Background

A somewhat controversial but continuing trend among large divisionalized corporations is to centralize the provision of information system services in the MIS department. The objectives of centralizing all or most MIS activities are to obtain economies of scale in the acquisition of computer hardware and to eliminate duplicate system development [9]. The centralization of MIS functions, however, creates certain administrative problems. These problems center around the degree of responsibility delegated to MIS for the choice and design of information systems, corporate control over the efficiency and effectiveness of MIS and the relationship between MIS and the corporate departments or divisions which use the service.

The problems inherent in effectively controlling the MIS function have been well documented [2,10], and much research has been done to help solve these problems [8]. One of these recommendations is to account for MIS as a quasi-profit center which provides services to other departments at a price (the transfer price). Profit center control is used quite extensively by U.S. corporations as a critical element of their management control systems. It requires that each division in the corporation be treated as an independent company responsible for its own costs and revenues. The performance of the division is judged on the basis of its measured profit. The advantages of such an arrangement are several. Profit center responsibility is believed to be a motivator of divisional performance, the transfer prices provide a basis for accounting for intracompany transactions and the measured profit can be used as a basis for evaluation and resource allocation. Profit center responsibility is generally found, however, in large corporations where both sales and production responsibility have been delegated to divisions. Very rarely is it found as the basis for evaluation of captive service centers like MIS. Service centers generally possess two characteristics that make them unsuitable for profit center responsibility: on the demand side they are often monopolistic and on the supply side
Transfer Pricing

their cost function typically contains a large portion of fixed and joint costs.

The interpretation of "profit" for a service center with these characteristics will therefore be very difficult, and it is unlikely that "profit" could be used as a guide to performance evaluation and resource allocation. The absence of a reliable yardstick for profits in a service center situation creates a methodological problem for the researcher. Even if he finds other sound reasons for pricing MIS services, he has no basis for judging the ultimate efficiency and effectiveness of his accounting system.

Despite this methodological problem and the general unsuitability of service centers to profit center control, researchers continue to support the use of profit center control for MIS. Such support is made in the expectation of (as yet unquantified) organizational and behavioral benefits that quasi-profit center control would produce. If these expectations are correct (and for the purposes of this article it is assumed that they are) then it is necessary to have a mechanism for pricing the services of MIS that will determine the revenue of MIS and the cost to the users of the services. It is the determination of this transfer price that is of concern here; there is no attempt to answer the broader control questions implicit in profit center responsibility. This is not to say that one can methodologically separate the economic aspects from the behavioral aspects. Clearly the management control structure must be judged in its entirety. The conclusions of this paper must be interpreted accordingly and are intended only as the first step in designing a congruent control system for MIS.

Transfer Pricing Theory and MIS

Objective

The transfer price developed here for MIS is the result of examining the body of accounting knowledge in the area of transfer pricing and determining a transfer price that is consistent with this theory yet operational within the constraints of the MIS environment. The final transfer price that results is thus derived inductively from accounting theory and in part deductively from observations of the MIS environment. This section of the article outlines the transfer pricing theory relevant to the development of the model and identifies the central problems of MIS to which the transfer price mechanism should be responsive.

Summary of accounting research on transfer pricing

The search for the "theoretically right" transfer price has occupied much space in the accounting literature [5, 6, 12, 15]. The use of transfer prices to account for the transfer of goods and services between divisions is a necessary adjunct to profit center control where there are intercenter transactions. The goal of profit center control is to motivate the centers to better performance and to simplify the task of evaluating their performance.

From a decision making standpoint this implies that a good system of profit center control will motivate the centers to make decisions that are congruent with the overall interests of the corporation. The danger inherent in any profit center control system, however, is that profit centers may make decisions that are profitable from their own limited view but are unprofitable from a corporatewide standpoint. This phenomenon of goal incongruence occurs when there is interaction between the cost and revenue functions of the profit centers as is likely between components of the same company. The key to designing an effective management control system is to develop an organization structure that minimizes the interdependence between the centers and to select a basis for the transfer price that reduces the number and importance of decisions that are made contrary to the interests of the corporation as a whole. The goal in transfer pricing is thus to reduce corporate level sub-optimization. Ideal transfer prices produce results such that "the activities of two divisions taken together would be the same as if they had been organized as a single profit center" [15,p. 192].
Two factors influence the choice of transfer price. First, the nature of the interaction between divisional cost and revenue functions affects the purpose of the transfer price. Second, available market and cost information constrains the choice of transfer price. Where a market price exists for the product traded between centers it may be taken as evidence of the opportunity cost of selling the product internally rather than selling it to a third party. In most situations this market price may be accepted as the transfer price \[6, 12\]. Where the internally traded product has no market price as a reference point, then marginal cost may be used as the transfer price \[5, 6, 12\]. Marginal cost is inadequate as a transfer price where capacity constraints exist. In this last case, the transfer price should be marginal cost plus the imputed cost (shadow prices) of the constrained resources \[5\].

**The environment of MIS**

**Demand function**

In order to relate these transfer price considerations to MIS, let us identify first the demand function of MIS and second the supply function. MIS is a captive service center in the corporation. Typically the sale of information services to external parties is the exception rather than the rule. Most of the information services provided are custom developed for the divisions or departments of the same company. Given the uniqueness of the services that each corporate MIS provides it is difficult to identify realistic market prices for these services. It is becoming increasingly possible to identify service bureau prices as a means of establishing market prices for these services. Prices are readily available on the basic clerical and accounting systems. Bid prices can be obtained on more sophisticated systems, but it is doubtful whether they can be classified as widely available prices. In addition, the service bureaus set prices to earn a reasonable return on their investment and the inclusion of a profit element in internal MIS prices may be inappropriate.

In the absence of readily available market prices it may be possible to construct an equivalent market price from the measured full benefits accruing to the user of the MIS service. Some of the benefits to clerical systems are cost displacement benefits and as such are measurable. The benefits from more sophisticated systems, however, are usually intangible and quantitatively indeterminate. It would therefore be very difficult to derive contribution margin objective functions using the benefits of MIS services as substitutes for the absence of market prices. In any case the contribution margin so identified would be a firm contribution and would give no indication as to the split between the contribution of MIS and the user department.

**Supply function**

In the absence of readily available market prices for MIS services, the transfer price must be cost based. Therefore, the supply function of MIS is critical. Four classes of costs incurred in supplying MIS services have been identified by a recent study \[16\]: development costs, variable costs, step-variable costs, and systems costs. Table 1 summarizes the findings of this study. The development costs refer to the initial investment in systems design and programming to develop new MIS services. When the service is up and running it will incur ongoing operating costs that are variable with usage. Data processing supplies and labor for data input preparation are examples of variable costs. Further costs are incurred at intervals into the future as the programs are modified to meet changing processing and output needs; these direct costs are step-variable in behavior. A large body of system costs are not directly traceable to user services. They are fixed with respect to use of the system by individual users and are jointly incurred for the benefit of all services. Note the large proportion of cost (54.1%, Table 1) that is incurred jointly to provide capacity for the services.

**Summary**

The absence of any reliable quantitative measure of the contribution of MIS services to corporate profits precludes a market price approach to transfer pricing. The only sound alternative is some kind of cost-based price.
Transfer pricing theory suggests that in the absence of capacity constraints and under certain competitive conditions in the final product market, the transfer price should be marginal cost [5, 6, 12]. The use of marginal cost, however, is quite difficult. Our inability to measure the benefits derived from most MIS services precludes our ability to gauge their impact on the output of the users of the services. We therefore have no basis for determining the effect of a cost-based transfer price on the net revenues of the users of the services. A further problem is that economists usually define marginal cost as a continuous and rising cost function. Of the four classes of cost listed in Table 1, only the variable costs form a continuous cost function. Variable costs are assumed, however, to vary proportionately with changes in volume.

Variable costs could be used as a substitute for marginal cost as a basis for the transfer price. A glance at Table 1, however, shows that variable costs account for only 16.2% of the total amount of cost traceable to MIS. The use of a transfer price based on pure variable cost would ignore two other types of cost (development and step-variable costs) that are direct costs and one major cost class (general system costs) that is not traceable to specific MIS services. The charging of only variable cost to the users of MIS services would ensure that MIS would incur a loss in excess of 80% of its costs. In addition, the users of MIS services would not be charged for approximately 30% (development and step-variable) of the total costs for which they are directly responsible.

Our analysis of the variability of the accounting costs omits consideration of an important element of the operation of any computer center, the “congestion costs” that arise from cyclical fluctuations in the short-run demand curve for system capacity. MIS may provide sufficient capacity to service its current portfolio of users, yet users often have flexibility in determining the time at which they may run their programs. This scheduling flexibility may set up demand cycles that create shortages of capacity at peak

### Table 1. MIS Cost Behavior

<table>
<thead>
<tr>
<th>Type of Cost</th>
<th>Traceable or Joint (to applications)</th>
<th>Avoidable after Implementation or Sunk</th>
<th>Constituent</th>
<th>Relative Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Development</td>
<td>Traceable</td>
<td>Sunk</td>
<td>Systems &amp; Programming Personnel</td>
<td>14.7%</td>
</tr>
<tr>
<td>Variable</td>
<td>Traceable</td>
<td>Avoidable</td>
<td>Data Processing Supplies, Input Data, and Quality Control Personnel</td>
<td>16.2%</td>
</tr>
<tr>
<td>Step-Variable</td>
<td>Traceable</td>
<td>Avoidable</td>
<td>Program Maintenance and Conversion Personnel</td>
<td>15.0%</td>
</tr>
<tr>
<td>Systems</td>
<td>Joint</td>
<td>Sunk or Jointly Avoidable</td>
<td>Software, Hardware, Operators, Specialists in Operations Department, Administrative Personnel, Building and Overhead</td>
<td>54.1%</td>
</tr>
</tbody>
</table>
times of the day, week, or month. These bottle-necks give rise to congestion costs, an opportunity cost to the user resulting from enforced delays in processing. This cost is apparent to the user but does not appear in the accounting records of MIS.

Conclusion

The analysis thus far leads us to three conclusions. First, the lack of quantified measures of the effects of MIS services on the net revenues of the users makes it impossible to apply the concept of opportunity cost to the choice of an appropriate transfer price. Second, we cannot use a market price or a contribution margin based price. If we must transfer price MIS services it must be cost based. Third, if we construct a cost based transfer price we should be aware that a strict interpretation of marginality or variability would likely exclude over 80% of MIS related costs (Table 1).

A methodological approach

A possible solution to this methodological dilemma is to concentrate on the relevancy of the costs of MIS as inputs to MIS and user decisions.

Decision analysis

Following is a selection of MIS and user decisions. The purpose of this section is to illustrate the types of costs that are relevant and therefore includable in the transfer price.

Service development decision: An important decision for both MIS and the users is to select a mix of information services to develop. Where the capacity to both develop and to process the new services is not constrained, then the relevant inputs are the separable or direct costs of the new services. These direct costs are the costs of developing the service (systems and programming), the variable cost of processing input data, developing output and maintaining files, and the step-variable costs of future reprogramming to keep the service operating. The cost of capacity—the systems costs—are incurred jointly for the benefit of all users and therefore are not relevant costs for the service development decision.

Activity level changes decision: Once a service is developed and implemented, additional cost will be incurred each time input data is processed. This cost is the variable cost of preparing data for machine input. System costs do not vary with changes in activity levels and are therefore not relevant for this decision. A short-run capacity problem arises, however, from changes in the time (of the day, week or month) that the service is processed. There may be short-run capacity shortages (congestion) resulting from too many jobs being processed at the same time. The delay in processing will be a real cost for some users. Considerable research has been done to develop ways of measuring this congestion cost [7, 11, 13, 14]. The approaches of these researchers is a variation around one theme; a flexible charge for the use of computer capacity to even out short-run cycles in the processing demand. The higher the demand at any one time, the higher the price. The price of "congestion costs:" it is suggested, may be determined by the use of queues. The longer the queue, the lower the price; a user may join any queue.

Retain or drop decision: The decision to continue processing a user's service is likely to be reevaluated by MIS and the user when system or output changes necessitate modifications to the programming service. These step-variable costs and the continuing variable cost of processing constitute the relevant costs of keeping or dropping the service. In the long run, the service competes for available capacity. Again the cost of capacity attributable to the service can only be determined by allocation.

Summary

This brief and limited analysis of MIS decisions illustrates that three types of traceable cost and the short-run congestion cost (if it can be determined) constitute costs relevant to the decision process. The fixed and joint systems costs are important inputs into decisions to expand capacity, computer system design and choice among
alternative systems. But they cannot, without some means of allocation, enter into the kinds of decisions that affect the use of the system, the very decision which the transfer price is designed to influence. A transfer price which is constructed under the criterion of relevancy should not include a charge for joint systems costs. To meet the criterion of relevancy the transfer price must provide the users of MIS services and MIS itself with information on those costs that will change as a result of user decisions. Since these direct costs fall into four different categories of behavior, the transfer price should separately disclose this cost information. This transfer price would therefore be a four-part price consisting of the following components:

1) A lump-sum charge for the development costs
2) A per unit charge for the variable costs
3) A lump-sum charge for the step-variable costs
4) A per unit charge for the congestion costs.

Better control will be achieved if these four costs are charged to the user at standard cost rather than actual cost. The use of standard cost provides MIS with an incentive to be more efficient. In contrast, the use of actual cost would guarantee that MIS would recover their costs. The availability of a standard at the beginning of the planning period provides the user with the cost information before he makes his critical participation and usage decisions. The standard charge for variable costs should be multiplied by the actual cost for the period. The development and step-variable costs should be treated as capitalizable items by the user. Treating these costs as expenses for the accounting period might affect the user's profit or budget picture adversely and discourage him from implementing new MIS services.

**Discussion**

**Current practice compared**

Current pricing practice among corporations with a centralized MIS can be divided into variants of four basic types:

1) No charge for the user
2) A charge for systems and programming costs only
3) A charge for computer and operating overhead only
4) Full cost—a charge for both systems and programming and computer and operating overhead.

The first method reflects a decision on the part of the company not to charge out or transfer price its MIS services. In some cases this may be done to avoid the problems inherent in calculating the transfer price charge and in the belief that realistic profit center control is impossible. In other cases it reflects a corporate strategy of encouraging the divisions of the company to use extensively the computer system facilities. In any case, it implies a subsidy of the cost of MIS and a direct cost of zero for each division.

The charging of users for the systems and programming costs of developing new services (and the charging of computer system overhead to the corporate budget) has the dual purpose of encouraging more extensive use of computer facilities for which there is no charge and policing the investment of funds in projects to develop new services. While this avoids the problems inherent in allocating the system costs to the users it does not charge for all the costs of use.

In contrast, the third method does not charge for any of the direct costs of use. By charging the computer and operating overhead it is generally hoped to encourage users to economize on available system capacity.

The fourth method charges for all MIS costs whether direct or indirect. A usual procedure is to convert all MIS costs into an average usage rate where costs are recovered from the users according to the number of hours of time for which each user is accountable. This average cost represents a mixture of direct and indirect costs. There is no way the user can determine the relevant costs of his usage decisions.
The proposed decision-oriented cost based transfer price would be superior to any of the above four methods if economies were the sole criterion. None of the above four methods charges the user directly for the costs that his use creates. The first three methods do not charge for all or part of the costs of MIS in the hope that certain administrative goals (such as encouraging computer use) may be met. The administrative goal does not, however, appear to be economically efficient.

Full cost, the fourth method, probably does the most to distort economic efficiency by mixing the direct and indirect costs. Paradoxically, however, this method is easily the most popular [3] despite its acknowledged inferiority [11] and despite the cost of developing and maintaining a system to allocate the joint systems cost to the users. The popularity of charging for systems costs has a lot to do with the size of system costs. Systems costs account for over 50% of the total costs of MIS (Table 1). A transfer price that does not include systems costs requires that over half of all MIS costs be covered by corporate overhead.

The behavioral impact of charging for systems costs

A factor that is frequently cited as a reason for charging for systems capacity costs is the hope that this will influence the use of the system and hence the availability of capacity. A user can influence the availability of system capacity in two ways. First, he can run his programs on the system and reduce the general availability of the system for other users. Second, he may be more or less efficient in his use of different components of the system via the design and writing of his programs. Available computer capacity is not simply a function of computer size, but also a function of the complex interaction of the different parts of the total system [17]. A sophisticated operating system might, for example, minimize slack in the central processing unit by switching programs in and out of online files. Similarly, the writing of the application programs for a new service can have a significant effect on the balance of computer capacity. A new service, for example, may require excessive channel time and create bottlenecks in what otherwise is a balanced system.

An important behavioral question is whether a charge for systems costs has an impact upon the general use of systems capacity and upon the mix of system components required by the users of MIS services. No research has been done in this area to provide an answer. But clearly many companies feel that charging users of MIS services for systems costs has a useful impact upon the user.

Technical feasibility of charging for systems costs

An allocation procedure that charges users for using general systems capacity requires an average charge per time unit. A charge that penalizes users for using individual components of the system must segregate cost by component. Various hardware and software devices are also available to keep track of the usage of each component of the system. One writer, for example, talks of the internal reporting method which uses a software monitor to sample the usage of each component [4]. The complexity of modern computer systems is such, however, that it would be impossible to allocate all computer costs by usage. Multiprogramming effects such as paging would be very difficult to allocate to the user. Inevitably a certain portion of systems costs would have to be allocated arbitrarily.

Economic feasibility of charging for systems costs

The problem with charging for systems costs is that the components of the computer system are used jointly by many users and charging for their use requires an allocation of this joint cost. The cost of using the CPU, for example, is not a direct cost to one user nor is it a relevant cost in his decision to use the system on an operating
Transfer Pricing

basis. The danger is, of course, that without a charge for the components of the system an important system design variable (the system components that will be used by an individual user) will be ignored and the overall long-run cost of using computer capacity will be treated by the user as zero. The benefits of an MIS service to a user will appear much greater because of this capacity subsidy.

The real objection to charging for systems costs is that they do not constitute relevant costs for short-run decisions. If a charge for systems costs is made the relevant costs of short-run decision making will be submerged. This particular dilemma can be at least partially avoided, however, by adopting a system similar to one recommended by Solomons for transfer pricing captive service centers [15, pp. 201-205]. The Solomons' solution is to charge the user for fixed and joint overhead via a lump sum period charge. This requires an allocation of joint cost, but it does not convert the fixed cost into a per unit variable charge. Therefore, it does not affect the charging of relevant costs on an incremental basis. The period charge would have to be based on actual usage. If the charge is based on actual usage, the total charge will be identical to that levied under a system of per unit charges. The actual usage could be used to determine the fair charge for the next budget period.

Synthesis

The inclusion of a charge for systems costs in the transfer price depends upon the purpose of the transfer price. The behavioral intent of influencing usage of system resources is clearly an important goal for many companies that do charge users for systems costs. There is no research available to guide us in determining what these behavioral effects might be. The continued popularity of charging for systems costs, however, may indicate that companies perceive the effects to be positive. From a technical standpoint it is possible to identify the usage of most but not all system components by application program. The allocation of costs that result, whether allocated on the basis of usage or some other basis, are still arbitrary allocations. Therefore, the allocations of systems costs cannot be justified on a strictly economic basis. If the systems costs are included in the transfer price they should be levied as a lump sum period charge rather than on a per unit or per time basis.

Conclusion

Any system of transfer pricing for MIS is constrained by the difficulty of treating MIS as a profit center and in the methodological difficulty of judging economic and behavioral impact of any transfer pricing algorithm. Much of the early part of the article is spent determining just how, and on what basis, the transfer price should be chosen. The four-part transfer price, a separate charge for congestion, development, variable and step-variable costs, is chosen on the basis of relevancy.

The criterion of relevancy does not lend itself to exhaustive analysis, but it is possible to illustrate the kinds of MIS and user decisions for which the transfer price will be relevant. Of the four parts of the transfer price, three are recorded in the accounting system of MIS. The fourth class of cost, the congestion cost, is of the nature of an opportunity cost. It is not recorded in the accounting system but is thought to be measurable. The last part of the article discusses the lack of inclusion of the systems costs in the transfer price. This issue is probably the most controversial one addressed in the article. The magnitude of systems costs makes their treatment rather important. The ultimate resolution of this question is a behavioral one that is not settled by this article. A possible solution is presented, however, that permits charging for the systems costs via the transfer price without affecting the marginal data necessary for operating decisions. This solution charges for systems costs via a periodic budget charge rather than on a per unit or per time basis. If this charge is levied, the transfer price becomes a five-part price. This five-part price is summarized by Table 2.

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### Table 2. Proposed Transfer Price

*All costs as estimated for the ensuing budget period*

<table>
<thead>
<tr>
<th>Itemized Hardware Cost. Software (some). Operators</th>
<th>System Costs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Systems and Programming</td>
<td>Development Costs Three Lump Sum Charges</td>
</tr>
<tr>
<td>Maintenance. Conversion</td>
<td>Incremental Costs Transfer Price</td>
</tr>
<tr>
<td>Supplies. Extra Shift Rentals. Specifically Assigned Operators. Input Preparers</td>
<td>Variable Costs Two Per Unit Charges</td>
</tr>
<tr>
<td>Congestion Costs</td>
<td>Short-run Capacity Cost</td>
</tr>
</tbody>
</table>

### REFERENCES


### About the Author

Peter B.B. Turney is a Consultant with Peat, Marwick, Mitchell & Co. He received his B.A. at Bristol University. M.S. and Ph. D. at the University of Minnesota. He previously taught at the University of Maine at Orono and the Graduate School of Management at Northwestern University. He is the author of articles in Management Advisor, Managerial Planning and Management International Review. and Management Datamatics. He is a member of the American Accounting Association and the American Institute for Decision Sciences.