EUC CHARGEBACK SYSTEMS
AND THEIR IMPACTS ON END USER BEHAVIOR

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Abstract
Chargeback systems in an end user computing (EUC) environment were evaluated in an empirical survey of 16 organizations and 151 end users. The organizations were classified into six EUC chargeback system groups according to the extent of operation, development and investment costs absorbed in overhead, EDP-department control over microcomputer purchases and end user involvement in EUC budgeting. The six chargeback system types were strongly associated with organizational characteristics and moderately associated with EDP-departmental characteristics, but quite independent of user population characteristics. The impact of different chargeback systems on end user recognition of control was tested and verified in part. Neither chargeback systems nor recognition of control groups were associated with user variables. This is explained by the unique nature of EUC, which does not support the use of indirect control mechanisms such as chargeback systems to regulate demand.

Keywords: end user computing, chargeback.
1 Introduction

Chargeback systems are said to be important instruments in the management of IS resources. Firstly, it has been argued that they are a necessary financial control mechanism for senior management’s control over the EDP department. As such, they are used to track costs, analyze cost structure, and report on the performance of an EDP department. Secondly, chargeback systems can serve as a basis for fair cost allocation, as the EDP costs are tracked and divided among user groups according to some agreed principle (e.g., the extent of resource consumption). Thirdly, chargeback systems can be used to regulate demand for scarce EDP resources. This is done indirectly by pricing the EDP services, so that users are more aware, accountable and responsible for EDP costs. Fourthly, chargeback systems can be used to commit users to plan for future EDP needs (budgeting) and to take part in systems development. The importance of chargeback systems as a management instrument has been emphasized, especially during the monopolistic era of centralized EDP (Dearden & Nolan 1973, Bernard 1977, Nolan 1977b, McKell et al. 1979, Axelrod 1979), but it has also been recommended for managing end user computing (EUC) as well. (Hammond 1982, Alavi et al. 1988, Swider 1988). In principle, a chargeback system has two major tasks: to gather information systematically and to affect user behavior.

Although the importance of chargeback systems is generally accepted, the impacts on user behavior have been hard to detect in previous empirical chargeback studies, conducted mainly in a centralized computing environment. There are in fact some weaknesses in the studies (e.g., most studies are based on EDP-manager insights instead of user opinions and the environmental characteristics have not been taken adequately into account). Moreover, the impacts seem to be modest even in the monopolistic, centralized ‘one resource-many users’ environment. Nevertheless, we have some reason to doubt that the purported usefulness of chargeback systems as a means of control in an EUC environment is likely to decline further. The reasons for this are discussed below.

Together with the emergence of EUC, an increasing volume of EDP costs has shifted from EDP department control to end user budgets. More controllable budgets and the maturity and competitiveness of outside EDP service markets have made users more willing to turn to outside suppliers instead of overloaded EDP departments. This affects the position of EDP departments as the sole controller of EDP costs and supplier of EDP services, and therefore constrains the scope of the EDP department to set prices for its services, because pricing is said to work best in a monopolistic situation (Diehr 1975, McKell et al. 1979) or under centralized control (Stevens 1986, p. 5). EDP managers face a dilemma; they are left responsible for costs without the authority to control them.

On the other hand, attempts by senior management to convert EDP departments into profit-centers require increasing chargeback (Rifkin 1986, Allen 1987). Consequently, management’s need for information on the profitability of EUC multiplies as EUC emerges. Unfortunately, the EUC environment is of the
‘many-to-many’ type, i.e., multiple resources are used by multiple users. This makes an ideal chargeback system very complex, expensive and time-consuming to implement. Case studies by Butler (Butler & Sandford 1983) and Narinen (Narinen 1987) illustrate the difficulties entailed in development and implementation of chargeback systems.

In addition, the cost structure of EDP services has changed. The shift from production to service in EDP departments emphasizes the importance of support functions (e.g., training and hot-line), whereas the proportion of direct operating costs declines (Alavi et al., 1988, Saarinen et al. 1988). The biggest cost items, i.e., indirect operating and development costs as well as investment costs in user departments, tend to be invisible to the centralized chargeback system of an EDP department.

These trends and conflicting research results suggest that chargeback systems may not be effective enough to control the emergence of EUC.

2 Previous Empirical Research

Studies of chargeback systems can be classified as follows:

- General principles of EDP chargeback systems,
- EDP department cost allocation procedures,
- price setting for EDP services, and
- empirical studies of implementation and success of chargeback systems.

This study focuses exclusively on the empirical research. The results of the empirical studies have been mixed; chargeback systems are generally considered important, but unanimity concerning their impact on end user (or user manager) satisfaction, behavior or performance has not been reached.

The use of EDP chargeback systems is quite common; about half of the large or medium-sized organizations have some kind of chargeback system (Drury in 1980, 58%; Bergeron 1986a, about 40%). Chargeback systems are recommended in an EUC environment (Hammond 1982), but are seldom adequately implemented (Carr 1987a & 1987b).

Nolan (Nolan 1977a) tried to explain the variation in user manager attitudes toward IS with the characteristics of chargeback systems. Thirteen organizations and 170 user managers took part in the study. He concluded that the chargeback system has a slight positive effect on user manager attitudes in the advanced stages of the EDP function (see Nolan’s stage hypothesis in Nolan 1979). His regression model explained 4% of all variation in user manager attitudes. The main determining factor in the latter stages is the tendency to train user managers to understand chargeback systems.

Drury’s studies (1980 and 1982) comprise exploratory research on EDP chargeback practices. The questionnaire was answered by 173 senior data processing
officers in Canadian organizations. The monopolistic approach in charging for
EDP services seemed to be dominant, and the main goals of chargeback systems
were either to provide better control or to activate user/management involve-
ment. Simple methods, e.g. full costs, were used for charging. The advantages
of chargeback methods seemed vague. As Drury states, “almost half of the EDP
managers felt that users were fairly to highly susceptible to being oversold by
data processing and approximately \( \frac{2}{3} \) were slightly or not at all knowledgeable
about EDP costs and limitations” (Drury 1980).

Olson and Ives (1982) examined the association between chargeback system
and user involvement in systems development and user attitude toward the EDP
department in 23 organizations. No relationship between chargeback method
and user involvement in system development was detected, nor was it cited as
the primary goal of the chargeback system. User information satisfaction with the
chargeback system was of a higher degree in development-oriented (i.e. resource-
usage based) chargeback systems and among non-charged users. Users who were
paying for EDP services were more critical with regard to EDP efficiency. In
general, Olson and Ives noticed that the chargeback systems were rather coarse
and had no significant effect on user attitudes.

Bergeron’s (1986a and 1986b) study evaluates the use of chargeback informa-
tion from the end users’ point of view. He looks for factors that affect the use of
chargeback information on EDP operating and development costs. The factors
which seem to explain most of the variation in the use of chargeback information
are user accountability, user involvement and cost variability. These results sup-
port findings in budgeting research. In his criticism of Bergeron’s conclusions,
Weitzel (1987) interprets Bergeron’s results according to which user managers
use the chargeback information when they are made accountable for their EDP
costs. They are therefore obliged to become involved in the budgeting process,
provided that the costs are variable, not fixed. Weitzel further concludes that
at low levels of the quality of chargeback information as well as at low levels of
authority, chargeback information usage might drop off. This is because in the
former case the information is unusable and in the latter case the user cannot
affect his costs.

Choudhury et al. (1986) surveyed 43 IS managers from 17 organizations, which
do not employ a chargeback scheme. The questionnaire sought to determine
managers’ opinions on chargeback systems. The expected benefits concentrated
mainly on controlling IS resource usage and on maintaining (or achieving) equality
between departments. The assumed drawbacks of chargeback systems were their
complexity and costs, the risk of users turning to outside suppliers and a decline in
innovativeness. The managers seemed to desire a chargeback system, but did not
want to implement it. They preferred a cost-center approach to a profit-center
approach, and this was explained by the immature state of their information
systems, see (Nolan 1977a). They concluded, therefore, that the profit center
approach is not beneficial until the latter stages of EDP maturity.

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Nayle & Scacchi (1987) described the intangible EUC costs in six departments of a large educational institution. They concluded that indirect costs as well as additional social and political costs can be unexpectedly large. By indirect costs they mean costs arising from demands for user time, skill, expertise and attention. The social and political costs are caused by alterations in the way people do their jobs (Nayle & Scacchi 1987).

2.1 Chargeback System Dimensions

In previous studies the effects of chargeback on end users were evaluated mainly from the narrow chargeback system point of view. This means that a chargeback system is understood as an indirect mechanism for affecting user behavior by pricing services and producing reports on usage, thus increasing user cost awareness. In an EUC environment we accept a broad concept of chargeback by also including accountability, authority and involvement (Nolan 1977a, Bergeron 1986a and 1986b). These factors are often an inseparable part of EUC chargeback systems in the form of user participation in the budgeting process and user freedom to invest in EUC. As such, they represent more direct control over users than mere cost allocation and the pricing mechanism of traditional chargeback systems. In our study we therefore use the following three dimensions to classify chargeback systems:

A. **The extent of costs included in overhead.** This dimension represents the extent to which the costs are charged to users and to what extent absorbed in the organization’s overhead. The chargeable costs are commonly divided into operating and development costs (Hootman 1977, Sollenberger 1977, Olson & Ives 1982, Bergeron 1986a and 1986b).

Operating costs include the costs of using fixed, scarce mainframe capacity for EUC, and the maintenance costs of microcomputers. Mainframe usage is frequently measured in CPUs, I/Os and disk space. These factors are priced at a standard rate, which must cover the investment cost and the overhead costs of running the capacity. The standard rate can be varied according to the demand. Mainframe usage is entailed, because the majority of end users’ microcomputers are nowadays connected to main-frames.

Development costs include conventional EDP department man-hours for design, implementation and maintenance of applications. In an EUC environment this means less straightforward application development for end users, but more service-oriented support for training and hotlines.

Nowadays, especially in a microcomputer environment, capacity can be expanded in small increments. We therefore incorporate investment costs, which include initial, incremental and replacement investments in both EUC hardware and software.

EDP departments usually keep track of these three cost categories in an EUC environment (Heikkila 1986). Chargeable EUC costs (costs visible to
an EDP department) are primarily those of investment, of aiding in application development and in use of tools (e.g. support, training, hotline). In addition to these chargeable costs, there are intangible costs which are not visible to EDP department and will therefore not be included in chargeback. These intangible operating and development costs are realized directly in the end users’ work—mainly as opportunity costs (Nayle & Scacchi 1987, Heikkila 1988).

B. **The extent of user freedom to purchase EUC equipment** is used to illustrate the extent of user authority to invest in EUC technology.

C. **The extent of decentralization in budgeting EUC expenditures** shows how much user departments are involved in the planning of EUC resources and are accountable for their costs.

3 Research Setting

3.1 Research Questions

In our study we aim at five major questions:

1. What kind of EUC chargeback system types are there? We use the three dimensions of chargeback systems (discussed above) in classification.

2. Are chargeback system types associated with environmental characteristics? The environmental characteristics come from the organization, EDP department and user-population levels.

3. Does user recognition of control vary in different chargeback systems? By recognition of control we mean whether end users are aware of chargeback and purchasing policies.

4. Do user variables differ in distinct chargeback system types?

5. Do user variables differ according to user recognition of control?

The research questions are partitioned into hypotheses, and the hypotheses tested with survey data from 16 organizations and 151 end users.

3.2 Framework

A research framework was created in order to examine the research questions. The research framework is illustrated in Figure 1 and explained here, concurrently with hypotheses, in more detail.
3.3 The Hypotheses

The following hypotheses are derived from previous research in a centralized mainframe environment. In statistical tests they are assumed to be valid in an EUC environment and treated as null-hypotheses. The hypotheses are also positioned in Figure 1.

**H1**: The EUC chargeback systems differ depending on the organization, EDP department and user-population characteristics, e.g. in complexity as in (Nolan 1977a).

As we consider the organizational environment (Figure 1, top), it is more likely that EUC costs are charged back to end users if:

- the organization is large, because large organizations tend to be more formal,
- the proportion of EUC costs in total EDP costs is considerable,
- the organization prefers containing to accelerating EUC strategy.

EDP departmental characteristics encourage use of chargeback systems if

- EUC takes place in a mainframe environment,
- EUC is formally supported (e.g. with an information center) and formal support has existed for a long time,
- an EUC steering committee has been established.

The following user population characteristics may also affect the use of chargeback systems:

- most of the personnel are white collar workers,
- the more routine use (more secretaries than experts and managers) the more chargeback,
- end users have been acquainted with EUC for a long time.

**H2**: The controls in complex and strict EUC chargeback systems are more often noted by end users than in simple and liberal systems (Figure 1, middle). This is especially the case with managers who are responsible for their department’s EDP costs (Bergeron 1986a and 1986b). (Although Drury gives the opposite argument (Drury 1980)).

**H3a-e**: Differences in user variables, see Figure 1, bottom. Both the chargeback system type and recognition/ignorance of control are used to determine whether differences in user-related variables can be found. The variables are:

- share of application developing users,
satisfaction with the services provided,
further needs for services,
Sources of support,
effectiveness increase, impacts on work environment and information increase,
problems and critical success factors (CSFs) in EUC.

**H3a:** The more chargeback, the more user-driven application development will emerge, because users avoid direct costs by doing the work themselves. The proportion of application-developing users is compared between both chargeback system types and between recognition of control groups.

**H3b:** Users are more critical towards priced EUC services (Olson & Ives 1982). The amount and quality of services are likely to be considered less satisfactory than in free service organizations. User opinions are assessed on two indices. One illustrates satisfaction with services provided, and the other the importance of the service used (see appendix B).

**H3c:** Chargeback cuts and concentrates needs to a few essential ones (Drury 1980, Choudhury 1986). The variability of needs for services is greater in organizations where chargeback does not make users set priorities for their needs. The open-ended answers to desired future services were classified afterwards into 14 categories in terms of desired-not desired. The number of desired services was compared between chargeback system types and recognition of control groups.

**H3d:** Chargeback decreases the amount of computer use (Drury 1980) and thus its impacts on end user’s work (Stevens 1986). Charged support services urge users to turn to other sources of support than the EDP department; for example, more external training courses are taken.

**H3e:** Problems and critical success factors are affected by chargeback, because cost-aware end users learn to emphasize the essential. The users mentioned a few critical factors for successful EUC in open-ended questions, which were classified afterwards into eight variables, either critical or non-critical. The questions about problems were asked and classified similarly in eight classes.

### 4 Empirical Study

#### 4.1 Sample

The data were gathered in 1987 through in-depth interviews with IS managers and with a structured questionnaire sent to end users in user departments with
Figure 1: Research framework of this study
varying amounts of **EUC** experience; the end users were chosen by the IS managers. The survey was carried out in **16** organizations, which were all experienced **EDP** users. They were chosen to represent a mixture of organizations with and without a formal information center. The sixteen IS managers filled in a structured questionnaire beforehand, in order to prepare for the interview. Another questionnaire was sent to **14** of the selected end users for a test interview. The revised questionnaire was sent to a further **161** end users. The total response rate was **85%** and we therefore had answers from **151** users.

### 4.2 Results

An overview of results is presented here, but more detailed findings can be found in (Heikkila 1988). The research methods are reported in appendix A.

**Classification of EUC Chargeback Systems**

The classification is based on the three dimensions of chargeback systems:

- **EUC** costs absorbed in overhead,
- freedom to invest in **EUC** technology, and
- decentralization of budgeting.

The extent of costs in overhead is calculated on the basis of whether users pay for the cost category or not. The cost categories are:

1. Operating costs of mainframe and maintenance costs of micro-computers,
2. development costs of support and training, and
3. investments in hardware and software.

In our sample it was discovered that freedom to invest in **EUC** technology can be divided into four classes. Firstly, the purchases can be prohibited totally. Secondly, specific **EUC** equipment vendors and branches or, thirdly, purchasing channels (e.g. via **EDP** department) can be recommended. Finally, users can be allowed to buy whatever they want within their budgets.

The data in this sample showed that there are three main alternatives for budgeting. First, the budgets are made solely by **EDP** departments. Next, users are responsible for budgeting hardware and software costs and, thirdly, the training costs are also budgeted by users.

Six different chargeback groups were found on the basis of the answers of IS-managers about the chargeback system’s dimensions (see Figure 2 and appendix A). Although an attempt was also made to use other groupings (e.g. groups 1+2, 3+4, 5+6) to explain the variation, they did not work as well as the initial classification:
1. End users are charged for all costs; nothing is included in overhead. User purchases are prohibited and budgeting is centralized in the hands of the EDP department.

2. End users are charged for all costs. Users can purchase equipment freely, but budgeting is centralized.

3. End users are charged for all costs. Purchases are allowed without restrictions. Users budget their hardware and software investments as well as their training costs.

4. Either training or support are included in overhead. Purchasing is either restricted to a list of recommended equipment or handled by the EDP department. Users budget their microcomputer and software investments.

5. Training, support and mainframe use are included in overhead. Purchasing is restricted to a list of recommended equipment. Users budget their microcomputer and software investments.

6. All costs are included in overhead. Users are free to buy equipment, but no budgets are made.

The six groups are ordered from the strictest chargeback organizations to the no-chargeback organizations. The most complex chargeback systems seem to concentrate in the middle of the classification in groups 3, 4 and 5; the users are involved in the budgeting process and recommendation lists are composed for purchasing EUC equipment. Similarly, some form of compensation—i.e., costs transferred to overhead—is utilized, mostly for development costs (training or support) and sometimes for the operating costs (mainframe use and maintenance of equipment); investments in EUC equipment are not compensated. The simplest chargeback systems are groups 1, 2 and 6 (see Figure 2).

Environmental Characteristics of Chargeback Systems (H1)

Organizational characteristics seem to be associated with chargeback system type. Organizations with turnover in excess of FIM 2 billion (1 FIM ≈ 0.25 US$) or personnel in excess of 1000, follow a strict centralized chargeback practice (chargeback groups 1 and 2). The smaller the organization the more users are involved in budgeting, and the more freedom they have to purchase equipment. EUC strategy, as divided between accelerating and containing strategy (Saaksjarvi et al. 1988), is equally associated with chargeback system type, but in an unexpected way. The most restrictive and centralized chargeback systems are found mainly in accelerating organizations. The explanation may be that containing organizations try to decrease the pace of EUC emergence by leaving the business to end users. This might be interpreted as the ‘laissez-faire’ stage of chargeback systems. Chargeback system type is not associated with the proportion of EUC costs to EDP costs.
<table>
<thead>
<tr>
<th>Group</th>
<th>Costs in overhead</th>
<th>Purchase freedom</th>
<th>User budgets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (3) [23]</td>
<td>None</td>
<td>Prohibited</td>
<td>Nothing</td>
</tr>
<tr>
<td>2 (3) [63]</td>
<td>None</td>
<td>Unrestricted</td>
<td>Nothing</td>
</tr>
<tr>
<td>3 (2) [14]</td>
<td>None</td>
<td>Unrestricted</td>
<td>Hardware, software, and training</td>
</tr>
<tr>
<td>4 (4) [30]</td>
<td>Training or support</td>
<td>Centralized purchases</td>
<td>Hardware and software</td>
</tr>
<tr>
<td>5 (2) [16]</td>
<td>Training, support and mainframe use</td>
<td>Recommendation lists</td>
<td>Hardware and software</td>
</tr>
<tr>
<td>6 (2) [5]</td>
<td>All</td>
<td>Unrestricted</td>
<td>Nothing</td>
</tr>
</tbody>
</table>

Figure 2: Chargeback groups in this study. Key: (n) organisations, [n] EUs

Some EDP departmental characteristics are associated with EUC chargeback systems. If the ratio of microcomputers to terminals is over 40% (which is considered high in 1987), then most of the organizations seem to employ more complex chargeback systems, i.e. there is some form of compensation, users are allowed to purchase their own equipment according to recommendations and users are dedicated to budgeting (groups 3, 4 and 5). If the environment is mainframe dominated, the centralized approach is used. Existence of an IC and an EUC steering committee is associated with the more centralized chargeback system type (and with the organization’s size!). No variation in the size of the support function personnel can be distinguished between the groups.

User-population characteristics can be used only partly in explaining differences in chargeback systems. EDP experience seems to distinguish the most primitive chargeback groups (1 and 6) from more complex groups (2, 3, 4 and 5), but the result is not significant. This observation supports Nolan’s conclusion concerning the increase in complexity of chargeback in more advanced stages of EDP growth (here EUC growth). This result should be interpreted with care, because the sample was selected. The ratio of clerks to managers and experts could not be evaluated because of the sampling method.

As a summary, we can see that hypothesis one holds true for organizational characteristics, somewhat true for EDP department and not true for user-population characteristics.

**Chargeback System Impacts on User Recognition of Control (H2)**

Neither chargeback system complexity nor strictness is associated with user recognition of control. This is because the most complex chargeback systems are not
Figure 3: Association between environmental characteristics and chargeback system type (Hypothesis 1). The numbers represent organizations.

the most obvious, but the groups 2 and 6. The user’s organizational position is associated with recognition of control as stated in the hypothesis—managers notice control more often.

Chargeback System Impacts on User Variables (H3a-e)

The results are discussed here and presented in Figures 4 and 5. More detailed results can be found in (Heikkilä 1988).

Chargeback increases user driven application development (H3a). The number of users developing their own applications does not vary in the chargeback groups.

User satisfaction diminishes with priced services (H3b). Satisfaction with the services provided does not differ in any of the chargeback groups. The second index, which is the satisfaction rating weighted with the importance of utilized services, is lower in groups 1 and 4 than in group 5. (See appendix B for calculation of satisfaction indices). The hypothesis is rejected, however, because the user’s organizational position as an intervening variable causes some of the difference in the weighted satisfaction index.

<table>
<thead>
<tr>
<th>Observations in group</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<td>Turnover in mill. FIM: $t \leq 300$</td>
<td>3</td>
<td>1</td>
<td>2</td>
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<td>1</td>
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<td>$300 &lt; t \leq 2000$</td>
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<td>$2000 &lt; t$</td>
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<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2</td>
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<tr>
<td>Strategy: Accelerating</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Containing</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>2</td>
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<th>Observation in group</th>
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<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
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<tbody>
<tr>
<td>Ratio (micros/terminals): $r \leq 13%$</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>$13% &lt; r \leq 40%$</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>$40% &lt; r$</td>
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<td>2</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
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<td>Information center: Yes</td>
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<td>1</td>
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<td>2</td>
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<td>3</td>
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<td>1</td>
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<td>2</td>
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<tr>
<td>EUC steering committee: Yes</td>
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<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
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<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>2</td>
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</tbody>
</table>

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Figure 4: Difference in user-related variables (H3a-c). Key: (S) Significant difference, (NS) non-significant difference, and (ND) no difference was detected.

**Chargeback forces users to set priorities on the use of services (H3c).**
According to the hypothesis, the need for marginal services should be higher in less-chargeback employing organizations. The future needs differed significantly only with respect to the amount of desired support in application development, but not significantly.

**Chargeback decreases the use of computers and support services (H3d).**
The first part of the hypothesis is partially supported. Weekly computing hours were fewer in group 4 than in group 2. The sources of support for hotline and training services differed most.

A closer look reveals that on the average, the primary source for training sessions in group 2 was the EDP department. Groups 1 and 5, however, turn less frequently to EDP departments. The sheer size of group 1 organizations can explain the tendency to use training from one’s own user department. In group five users were encouraged by compensating for training costs, but users did not
H3d. Chargeback systems affect the use of computers and EDP departments services
- Help in choosing/purchasing equip.  S    ND
- Demonstrations of hw/sw     NS    NS
- Training sessions  NS    NS
- Hotline  ND    ND
- Person-to-person teaching  ND    ND
- Application development  ND    ND
- Extract databases  ND    ND

H3e. CSFs and problems are dissimilar:
Critical success factors
- Adequate resources  ND    ND
- Organization of EUC activities  ND    ND
- Availability of services  S    ND
- Understanding user needs and tasks  S    ND
- Support person’s personality  ND    ND
- Support person’s ability to comm.  ND    ND
- Support person’s expertise  ND    ND
- Training  ND    ND
Problems
- Purchasing process and incompat.  ND    ND
- Data availability and transfer  ND    ND
- Unsatisfactory equipment  NS    ND
- Peripherals  ND    ND
- Training and support  ND    ND
- Inadequate abilities  ND    ND
- Application development to others  ND    ND
- Others  ND    ND

<table>
<thead>
<tr>
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<th>Between chargeback type groups</th>
<th>Between recognition of control groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>H3d. Chargeback systems affect the use of computers and EDP departments services</td>
<td>S    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Help in choosing/purchasing equip.</td>
<td>S    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Demonstrations of hw/sw</td>
<td>NS    NS</td>
<td>NS    NS</td>
</tr>
<tr>
<td>Training sessions</td>
<td>NS    NS</td>
<td>NS    NS</td>
</tr>
<tr>
<td>Hotline</td>
<td>ND    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Person-to-person teaching</td>
<td>ND    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Application development</td>
<td>ND    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Extract databases</td>
<td>ND    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td></td>
<td>S    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Critical success factors</td>
<td>ND    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Adequate resources</td>
<td>ND    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Organization of EUC activities</td>
<td>ND    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Availability of services</td>
<td>S    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Understanding user needs and tasks</td>
<td>S    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Support person’s personality</td>
<td>ND    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Support person’s ability to comm.</td>
<td>ND    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Support person’s expertise</td>
<td>ND    ND</td>
<td>ND    ND</td>
</tr>
<tr>
<td>Training</td>
<td>ND    ND</td>
<td>ND    ND</td>
</tr>
</tbody>
</table>
| Problems
| Purchasing process and incompat.  | ND    ND                        | ND    ND |
| Data availability and transfer  | ND    ND                        | ND    ND |
| Unsatisfactory equipment  | NS    ND                        | ND    ND |
| Peripherals  | ND    ND                        | ND    ND |
| Training and support  | ND    ND                        | ND    ND |
| Inadequate abilities  | ND    ND                        | ND    ND |
| Application development to others  | ND    ND                        | ND    ND |
| Others  | ND    ND                        | ND    ND |

Figure 5: Difference in user-related variables (H3d-e). Key: (S) Significant difference, (NS) non-significant difference, and (ND) no difference was detected.
attend sessions. Hotline services from the EDP department were used most in group 2 and least in groups 3 and 5, although hotline costs were transferred to overhead in group 5.

Help in choosing and purchasing equipment was used least in group 3 as compared to groups 2, 4 and 5. This was due to the decentralized budgeting process and full freedom to buy EUC equipment.

The hypothesis concerning chargeback impact on declining use received scarcely any support, because contradictory evidence on the impacts of chargeback systems was found.

**Critical success factors (CSFs) and problems are affected by chargeback (H3e).** Almost all CSFs were similar in each group, with the exception of availability of services, which was critical in the groups 1 and 2, but almost excluded in group 4. Another exception was the understanding of user needs and tasks, which was emphasized in group one.

Seven out of eight problem categories were equally common in all chargeback system types. Only one confusing exception was detected, as unsatisfactory equipment was found significantly more often in group 5 than in group 1.

It was clearly shown that only minor support for the third hypothesis was attained. Users were not affected differently by chargeback.

**Recognition of Control Impacts on User Variables (H3a-e)**

No significant differences were found. The only exception was that users noticing the control were less interested in demonstrations of hardware and software than users ignoring control.

The findings concerning recognition of the impact of control on user-related variables mean that the behavior of those users noticing chargeback are similar to those ignoring it.

**5 Summary and Conclusions**

Six chargeback types were found according to the extent of costs included in overhead, user freedom to purchase EUC equipment and decentralization in budgeting EUC expenditures. Most of the organizations always charge their users for equipment. Only in some cases is compensation made for support (training and hotline) and even less for mainframe use. In the most complex chargeback systems the users participate in the budgeting process and recommendations for e.g. purchasing policy of EUC equipment emerge.

Organizational characteristics such as size and EUC strategy seem to be more able to distinguish the chargeback system types than EDP-departmental (technology, support) or user-population (experience, number of users) characteristics. The recognition of control does not differ according to hypothesis in chargeback groups. Instead, the organizational position of end users is associated with the recognition of control so that managers responsible for departments costs are
most aware of control. On the other hand, users recognizing the control use computers to virtually the same extent as users ignoring control. As a whole, no significant differences between user-related variables in chargeback groups can be detected. This means that in this sample chargeback has no impact on user opinions or behavior.

These findings imply that the chargeback system was an organization-wide policy issue and reflected organization level EUC strategy. Chargeback systems seem to be used mainly as an accounting system for cost collection and fair cost allocation rather than in regulating the demand or activating users.

Because organizations are independent, opinions ratings can mean different things in organizations—users can be satisfied with the service level in one organization, whereas the same service level in another organization might be unbearable. As the sample is selected instead of random, some of the tests based on the user population may have been distorted. Another limitation typical to the survey as a research method is the difficulty in determining the direction of causalities. Although we have some reason to suspect that most simple chargeback systems are implemented in the initial stages of EUC evolution, this question cannot be argued because trends or shifts cannot be detected from the data.

Keeping the above limitations in mind we try to explain the modest effects of chargeback systems on end user behavior by the evolution stage of EUC and by the unique cost structure of EUC.

Firstly, EUC is in an early stage. It has been argued that a chargeback system can slow down the growth pace of EUC evolution by making non-end users more cost-conscious (King 1988). We tried to find evidence for this impact with the diffusion rate of end users to white collar workers. The figures were requested from EDP managers at the beginning of organizations’ EUC, in 1981, in 1986 and in 1991 (the last one being an estimate). Unfortunately, no associations were found. Instead, slow growing and rapidly developing EUC organizations were equally represented in chargeback system type groups. This might be explained by the low degree of diffusion of EUC in the organizations. On the average, 13% of the white collar workers were considered end users in our sample. This percentage is about the same as the “take-off” point suggested in diffusion theory—approximately 16% of adopters in the population—at which the rate of diffusion becomes self-generating and non-reversible (Markus 1987). So these users can mainly be considered early adopters in the initial stages of EUC. These early adopters are in the position and have the competence to manage without management intervention. The remaining 87% of potential users are more passive and wait for management actions before adoption (as in Leonard-Barton & Deschamps 1988) and it is they who are traditionally affected by the chargeback, not the early adopters. In an EUC environment it is especially true that pioneers pay most. Thus these early adopters could in principle be supported by absorbing the costs in overhead.

The second explanation is that chargeback systems cannot keep up with the pace of evolution and adapt swiftly enough to the evolving phenomenon and its
complexity. This can be explained by the exceptional cost structure of EUC. In EUC the most significant costs are, in the beginning, investment costs in hardware and software, which are very often budgeted and bought by end users. After purchase, the operating costs are mainly opportunity costs (costs of choosing the second best alternative) in the short run (e.g., learning computer use outside office hours or developing applications, though it is not one’s primary task). So what is left? The only costs that affect user behavior are either costs originating from the use of mainframe or from the use of support provided by the EDP department. Because almost half of the organizations have delegated the training to outside consultants, and mainframe costs are rather fixed and uncontrollable, there are few means to affect user behavior with chargeback. Similarly, the constraints in setting effective prices (indirect control) and the difficulties in obtaining an affordable chargeback system limit the usefulness of a chargeback system as a management tool, even in the latter stages of EUC.

Because few effects of chargeback on end users were detected, it can therefore be recommended that the balance of demand and supply (rate of growth) is maintained with more direct controls and incentives than with chargeback. In large centralized bureaucratic organizations more direct policies in the form of participation in budgeting, open communication and a more coordinating than controlling role could be more suitable for the management of the EUC. In a decentralized environment a total ‘recentralization’ (a term adopted from (King 1988)) of accountability, responsibility and authority of EUC costs to user departments, could be most convenient. Nevertheless, the importance of chargeback systems in the cost tracking and allocation is likely to be emphasized as the pressures to prove the profitability of EUC investments increase.

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A. Research methods

The survey data was analyzed with a variety of methods. The 16 chargeback organizations were clustered to form six groups on the basis of IS managers’ answers using the HYLPS statistical package and cluster analysis with Korhonen’s method. After clustering, the sample of 16 organizations was examined with crosstabulations in order to reveal the organizational and EDP departmental characteristics distinguishing the chargeback systems. The sample of 151 end users was analyzed with oneway analysis of variance
(the Student-Newman-Keuls procedure test of multiple ranges was used to detect the significantly different groups at 0.05 level). Differences between the recognition of control groups were analyzed with the t-test and Mann-Whitney test whenever the scales were insufficient for parametric tests. The percentage of positive answers in each chargeback group was compared with the analysis of variance and t-test. Because the numbers of observations in the groups were not equal, the homogeneity of variances in one-way ANOVA was checked with Cochran’s C and Bartlett-Box F and reported in (Heikkila 1988). Accordingly, t-test results were computed in two columns for pooled variance and separate variance tests, depending on the F-test value for the groups. Any intervening variables of user position, age and experience were analyzed similarly and were reported in the previous version of this paper (Heikkila 1988). All tests, except the cluster analysis, were conducted with SPSS/PC+ statistical package.

B. Calculation of EUC satisfaction scores

Users rated the nine forms of service they have used from 1 to 5; five means that the service is excellent. The rating is zero, if they did not use the service. The calculated total score of user satisfaction is divided by the number of services used to obtain an average of user satisfaction scores to eliminate the different service usage profiles. This can be expressed as:

\[ \frac{\sum S_i}{n} \]

where \( S_i = 0 \), if service \( i \) is not utilized by an end user. If the \( S_i \) has been used, it is ranked from weak to excellent on a scale of 1 to 5. \( n \) denotes the number of occurrences of \( S_i \neq 0 \).

Another index of user satisfaction takes the importance of the service used into account. The weighted satisfaction Index is calculated as:

\[ \frac{\sum S_i - \sum I_i}{n} \]

where use of service, \( S_i \), is rated as in the former index. The importance of service \( i \), \( I_i \), is zero, if service \( i \) is unimportant to an end user. If service \( i \) is considered somewhat important to extremely important, \( I_i \) ranges from 1 to 5. \( n \) denotes the number of occurrences of \( S_i \neq 0 \) or \( I_i \neq 0 \).

References


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