

ASSESSMENT OF CHARGEBACK SYSTEMS IN IT MANAGEMENT ¹

D.H. DRURY

*Faculty of Management, McGill University, 1001 Sherbrooke St. West
Montreal, Quebec, Canada*

Tel: (514) 398-4057; Fax: (514) 398-3876; E-mail: drury@management.mcgill.ca

ABSTRACT

The management practice of billing cost centers or user departments for services provided by an in-house information technology center is referred to as a chargeback system. Chargeback systems have been widely advocated as method of making users responsible for the information technology costs that they incur. With the rapid pace of technological change, increasing investments, and a growing diversity of users and usage's, the importance of effective information technology cost control has increased to management.

Some organizations have adopted chargeback systems from the earliest computer applications but chargeback has remained a controversial management technique. The necessary and sufficient conditions for effectively using chargeback systems have yet to be determined. This paper examines prior research on chargeback systems focusing on its application and relevancy to the current technological environment. The extant cost management literature on allocations of support costs is introduced to the discussion. The importance of information, congestion, and incentive effects are emphasized in evaluating cost allocation systems. Considerations of capacity levels, opportunity costs, and positive and negative externalities are introduced in the debate of using or not using chargeback systems. The contingent technological and management contexts are used to develop a framework for chargeback choice and effectiveness evaluation.

Keywords: Information technology, chargeback systems, cost control systems, IT management, information management.

RÉSUMÉ

La pratique qui consiste à facturer aux centres de coûts et aux unités clientes les services fournis par un centre interne de technologie de l'information porte le nom de système de facturation interne. Ces systèmes sont généralement présentés comme un moyen de rendre les utilisateurs responsables des coûts qu'ils engagent au titre des technologies de l'information. Compte tenu de la rapidité des progrès technologiques, de l'accroissement des investissements et de la diversité accrue des utilisateurs et des usages, le contrôle des coûts liés aux technologies de l'information revêt désormais une plus grande importance pour les gestionnaires.

Certains organismes ont adopté des systèmes de facturation interne dès l'arrivée des premières applications informatiques, mais ces systèmes sont encore aujourd'hui un mode de gestion controversé. On n'a pas encore déterminé dans quelles conditions précises ils peuvent être utiles. Cet article examine les recherches menées à ce jour sur les systèmes de facturation interne en se concentrant sur leur application et leur pertinence dans le contexte technologique actuel. Cet examen tient compte des données sur la ventilation des coûts de soutien relevées dans les publications consacrées à la gestion des coûts. L'évaluation des systèmes de ventilation des coûts tient particulièrement compte de l'importance que revêtent l'information, la congestion et l'effet des incitatifs. Le débat sur l'opportunité d'utiliser les systèmes de facturation interne tient également compte de paramètres comme la capacité, les coûts de substitution et les effets externes positifs et négatifs. Le cadre d'évaluation du choix et de l'efficacité des systèmes de facturation interne a été établi à partir des contextes technologiques et de gestion contingents.

Mots clés : Technologies de l'information, systèmes de facturation interne, systèmes de contrôle des coûts, gestion des TI, gestion de l'information.

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1. INTRODUCTION

When a service is free, it is human nature to take it for granted. But when the same service costs money, a shift in perception occurs and it becomes a valuable commodity. That is the theory behind chargeback systems the practice of billing cost centers or user departments for Information Technology (IT). A chargeback system is sometimes called a billing system, chargeout system, cost recovery system, or an internal pricing system. A chargeback system accounts for who uses a company's computer resources and allocates the costs back to users (Drury, 1997; Verner, et al., 1996). Chargeback is advocated to encompass management of an organization's computer related assets by extending approaches and techniques of control used in other organization functions to Information Technology (IT) (Rubin, 1992; Scott, 1992).

Some organizations have used chargeback systems in IT management since the earliest computer applications. Many organizations have attempted to deal with IT problems such as user awareness of IT costs (Cooke, 1992), saving money (Fernberg, 1993), and assisting in the evaluation of new IT investment (Graham, 1994) through implementing chargeback systems. Fundamentally, the concept of charging for services has a rational economic base. The allocation of scarce resources is accomplished through prices. The ability to pay is supported through markets that discriminate between efficient and inefficient users of capital. In other words, paying for products and services is regarded as the natural order of economic activity inside and outside of organizations. Chargeback systems seem to be consistent with this platitude of paying for scarce resources.

However, surveys consistently show over time that only about half of all organizations have ever used chargeback systems (Informatics, 1978; Drury, 1980; McGee, 1987; Raghunthan, 1994, Drury, 1998). If chargeback systems are the panacea of many IT problems, then the number of organizations using chargeback systems should consistently increase with maturity and dissemination of management techniques. This creates a paradox since some organizations appear not to be rational in managing IT. An alternative explanation is that the usage of chargeback systems is more complex than a simple application of prices and markets. Market imperfections may be dominant thereby making chargeback systems impractical in many situations. An appropriate solution may be to abandon the idea of IT chargeback systems altogether. However, this would simply create another dilemma since many organizations have used and continue to use chargeback systems over a lengthy period of time. Under some conditions, a chargeback system may be a positive force for improvement and in others, a time-consuming and restrictive approach to control.

In spite of many years of research on the issue of chargeback, the paradox created by chargeback systems doesn't seem to be closer to resolution. Part of the difficulty is that the IT environment has not remained stable in order to try, adopt, and discard new things. It is not clear that the lessons of the past are transferable to the present context of chargeback systems. Second, chargeback systems are utilized or not utilized as part of a mix of planning and control techniques. Prior studies have tended to look at chargeback systems as unique and separable. Third, IT is part of the organization structure and resources. Examining IT in isolation takes chargeback systems out of the organizational context and the management techniques employed elsewhere. Finally, recent results in the management control literature on service department costing have added new considerations to the question of using chargeback systems for IT costs.

IT has been found to pervade every function and level of organizations. How management controls IT costs and allocates resources is critical to current operations, embracing innovations, maintaining a learning posture, and sustaining financial performance. Both the philosophy and practice of chargeback systems have been recognized as the

reflection and execution of these key organizational issues. Unfortunately, the usage or non-usage of chargeback systems is surrounded by biases that have little grounding in reality. Prior research has done little to provide a rational base for the assessment of chargeback systems.

There are two objectives of this paper. The first is to review the relationship of chargeback practice to research. This is intended to consolidate the lessons of the past and isolate potentially fruitful directions. From this background, the focus is on the critical question of whether or not chargeback systems should be used. The next section of this paper traces the development of the chargeback approach in IT management. The following section summarizes and evaluates the research that has sought to enhance understanding of the benefits and limitations. Significant variables are isolated and the evidence is presented that supports them.

The second objective is to examine the economic base for using chargeback systems. Chargeback systems are economic systems with behavioral and organizational consequences. Numbers are never neutral and the economic premises are important to whether or not chargeback systems ultimately achieve their objectives. Developments in costing internal activities and functions are used to extend the economic structure of chargeback systems. Critical issues are isolated which require resolution in applying chargeback systems effectively in organizations. The final section summarizes the assessment and provides directions for future research.

2. EVOLUTION OF CHARGEBACK SYSTEMS

During the 1960s and 1970s, Information Technology was seen as the savior of all corporate administrative problems when automated payroll and general ledger processing were done on the mainframe computer. Sometimes, this supported key strategic initiatives that developed organizational requirements. The problem of allocating the cost of computer resources to users was largely ignored until the late 1960s. Computing had been allowed to expand to meet demand and computer costs were rarely allocated to users. In addition, the operating systems of that era did not permit the easy capture of statistics necessary for accurate job costing. Large expenditures on data processing in governments and universities led to discussion of cost and pricing mechanisms for IT (Enke, 1966; Smidt, 1966; and Greenberger, 1968).

The mild recession of the late 1960s indirectly promoted an interest by businesses in allocating costs and pricing of computer services to users as a means of controlling costs. By 1970, Nielsen indicates that many organizations had adopted chargeback systems. Discussion in the literature was primarily prescriptive taking a strong advocacy approach to the use of chargeback systems (Rethis, 1972; Nuben, 1970; Bookman, 1972; Joy, 1972). In the technical literature of the period, chargeback systems were clearly in vogue and received a great deal of attention. By the late 1970s, surveys revealed that more than half of organizations had already established chargeback systems (Informatics, 1978; EDP Analyzer, 1974; McKell, 1979).

During the mainframe era, many organizations tried to control costs through chargeback. Business units were charged for utilization of the central computing facility on the basis of metered usage. This was never entirely successful, a prime reason being that it was difficult to establish a basis for charges that users could understand and control.

The PC brought power and technology to the local department and to the desktop, and users of central IT services became more scarce. Users implemented their own technology solutions on desktop systems. IT continued with the administrative systems on the mainframe while users implemented local PC based solutions to support their business requirements. They didn't want IT support because they viewed it as conservative

and felt they could implement their own solutions. And IT administration responded accordingly by providing exactly the kind of service that PC users wanted, very little. IT personnel wanted no part of that PC environment and let users fend for themselves. IT personnel thought the users would find too many technology issues awaiting them, then fail. But the PC users didn't fail to implement their requirements in a more timely and less costly manner. The arrival of the PC dealt a blow to the practice of chargeback as users moved their systems to computing platforms which appeared to be free, at least after acquisition costs were written off.

While the technology was constantly changing throughout the early 1980s, IT infrastructure remained relatively stable. Organizations became less concerned with control and the emphasis was on strategic competition and technological advantage (McFarlan, 1985; Porter, 1985; Cash, 1985). The use of chargeback systems was reaching maturity as organizations sought to refine procedures (Hoshower, 1986), align chargeback systems with organizational objectives, (McKinnon, 1987), improve their information producing ability (Emery, 1986), focus on their implementation (Perry, 1988), and improve users perceptions of fairness (Hufnagel and Birnberg, 1989). However, justification became important and change in IT tended to upset the environment.

In the late 1980s, usage of chargeback systems seemed to have reached maturity and saturation (Buse, 1988; Call, 1987). The technical literature and the management literature both reveal that interest in chargeback systems waned. King (1988), for example, concluded that the role of centralized information systems would change due to the increased use of packaged software and growth in departmental computing, making the chargeback system no longer necessary in the way it once was for the following reasons.

1. It is not possible to apply true market principles when there is on-in-house provider of computing services
2. The available supply of computing services cannot easily be increased or decreased because lumpy increments are used
3. There is no real need to maintain a chargeout system other than as a monitor, as true computing costs are driven by decisions about new applications based on considerations in the market outside the application

The introduction of client/server systems provided even more power at the local level. End users started looking toward replacing mainframe applications and/or new business functions with client/server technology. From the IT perspective, the problem was that users never learned to support critical applications. However, IT managers who moved to new technologies, such as client/server environments encountered new management problems (Karon, 1994). There were increased pressures resulting from dwindling budgets, more demanding senior management, and a greater variety clients, external competitors and alternatives for parts of operations, including outsourcing (O'Leary, 1992). Further, most established information centers experienced a high demand for their services as a result of advancing technology and rising user expectations. IT centers are driven to offer increasing support and became demand-driven and burdened with responsibilities in attempting to achieve user self-sufficiency (Karten, 1986).

Many writers, particularly writing to IT managers now advocate the use of chargeback systems (Mercy, 1991, Toscano, 1994, Graham, 1994). With changes in technology, writers in the field have not only encouraged the use of chargeback systems, but also have predicted increased usage (Rubin, 1992; Scott, 1992). There are five major reasons for this interest.

First, management's have sought to control the mushrooming expenditure in IT. The costs of new technology are higher. While the hardware costs tend to be less than mainframe hardware and software costs, ongoing costs of operations tend to be much higher (Toscano, 1995; Chisholm, 1994). Further, these costs are expected to increase in the future (Jayson, 1995). At the same time, perceptions of price/performance are slipping according to a study by the Sentry Market Group (Stackpole, 1995). Companies are spending a lot of money on expensive technology. Increasingly, IT departments are finding that they have to demonstrate their worth resulting in an increasing emphasis on metrics to support IT as a cost or revenue producing center (Cooke 1992; Crowley, 1995).

Second, central IT functions also have reasons to support costing changes. With so much of the technology infrastructure comprised of PCs distributed through the organization, the systems department does want to continually play the role of referee and act as the gatekeeper for each new request for desktop equipment. Further, they would no longer be placed in the way of technology investment and innovation by its clients (Gotlieb, 1995). Business units are able to implement departmental solutions on their own LANs deciding which among several project requests to take forward for corporate approval. Thus the idea of having business units pay for the total cost of the technology they use — including LANs, servers, software and support staff — is starting to gain currency.

Third, at the same time, there has been increasing emphasis in determining costs more accurately in organizations. For example, Activity Based Costing uses new types of cost drivers and classifications of costs to more accurately determine the costs of products, processes, and services (Cooper and Kaplan, 1988). The emphasis on Total Quality Management, Target Costing, and Life Cycle Costing are part of the thrust in organizations to determine and report all costs more accurately (Atkinson et al., 1997).

Fourth, Information Technology in the past was primarily used to collect operating data and process transactions. IT now affects the whole organization; structure, management processes, human resources, and relationships with customers. Nothing in an organization is untouched by IT. Currently, IT influences all functions and levels within organizations. Over 60% of workers in North America are classified as knowledge workers. Using IT effectively and efficiently has become increasingly important (Drucker, 1997).

Finally, while computing has become more widespread and distributed, the IT cost structure has changed. Labor and support costs have risen dramatically. The Gartner Group, a consulting firm in a well-publicized study, estimated the cost of a single PC to be around \$1200. However, systems, software, servers, maintenance and support make the Total Cost of Ownership closer to \$9000 (Toscano, 1994). Measuring the indirect costs and attributing them back users through a chargeback system has become increasingly important to the management of Information Technology. For all of these reasons, chargeback systems have found a new resurgence of interest in recent years (CMG, 1993).

The focus of chargeback research has been to understand issues and provide practical guidance. The next section traces the research progress to isolate lessons of the past and identify unresolved questions. This is followed by evaluation and extension of the logical premises of charging systems.

3. PRIOR RESEARCH

Research on IT chargeback systems can be summarized around three fundamental themes which are

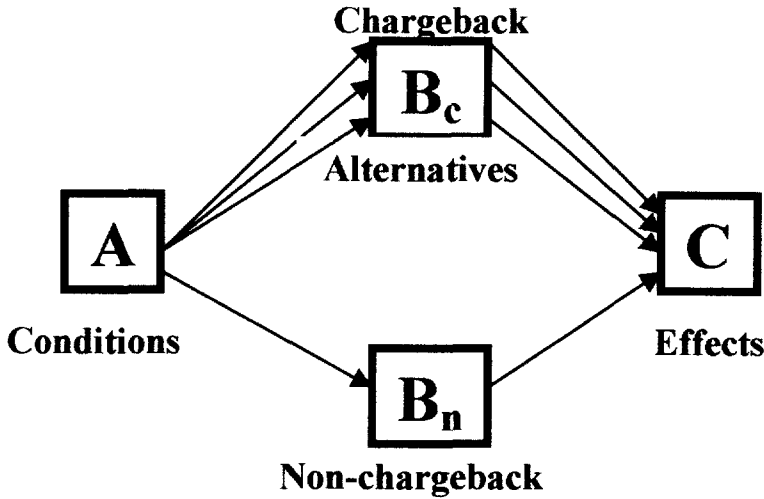


Figure 1: IT Chargeback Research Structure

- (A) determining the conditions for using or not using chargeback systems
- (B) evaluating systems alternatives, an
- (C) assessing the system's effectiveness

These themes are represented in Figure 1 where A are environmental and organizational conditions, B_c are preferences and alternatives in applying chargeback or non-chargeback B_n , and C are investigations concerning the effects or results of chargeback systems. These themes are elaborated in the following discussion.

3.1 Conditions

Computer systems were first used by large organizations and it is not surprising that maturity of IT use and size have been found to be consistently related. From the earliest investigations, chargeback systems have been found to be primarily, but not exclusively used in large organizations. Nolan (1977) found an association between size and usage of chargeback systems. Lientz and Swanson (1980) similarly found that size was a differentiating condition between chargeback and non-chargeback organizations.

Other researchers broadened the variables to include components of the IT and organization infrastructure. Drury (1980) found that the extent of decentralization of divisions, growth in organization and IT size, more dispersed processes, more complex processing requirements, and separate budgeting of operations and projects favored chargeback systems. The factors favoring non-chargeback include lower percentage spending, similarity of users processing needs, larger proportions of external processing, and long planning horizons for IT.

In Van Lengen and Morgan's (1994) survey, the majority of respondents reported the use of some form of chargeback system that recovered the costs of providing IT services. Findings indicate a positive relationship between sophisticated chargeback systems and most measures of maturity of IS management and use. However, a significant negative relationship was found between the level of chargeback effectiveness and measures of strategic use of IT.

Raghunathan and Raghunathan (1994) compared chargeback and non-chargeback organizations. Their analysis was from 231 organizations; 42% used chargeback and 58% did not. Using discriminant analysis which classified 72% of organizations correctly, chargeback organizations were distinguished as being more IT decentralized, organizationally larger, providing more IT support, more integration of goals, and their IT budgets tend to be bigger.

Even over an extended period, this set of conditions for using chargeback systems has remained fairly stable in spite of significant changes in IT, the way it is used, and organizational changes empowering users. But there are clearly gaps in understanding as well. For example, some organizations routinely charge user departments with all other services from human resources to telephone calls as part of the management control philosophy. Whether or not IT costs are treated the same or not has roots in

- (a) the management philosophy to control
- (b) the relative importance and objectives for IT such as being a leader or a follower, and
- (c) the organization's ability to measure costs and performance using other techniques

There are many possible variables at the level of IT management, the organization, and its environment which may influence the choice of using chargeback systems or not. Explorations into the conditions under which chargeback is effective or not would serve to put the debate over chargeback systems (or not) on a more constructive level.

3.2 Chargeback Alternatives

Descriptive surveys of practices have primarily been utilized in the examination of chargeback alternatives (B_c) in Figure 1. Early theoretical research was heavily influenced by the mainframe architecture of the time. The emphasis was on economic considerations extending from an accounting and operations research base. For example, Smidt (1968) describes the demand for computer services as

1. growing rapidly over time
2. subject to daily, weekly, and annual cycles
3. postponable in the sense that every demand doesn't have to be satisfied instantaneously, and
4. computer demands vary in urgency

The problem was to allocate fixed computer resources efficiently using pricing mechanisms given these demand conditions (Enke, 1966; Greenberger, 1966; Williamson, 1966). Sobczak (1974) for example, advocated flexible pricing to resolve peak load problems but this was only part of the accounting issues that were discussed. Schaller (1974) recommended setting standard rates based on elapsed time, estimated size of the portion of the system used by the job, and a time adjusting factor which takes into account job's priority and mix in the system. The emphasis in these recommendations was total system cost minimization.

Dearden and Nolan (1973) discussed the advantages and disadvantages of chargeback systems, Wiorkowski (1973) the various approaches to developing chargeback algorithms, Cushing (1976) the accounting issues involved, and Schaller (1974) flexible pricing. Gordon (1970) examined costing in a multiprocessing context and Rethis and

Smith (1972) the planning and control implications of IT. Performance measures also became an issue (Kasperek and La Velle, 1972; Waldo, 1974). Until 1980, many theoretical papers were written but very few related to the real world (Kriebel and Moore, 1980)

Lin (1983) distinguished between four types of chargeback systems based on the type of budgetary practice used within the organization. Allocation chargebacks use the soft money concept in which costs are only stated in memo form and direct chargeback systems use the hard money concept to transfer costs through the general ledger. Direct charging is classified into three sub-categories which are (1) the average cost method which divides total costs by recorded usage within each load center and assigns percentages to end users, (2) standard cost chargeback based on predetermined prices for computer usage for future periods, and (3) flexible price chargebacks that charge higher prices for scarce resources. Each system differs in the amount of control, accountability, administrative support, and management participation. Further, they require different levels of user sophistication and expertise to develop and administer.

McKinnon and Kallman (1987) viewed the above methods as a hierarchy which when combined with Nolan's six stages of IT growth, ie. initiation, contagion, control, integration, data administration, and maturity yielded 24 decision cells. For example the lowest need for management accountability would require only allocation chargebacks in the initiation stage whereas the highest level requires flexible price chargeback in the mature stage where the organization tends to be more proactive and treats IT as a strategic resource. However, this prescriptive framework ignores prior research in that the IT growth stage structure has been demonstrated to have questionable validity (Benbasat et al., 1984). Second, chargeback systems seem to be used primarily in large and mature organizations thereby eliminating most of the cells of the model. Also, the structure was not empirically tested and its usefulness and practicality are doubtful. Finally, the range of alternatives found in practice is considerably narrower than these writings would suggest.

Drury (1980) found that organizations tend to charge all costs (67.8%) for both operations and systems. IT is treated as a cost center as opposed to profit or investment centers. Few organizations set their rates with any resemblance to market prices and most revise their rates annually. Neither premiums for peak periods or fast turnaround were charged. McGee (1987) found that in 191 chargeback organizations that they use some form of full cost charging. Comparisons between budget and actual costs are usually made quarterly and more frequently. Chargeback rates are generally revised annually or more frequently. Premiums for fast turnaround were not used by the majority neither are rate differentials. He also found that users complained about the methods used to charge IT costs and most users did not understand the costs being charged. Van Lengen (1994) also found that the majority of organizations use some form of average cost pricing for IT.

Many of these investigations were undertaken during the period that PC's were just beginning to make a major impact. In order to gauge the changes in chargeback systems over time, Drury (1997) repeated the earlier study with the same organizations. Surprisingly, the preferred choices were found to have changed very little over time. About the same proportion or organizations still treat IT as a cost center and the typical practice is to charge full costs. Flexible pricing still tends not to be used. What have increased are technical difficulties in allocating costs and educating users to use chargeback information effectively. Users were found to be reluctant to pay for IT when they consider it to be part of the organizational infrastructure.

Unfortunately, these investigations have not penetrated the surface of the cost struc-

ture and charging issues in the changing technological environment. This deficiency has made it difficult to apply cost improvements such as ABC costing with the emphasis on finer cost classifications and the determination of cost drivers for IT. Also, the emphasis has been on chargeback alternatives (B_c). In contrast, the discussion of non-chargeback alternatives (B_n) has been scarce. Because chargeback systems have difficulties does not imply that non-chargeback is better. Direct comparisons between chargeback and non-chargeback alternatives have been deficient in the literature.

3.3 Chargeback Effectiveness

This raises the issue of whether or not chargeback systems are effective which appeared as C in Figure 1. Nolan (1977) was the first to explore the organizational consequences of chargeback systems. Chargeback systems were categorized as mature to the extent that managers gave them high ratings on four dimensions

1. understandability
2. controllability
3. cost/benefit incidence, and
4. accountability

The investigation confused maturity and the extent to which user attitudes were the result of failure to make appropriate use of chargeback information in the performance evaluation process.

Olson and Ives (1982) extended and replicated Nolan's study by classifying chargeback systems and adding another dependent variable, user involvement. Contrary to Nolan's (1977) findings, the results of Olson and Ives showed no significant relationship regarding the effect of interface quality on user attitudes and involvement. They did observe a decrease in satisfaction as allocation methods became more sophisticated. However, it is possible that higher levels of systems also imply different purposes and whether this is an accounting or management problem remains unresolved.

Bergeron (1986) speculated that the inconsistent results occurred because of an intervening variable, the extent of usage of chargeback information for control and analysis. The characteristics tested by Bergeron include

1. Accountability
2. Authority over data processing activities
3. User involvement in the IT budget
4. Cost variability and
5. Quality of billing information

The results suggest that each of the five variables is significantly related to chargeback use. However, as Hufnagel and Birnberg (1989) point out, it is not surprising that managers who are not involved and not accountable don't use these systems.

Markus (1987) examined the usefulness of chargeback systems in a particular setting. She investigated the implementation of office communication systems and concluded that chargeback systems were not useful in this setting. The results are context dependent and until investigations are made in other settings it is premature to draw

broad conclusions. However the investigation did attempt to address the research issues and take them to a more specific level.

Senn and Yardley (1989) had a similar research purpose in experimentally testing the effects of cost feedback on two task objectives time minimization and cost minimization. The subjects were accounting majors and the task was ranking 59 students on different criteria. The sample and context makes the validity and generalizability of the results questionable. Still however, several of the results may provide insights for future research. For example, they found that when timeliness of decisions became critical, costs and therefore the charging systems were ignored. Subjects minimized either cost or timeliness. This may indicate that the decision culture is critical to whether chargeback systems are effective. Further, we would expect that the emphasis on efficiency and results in the 1990s would tend to exacerbate the problems of effectiveness of chargeback systems.

Drury (1999) examined the success of chargeback systems. Principal findings were that firms with high scale, scope, and rate of change of IT found chargeback systems to be more successful. Again, while chargeback systems are associated with larger organizations the significance of the high rate of IT change means that maturity is not the primary factor. Organizations that used chargeback systems successfully employed them to principally support decisionmaking. The control objective had no effect on appraisals of success of the system. Successful organizations have integrated chargeback information into the decisionmaking structure and use a mix of control techniques that support and enhance the capabilities of chargeback systems.

There is a common problem in these investigations concerning the criteria by which chargeback systems are evaluated. After an extensive review of the literature, Delone and McLean (1992) concluded that six principal effectiveness dimensions have been used to evaluate a wide variety of systems. The six major dimensions are (1) system quality, (2) information quality, (3) use, (4) user satisfaction, (5) individual impact, and (6) organisational impact. These dimensions and their measurement have evolved over time and while there have been criticisms about the overlap of and ordering of the measures, the structure has been widely accepted (Ballentine, 1996; Ishman, 1996).

The effectiveness of many different types of systems have been examined using the six dimensions and instruments associated with them. However, it is questionable whether or not these dimensions are necessary or sufficient to evaluate chargeback systems. In addition to being information systems, they are at the same time accounting and control systems. Numbers are never neutral. They can lead to desirable or undesirable behaviour depending on how they are used which is critical to their evaluation. Their usage is not voluntary to users. On the other hand, the intention is to change behaviour and controllability of costs which requires inclusion of issues of fairness, equity, responsibility and controllability (Hufnagel and Birnberg, 1989). These dimensions go beyond those of traditional systems effectiveness studies, requiring new instruments to make the evaluation. To date, this has proved to be a major limitation to empirical and survey research on chargeback and non-chargeback systems.

3.4 Structure of Chargeback Practices

It is not unusual in organizations to make departments responsible for costs other than IT. Extensive survey evidence exists on the reasons why managers allocate other corporate and support costs such as administration and human resources costs to divisions, departments, and functions. A U.S. survey revealed the following ranking by frequency:

1. To remind managers that indirect costs exist and that profit must be adequate to cover some share of those costs

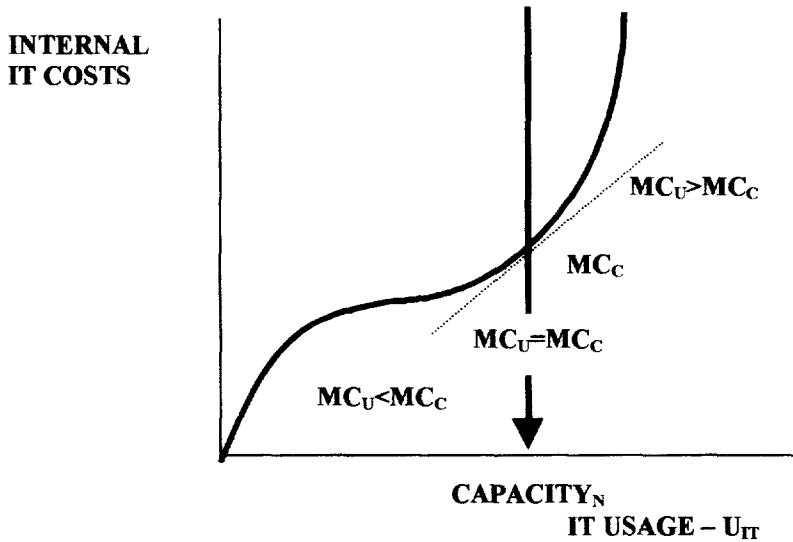


Figure 2: Internal IT Costs and IT Usage

2. To encourage the use of central services that would otherwise be underutilized
3. To stimulate profit center managers to put pressure on service center managers to control service costs. (Fremgen and Lia, 1981)

Canadian executives gave similar reasons,

1. to determine costs
2. to evaluate centers
3. to fix accountability
4. to allocate cost per usage
5. to promote more effective resource usage, and
6. to foster cost awareness (Atkinson, 1987)

Surveys were conducted among Australian and U.K. managers giving similar results (Ramadan, 1989; Dean and Blayney, 1991).

In general, the practice of charging for support services is controversial within the economics and accounting literature. Economists and accounting researchers typically recommend either no or marginal cost pricing at the most. (Hirschliefer, 1956; Zimmerman, 1997) However, organizations in practice tend to charge full costs for other services (Borokowski, 1990), including IT as our summary of IT chargeback surveys has pointed out. Yet, empirical studies consistently show that some organizations do not chargeback services at all, including IT. The major initial question remains in identifying the conditions for using or not using chargeback systems for support services. Connecting two different but related theories of general cost allocation assists in putting the economic base into perspective. The first is internal cost resource utilization within

functional areas. The second utilizes the effects of externalities in the cost allocation process. Each of these will be explained and then combined to determine the economic conditions for using or not using chargeback systems.

Figure 2 shows a typical total cost curve of a user departmental or organizational unit for a specific resource where the Y-axis is total cost and the X-axis is usage. In this case, U_{IT} refers to IT usage. Total departmental IT costs increase as usage increases. Economies of scale and scope are initially present as reflected in the change in the curve. Banker et al., (1988) note that as capacity begins to be reached, marginal costs increase even prior to reaching capacity. As internal congestion continues to set in, the total cost curve continues upward. While internal congestion effects can be managed through flexible capacity, balanced workloads, merging tasks and polling, increasing usage with constrained resources and increased management complexity would eventually result in exceeding capacity (Loch and Terwiesch, 1999).

Normal capacity is the expected utilization of system under efficient conditions. Normal capacity ($CAPACITY_N$) includes regular maintenance and down-time and appears in Figure 2 as the solid vertical line. It is the expected efficient utilization level of the system and has marginal cost at this level of MC_C , the level of normal capacity. This divides the total cost curve into three regions where MC_U is the marginal cost at any point on the curve.

1. $U_{IT} < CAPACITY_N$ Utilization is less than capacity and $MC_U < MC_C$. In this region, the problem is to utilize capacity. Most writers in the field have argued that charging for services will discourage usage and it is better to have the resources used, even if somewhat inefficiently. Not charging is thought to encourage IT usage. The appropriate measure of opportunity cost for capacity is zero when demand or usage is insufficient to fill capacity (Noreen and Burgstahler, 1997). Charging full costs would overstate the incremental costs to the department and produces sub-optimal decisionmaking
2. $U_{IT} = CAPACITY_N$ At this point, capacity is fully utilized and therefore, $MC_U = MC_C$. Charging costs to users neither encourages nor discourages usage and this is the indifference point
3. $U_{IT} > CAPACITY_N$ Usage exceeds capacity and IT becomes more expensive, $MC_U > MC_C$. Bottlenecks are created, systems are less efficient, more breakdowns occur and substantial wait time is encountered. In this region, efficient resource utilization becomes necessary and the pricing mechanisms become necessary. Prices set at current cost levels are intended to drive down usage to more efficient levels

There is agreement in the literature that for charging systems to be regarded as fair, managers must have the necessary authority to affect those outcomes or performances on which they will ultimately be judged (Hufnagel and Birnberg, 1989). This criterion can be interpreted to require that charges included in managers performance evaluations should not be influenced by the actions of other managers. However, this also implies that they should be charged for costs which others incur on their behalf.

If activities in one part of an organization were completely isolated from other parts of the organization then only consideration of the user departments costs and usage's as in Figure 2 would be sufficient. However, organization units are cross-connected because units have different functions. Negative externalities are costs imposed on other individuals without their participation in the decision and without compensation for the costs imposed on them. For example, the level of activity of a manufacturing

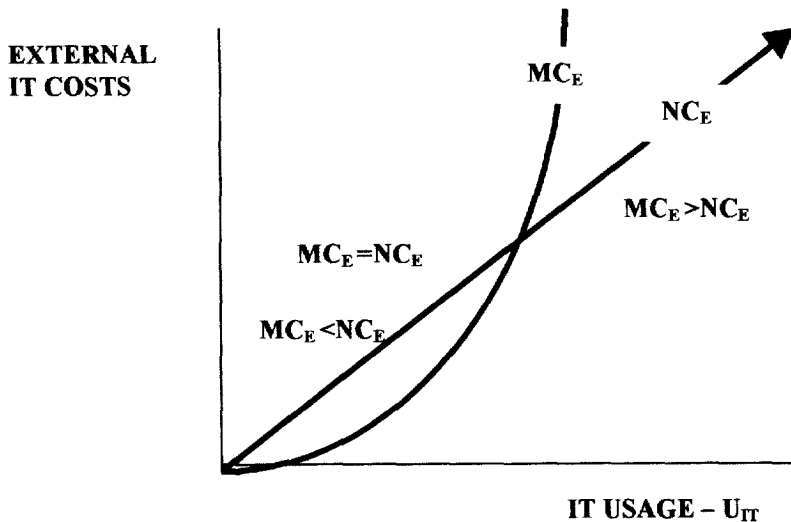


Figure 3: Evaluation of Externality Costs

department indirectly affects the human resources department. More people need to be hired and managed increasing human resources administration. In the same way, expansion of departmental computing requires more IT support, for example. End user departments inflict costs on IT administration through its choices of hardware and systems, maintenance, telephone connections and other indirect costs. When these costs are allocated back to the source department, the amount is a proxy for hard to measure externalities.

There are three effects from negative externalities. These are (1) incentive, (2) information, and (3) congestion effects (Zimmerman, 1979).

1. Incentive effects arise because managers are often exposed to over consumption syndromes to the detriment of the firm's overall profitability. Young (1985) and Jordan (1988) investigated the incentive aspects concluding that cost allocation is an arrangement to motivate every participant to optimize the firm's overall profit over their opportunity sets even though they may not even be identifiable
2. The informational aspect of cost allocations was analyzed by Beja and Zhang (1986). Under the assumption that a firm is an informationally decentralized team, cost allocation serves as an information system that evaluates profitability of different divisional activities which are correlated through a joint profit/cost component. They demonstrate that this information system is undominated in terms of accuracy, information volume, and coordination complexity. Users lack technical information and IT departments local information to effectively administer IT resource allocations. Charging systems establish a mutual monitoring relationship overcoming the problem of asymmetric information between users and suppliers (Amershi and Cheng, 1987). Charging is also thought to adjust consumption in the appropriate direction by offsetting biases created by some plausible measurement problems (Dickhaut and Lere (1983)
3. The third component is congestion which imposes delays and rationing costs on other users of the resources within the organization. The main quantitative result

is that there is over-congestion if no cost is placed in the use of limited resources. This has also been found to be the case with allocation models with stochastic demand and penalties for delays (Devany and Frey, 1981). Miller and Buckman (1989) showed that in the presence of congestion, fully allocated costs serve as a proxy for difficult-to-calculate opportunity costs when the capacity cost has a linear form

Figure 3 presents the cost structure of negative cost externalities arising from user departments on external departments. With constrained resources, the expected cost external departments, services and support, should regularly increase with usage. This is the expected or normal cost (NC_E). However, the effect of externalities will cause the actual costs to rise faster, or slower. The actual marginal cost of externalities (MC_A) initially lies below the normal cost line and rises consistently. Three regions of the graph are discernible.

1. $MC_A < NC_E$ The marginal cost of externalities is less than the normal external cost. In this region, user IT is not increasing the average costs of the other departments in the organization. Thus, there is no need to limit usage through pricing mechanisms such as chargeback systems
2. $MC_A = NC_E$ The marginal costs of externalities are equal to the normal costs. These costs maintain the expected cost level but do not increase it. Consequently, pricing at the marginal cost neither increases nor decreases normal costs. The organization should be indifferent between charging or not charging
3. $MC_A > NC_E$. The marginal costs of externalities are increasing the average cost of other departments. Real costs are being incurred elsewhere in the organization to support IT user departments. Mendelson (1985) shows that charging users for the externality effect would induce the optimal level of consumption. Whang (1989) demonstrated under restrictive conditions, that cost allocations not only induce users to reveal their true values but also achieves ex-post efficiency in allocating capacity. A chargeback system should be used whereby users are charged for these costs of externalities. In this manner, the opportunity cost of using IT would be correctly indicated in the costs of user departments

The results of Figures 2 and 3 are summarized in Table 1. The three regions of Figure 2, internal cost structure, are shown down the left side. The three regions of Figure 3, externality costs, appear across the top producing nine cells or conditions.

The middle cell is the indifference point where $USAGE_{IT} = CAPACITY_N$ and $NC_E = MC_A$. Technically, while the point exists, it is more likely that the organization is or would be moving towards another condition. The upper right cells support usage of chargeback systems. Usage is greater than capacity and/or the marginal cost of externalities is greater than the normal external department costs. Under these three conditions the practice of using chargeback systems seeks to rectify demand by charging.

In the lower left cells, usage is less than capacity and/or the marginal costs of externalities is less than the normal costs. Under these conditions, a charging system would not allocate resources effectively.

The two boxes in the opposite corners contain more complex situations and must include the overall comparisons of internal and external costs. If $MC_U - MC_C > NC_E - MC_A$ then the net effect is that organization resources are overutilized indicating that chargeback should be used. Similarly, in the other corner. If $MC_A - NC_E > MC_U - MC_C$ then externalities outweigh internal costs again indicating the use of

	$NC_E > MC_A$	$NC_E = MC_A$	$NC_E < MC_A$
$USAGE_{IT} > CAPACITY_N$	YES* $MC_U - MC_G > NC_E - MC_A$	YES**	YES***
	NO* $MC_U - MC_G < NC_E - MC_A$		
$USAGE_{IT} = CAPACITY_N$	NO**	Indifference Point	YES**
$USAGE_{IT} < CAPACITY_N$	NO***	NO**	YES* $MC_A - NC_E > MC_U - MC_G$
			NO* $MC_A - NC_E < MC_U - MC_G$

Table 1: Chargeback Choices

chargeback systems. If instead, in the upper left $MC_U - MC_C < NC_E - MC_A$ the net effect is logically negative as would the condition in the lower right, $MC_A - NC_E < MC_U - MC_C$. This would indicate that chargeback would not be warranted to allocate IT costs.

4. DISCUSSION

The classification of internal conditions for using or not using a chargeback system provides an explanation of why some organizations do, and should, use chargeback systems and other organizations don't. However, there are initial conditions to using this classification. First, in Figure 2, the essential classification condition depends upon the existence of capacity. This is a major difficulty since the notion of IT capacity has been constantly changing and is more dependent on the ability to keep up with current technological change which has regularly shifted the boundaries. Second, in Figure 3, the initial problem is the optimal cost levels for external departments and services in particular. The services of support departments are derived from needs elsewhere in the organization and whether or not there is an optimal support structure is an unresolved question, especially when change is prominent. The externality effect is a function of capacity. Hence knowledge of the demand function is critical directly for the IT service decision and indirectly for the IT capacity decision. The primary difficulties in the decision to use chargeback systems are internal capacity and the optimal cost levels for service departments.

Of course, even if the set of initial conditions is strictly adhered to, this does not mean that using chargeback (or not) will result in successful systems. The interaction between logical economic structure, and the ability to implement is critical. People and organizations provide their own set of limitations and advantages that need to be considered. For example, one of the most important considerations which has emerged is the incentive system. Drake, Haka, and Ravencroft (1999) show that the interaction of the type of incentive system with cost allocation affects profitability, productivity, innovation, and the exchange of information between parts of organizations. There is a shortage of investigations which have extended chargeback into this realm. The research to date has neither been consistent nor penetrated the surface structure as our review of the literature has pointed out.

This has hampered the effective construction of cost and reporting mechanisms for IT. Neither the theoretical nor practical alternatives have been elucidated and surveys of practice point more to stability and complacency than to improvement or logic. Indeed, some organizations have utilized techniques other than cost allocation advantageously to achieve organizational goals. Taitkonda et al., (1999) report of an organization (anonymous) that adopted, then removed an ABC system. It instead implemented a mix of process simplification, the 80/20 rule, organization structure changes, product design, employee management, and other performance measures, instead of relying on cost allocation such as chargeback systems. Investigations which compare and explore the range of alternatives to IT chargeback would generously be described at this stage as scarce but essential.

5. CONCLUSIONS

Organizations have struggled to keep up with the frequent changes in Information Technology. Management attention has been focused on implementation and problem solving. Accompanying these changes has been the growing realization that Information Technology affects all parts of the organization, that IT change is continuing and inevitable, and that the cost will continue to increase in the foreseeable future.

Chargeback systems are viewed as a method of regaining management control. Tracing costs to users is expected to improve effectiveness, efficiency, and separate value added from non-value added usage's of IT. While the intention is laudable, the execution is far from simple. We have shown through model development that there are basic conditions to using or not using chargeback systems. Further, we have isolated concepts of internal capacity and external cost structures that are essential to costing yet rarely recognized by organizations in practice or research as fundamental conditions. Traditional cost structures have used concepts of fixed capacity and normal external costs. However, IT capacity is not static but dynamic and the way in which IT affects and integrates other parts of the organization is has become the critical essence of IT. Further, the instability of the IT environment may dictate that organizations move in and out of any of the basic conditions necessitating certain types of control systems such as chargeback systems and not at other times. This is in marked contrast to the practices of organizations which adopt and rarely re-evaluate the appropriateness of chargeback systems. For example, organizations may find it more appropriate not to use chargeback in the early and growth stages of new systems adoption but adopt it in the later stages. Future research and theoretical development are required to isolate the warning signals and indicators of when chargeback systems should be emphasized and when they need to be de-emphasized.

Our review of the literature was not a sample, but included the critical research and practical literature on chargeback systems. The picture is intended to be complete for researchers and practitioners seeking to understand the issues. The history is important. Views about chargeback system have changed over time and are continuing to evolve. Chargeback systems were early heavily used, lost favor, and have emerged again. The costs and impact are now greater. There are developments on the horizon which extend past studies through applications of ABC costing, Theory of Constraints, and Life Cycle Costing as significant possibilities. These have yet to have practical impact as organizations cling to traditional systems as described in our survey. There are rich opportunities for organizations to implement alternatives but they must also be willing to discard alternatives. The conjunction of research and practice will be critical to the development and dissemination of these ideas.

The literature review also shows that chargeback systems are many different configurations depending upon the identification, collection, and distribution of costs. It is not that chargeback systems accomplish a set of objectives, but that different systems achieve different objectives. Research has taken the former view in that chargeback in general is used or not used, successful versus unsuccessful. Success or failure of these systems has become increasingly meaningless unless the conditions are specified and particular choices are addressed. Both the theoretical and empirical conditions have lacked the foundation to make optimal choices in the evaluation of systems success. Further, in reviewing previous research of chargeback practices, the critical assumption has been that organizations have made the optimal choice to begin with which has no basis in validity.

Measures and instruments to examine success seem to be premature even though chargeback systems have been used for many years. IT costs are a major issue to organizations. Their many facets, most of which are unexplored, make implementing and improving with chargeback systems a tenuous exercise. In conclusion, using or not using chargeback systems is on the one hand, a source of frustration, but on the other, an opportunity to consider in a more structured manner the realities and complexities IT costs and their impact on using IT effectively in the future.

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Don H. Drury is Professor of Accounting and Information Systems at McGill University in Montreal, Canada. His Ph.D. is from Northwestern University. He has published papers in *MIS Quarterly*, *Communications of the ACM*, *Management Science*, *Information & Management* and numerous other journals in management information systems. He has written four monographs on planning, costing, and control issues in information technology and is consultant to government and business organisations. He can be reached via drury@management.mcgill.ca.