, 1986).

Alienation, dehumanization, lack of communication, and decrease in social integration, are expected to occur (Rivard, 1984).

2. Information Center

In order to take advantage of EUC benefits and minimize risks from EUC, and appropriate level of organizational support and control is required. Establishing control by setting consistent

guidelines,

rules, or standards is suggested as a way of improving data integrity,

data security, and system compa-tibility (Davis & Olson, 1985; Sprague & Mcnurlin, 1986). However such overt control might deprive users of entrepreneurship, resulting in inhibiting users from taking full advantages of EUC by imposing too severe regulations on users.

It becomes an important issue to find an optimal level of control which prohibits risks from EUC, while not driving users to "sign-off" or "turn-down."

Accompanied by the appropriate level of control, technical and organizational support is also imperative for successful EUC. Training and education are suggested for supporting EUC (Benson 1983; Brancheau, Vogel & Wetherbee, 1985; Henderson & Treacy, 1986; Leitheiser & Wetherbe, 1986; Gerrity & Rockart, 1986; Sumner & Klepper, 1987). Top management support is also perceived as an important component for the successful EUC (Benson, 1983).

Thus, provision of various levels of support for the end users enables the organization to help users overcome the problems and becomes a necessary condition for the successful EUC implementation.

All the controlling and supporting activities are manifested in the role of the IC.

The information center educates users

and provides technical assistance as well as functional knowledge in developing end-user applications. This support center will also assume the role of controlling end users such as enforcing standard policies in terms of hardware and software acquisitions in a very unobtrusive way to avoid discouraging the growth of end-user computing. The information center is the popular choice in many organizations as a central core

in the organization to provide various types of support and control activities.

3. Traditional Models for IC's Role

In mid-seventies, IBM Canada, recognizing the growth of EUC and being unable to respond to the large number of requests for new systems from users, established a support group to help users satisfy their information needs directly (Hammond, 1982). Hammond described the IBM concept of an information center and defined it as a portion of the IS development resource organized and dedicated to support the users of IS services by providing technical support and consulting services.

The IBM/Hammond model describes the role of an IC primarily for IBM mainframes. Microcomputers are now the major force in driving the growth of end user computing. PC users are usually more independent from the central MIS policy. The expansion of PC's into the corporate organization requires many new support services related to PC issues such as connectivity and independent work-

group.

Recognizing this new trend, Leitheiser and Wetherbe (1986) listed the basic support activities for end user computing. They are advising, backup, compatibility, development, documentation, hot-line, list resources, maintenance, data transfer, newsletter, purchase assistance, recovery, research products, and training. Davis and Olson (1985) defined the specific support the IC should provide:

- 1) technical assistance in writing instructions in a very high level language.
- 2) education in the use of high level languages and developmental tools
- 3) assistance in accessing data
- 4) assistance in debugging
- 5) access to reference material on facilities, databases, etc.
- 6) administrative support with various computing procedures

Being aware of the changing role of ICs with the growth of end user computing, several researchers attempted to identify lists of support and control activities to identify lists of support and control activities in different growth stages. Henderson and Treacy (1986) developed the three stage normative model for EUC management termed as Initiation, Integration, and Mature stage. In the initiation stage, with the objective of increased usage, user satisfaction, and diffusing of technology, implementation and marketing perspectives are proposed, emphasizing education and minimal control. An operation perspective, in the integration stage, is employed with the objective of integration and efficiency. In

this stage, centralized policies are needed to ensure data integrity and security and to develop technological standards to facilitate integration and efficiency. In the last stage, an economic perspective is adopted to achieve competitive advantage by linking the IS plan to strategy. Distributed operations and incentive systems are recommended.

The five stage descriptive growth model for EUC management developed by Huff, Munro, and Martin (1988) is based on Nolan's stage model. They named the five stages as isolation, stand-alone, manual integration, automated integration, and distributed integration.

Brown and Bostrom (1988) proposed a two-stage model consisting of the initial and the integration stage.

The previous stage models ignored the growth of hardware or technological infrastructure. Since end-user computing activities are more closely related to individual user's activities, the hardware an user can access is an important consideration. The dominant computer type used in end-user computing is the personal computer. Norton and Evans (1988), based on their extensive experience with Nolan, Norton & Company, described the typical growth pattern of personal computers in an organization as three phases. The first phase is characterized as stand-alone PC's where the improvement of individual productivity is the main goal. In the second phase, PC's are connected to each other by a local area network (LAN) so

that work group station concept becomes popular in the organization. In the third phase, local LAN's are connected to one another and to the corporate mainframe so that the entire organization is electronically linked.

As evidenced in the literature review, there has not been an attempt to develop a sociotechnical model in IC. The present study incorporates users' characteristics and technological factors in the consideration of the role of IC's with the involvement of EUC.

III. Analysis of the Interviews

In order to obtain more practical insights into the effective IC's role, a series of on-site interviews was conducted. A total of seventeen companies located in the Midwest area in the United States participated in the study. As shown in Table 1, most of these companies have been in the service industry for more than 30 years.

The minimum number of employees in each company is 300, and their annual sales range from several hundred thousand dollars to several million dollars.

Of the total of seventeen companies, only two did not have a formal information center (IC). In these two companies (Company Code 1 & 7), instead, end users receive technical assistance and guides from an EUC

director working in DP/MIS who is assigned to solely take care of end user,

Questions concerning benefits and disadvantages in implementing end user computing (EUC) were asked of interviewees. Potential benefits examined in the interview include overall EUC successfulness,

DP time reduction, DP backlog reduction, user needs met, and improvement in decision making performance. The disadvantages include problems in important data loss, data compatibility, user privacy, and inefficient use of computing resources due to redundant data. Because the reliability of measurement scales for these variables is questionable and the sample size ($n=17$) is too small, a rigorous statistical test cannot be made for these variables. However, they suffice for the purpose of gathering exploratory data to develop a normative model in IC.

Their overall estimate of EUC success ranges from 3 to 5 on a 5-point Likert-type scale. The overall success of end user computing in the host companies was reaffirmed by the fact that eleven of seventeen companies agreed that information system development time in their DP department had been reduced since introducing end user computing. About seventy percent of companies believed that user developed information systems better meet users' information requirements and more than eighty percent of the respondents agreed that decision making performance had been improved

since implementing EUC.

With regard to disadvantages of EUC, most companies (83%) very rarely or never experienced data loss problems. Data incompatibility was pointed to as a minor problem in two companies, a user privacy problem was not found among the surveyed companies. Overall, the host companies had benefited rather than having problems by implementing end user computing.

The basic assumptions in previous research (Nolan, 1979; McFarlan and McKenney, 1983; Munro, Huff, and Moore, 1988; Henderson and Treacy, 1986) had been that IC is a subunit of the MIS/DP department or, at most, an independent staff supporting a specific functional unit such as a finance department or a marketing department. In current study, however, three out of 17 companies have been found to have an organizational-level IC. Contrary to previous research, ICs in these companies are dominating almost all phases of computing activities, from system planning to implementation. MIS/DP department still exists in those companies, but as a subdivision, not as a superior.

Another important finding with the companies having successful ICs is that they are all exercising "power" over end users to a minimal extent. They do not overtly enforce regulations or policies

upon users, while encouraging extensive user involvement in almost all phases of the system development life cycle. They

Table 1

Company Cod	Products & Service	Number of Employees	Annual Sales	Company Age (Years)	DP/MIS Age (Years)	IC
01	Research Lab.	2	3	55	25	0
02	Communication	3	4	25	25	1
03	Marketing	1	2	30	12	1
04	Mailing	2	3	45	11	1
05	Computing	1	2	24	24	1
06	Banking	2	4	87	24	1
07	Telephone	4	4	40	40	0
08	Education	4	4	99	29	1
09	Finance	4	4	90	30	1
10	Utility	4	4	29	29	1
11	Insurance	4	4	43	43	1
12	Banking	2	4	82	30	1
13	Insurance	4	4	66	15	1
14	Mailing	2	4	45	15	1
15	Utility	1	4	30	21	1
16	Hospital	2	4	75	22	1
17	Utility	4	4	44	25	1

Note: Number of Employees, 1:300-500, 2:500-1000

3:1000-2000, 4:More than 2000. Annual Sales, 1:less than 1 mil., 2:1-5 million, 3:5-10 million, 4:more than 10 million.

IC 0: not existing, 1:existing.

are, to a great extent, responsive to comments, suggestions, and requests from end users. There is only one exception, which is common in all seventeen organizations, in that users are not allowed to have a say in the selection of the programming language and data base organization. This finding is closely related to the fact that only a few organization has data integrity, data security, or incompatible software problems. Early awareness of risks from EUC might prevent those problems from arising in those successful organizations. However the important point that should be mentioned here is the fact that none of these IC managers has ever heard complaints from end users about the policy. There can be two possible reasons;

end users never realized that they could have a say in the selection of language and data base organization, or the IC managers deliberately controlled their end users without hurting their autonomy. During interviews with the directors of IC's in these companies, two issues were mentioned frequently, as a critical matter in managing EUC. These issues are:

- 1) Management of balance between control and slack
- 2) Redefinition of IC's role in the evolution of EUC, in particular, in its relations to the role of MIS departments.

In summary, as found from interviews with IC managers, the role of the IC is

evolving into a more comprehensive concept than most academics understand now. This is occurring as modern business workers become more computer literate and end-user computing is utilized as a competitive weapon in some organizations. It is also recognized that a higher level of managerial skill in balancing control and support is required to take a full advantage of EUC.

IV. Development of a Normative Model

A new framework for the IC's role in different stage of EUC is developed based on previous research and findings from the on-site interviews. The three stages are termed individual EUC, group EUC and organizational EUC. The role of an IC and its relationship with MIS department changes as EUC evolves through the stages. Note that the three stages are not in temporal order, but in logical order.

The high stages cannot stand alone without having the features of the lower stages. However, the lower stages do not have to progress to the higher stages if they are optimal in a given situation. The description of each stage and the changes in IC's role and relationship with MIS department are summarized in Table 2.

1. Individual EUC

The individual stage is brought on by either self starters or top management recognizing the advantages of EUC.

In this stage, EUC activities are characterized as transforming individual tasks into computerized information systems. The improvement of individual productivity is the main goal. Typical users in this stage work with stand-alone PC's.

Software packages may be purchased or developed by users but these are run in a stand-alone fashion, usually aiding individual decision making. Data sharing among users is extremely limited.

In this stage, the role of the IC department is to encourage more knowledge workers to become involved with end-user computing activities. As Henderson and Treacy (1986) asserted, the IC department should employ implementation and marketing perspectives.

Referring to the strategic choice, slack environment is likely to be employed in this stage. Thus, the main goals of the information center should be 1) to increase the usage of the computing resources by end-users, and 2) diffuse end-user computing concepts throughout the user communities.

End users in this stage are relatively naive. Thus, the emphasis should be placed on technical and education services by IC.

The typical services at this stage provided by IC are 1) education in the concept of end-user computing, 2) education in the use of high level languages and development tools, 3) technical assistance in writing this stage

is to increase the productivity of each work group.

In this stage, the strategic choice between control and slack typically depends on the specific organization. This is the stage where EUC is spread in the organization at the departmental level.

Determining the pace at which EUC is developed in the firm depends on the objectives, goals, financial resources available, or the commitment of management of the organization. For an

example, if the goal of a firm is growth maximization of EUC, this firm will choose the slack environment. There may be another case where a firm does not have much financial resources. The goal of this company may be controlled growth with a relatively small amount of the budget allocated to EUC. This firm is likely to go for the control environment. IC should recognize the goals of the organization and design its plans and services based on the objectives of the organization.

Table 2
EUC Growth Stages, IC's Technical Infrastructure

	Growth Stages		
	Individual EUC	Group EUC	Organizational EUC
Dominant User Type	Independent users	Functional work group	Park of integrated system
Typical Industry Example	Research Lab Hospital Telephone	Banking, Utility Insurance Education Computing Service	Financial Company Communication- Utility Company
EUC Infra-Structure	Stand-alon PC's Extremely limited data-sharing Hot-line Assistance	eDepartmental LAN Moderate use of corporate data Located around functional units	Corporate Network Extensive Corporate data-sharing Completely integrated EUC
IC's Role	Training & Education Market the benefits of EUC	Assist application development Help users transform work-process into IS	Taking a major responsibility of an IS Strategic use of EUC
Relation B/W IC & DP/MIS	subunit of DP/MIS	Coordination with DP/MIS	DP/MIS is a subunit of an I

At this stage, functional knowledge of the end-users' is expected to be influential in establishing the role of the IC.

Technically competent users recognize that a large portion of their work can be computerized. Consequently the application backlog for the DP department increases. The IC's role is to transfer this backlog to the users' responsibility. The IC's ability of transferring the created demands to the users is critical to the success for EUC.

2. Organizational EUC

A distinctive feature of this stage is the emphasis on organizational performance rather than on the work group or the individual. The changes required to evolve into the third phase are dramatic, calling for the transformation of the entire business. In this stage, work group processes are electronically combined in the same fundamental manner that individual tasks are combined in the second stage. According to Norton and Evans (1988), this transformation restructures the business to exploit a fully integrated corporate information services platform more effectively.

The changes in stage three carry a high degree of risk mainly because of the huge amount of financial resources needed to implement the changes. Because of this high risk, top management increased the commitment to EUC activities and try to achieve a certain level of control to reduce the risk while not reducing the benefits

obtained from EUC activities and try to achieve a certain level of control to reduce the risk while not reducing the benefits obtained from EUC.

One of the major roles IC should play in this stage is to bridge the gap between the users' desires and organization's goals as well as to balance control and slack.

To achieve this balance, IC should make each end-user have the discipline, skill, and personal computer technology sufficient to contribute to the organizational system.

The level of computer competency for individual end-user is important for the successful implementation of EUC.

The emphasized services in this stage are 1) assistance in accessing data, 2) access to reference material on facilities, data bases, and etc, 3) administrative support with various computing procedures, and 4) education of users in terms of data transfer, maintenance, compatibility of hardware and software, etc.

End-users in this stage are typically more sophisticated compared to the end-users in the last two stages. However naive user groups always exist in this mature level EUC. The heterogeneity of the end-user community complicates defining IC's role in this stage.

For multiple levels of end-users, IC should provide multiple services such as providing adequate level of technical assistance, education and train to both naive end-users and sophisticated users.

IV. Conclusion

The present study incorporates user characteristics, technological infrastructure, and the evolving nature of EUC while identifying the IC's role relative to the DP/MIS department. The

literature review and exploratory interviews revealed that the roles of the IC must be defined contingent upon the stages of EUC. Three stages of EUC evolution are identified according to the degree of computerization; individual, group, and organizational work transformation.

Another important finding from the interviews is that for companies in specific industries, EUC activities are so dominant in corporate computing that

information centers in those companies are completely separated from existing MIS departments and IC's are playing a much more important role than the DP/MIS departments. For some companies, DP/MIS departments are actually playing supportive roles for the IC's. In these firms, almost every manager is an end-user and EUC is just an every day work phenomenon and these companies have reached stage three of the EUC evolution. Thus, for the companies in the third stage, the IC is much more dominant in terms of power and budget compared to MIS departments and the DP/MIS department becomes the sub-unit of an IC. Further empirical study with larger sample is required to increase the external validity of these finding.

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◆ 저자소개 ◆

공동저자 이성열은 현재 단국대학교 강사, 세화 회계법인 경영자문으로 재직하고 있으며 연세대학교에서 영문학으로 박사학위를 받은 후 미주 마이아미대를 거쳐 네브라스카주립대학에서 경영학 박사학위를 취득하였다.

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