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Determination of Unit Costs for Library Services

As with other public service activities, inflationary trends and public opinion provide a clear mandate for attempts to control the increasing costs of providing library services. Cost control necessarily requires knowledge of the quantities and sources of costs. A methodology, known as microcosting, for identifying the unit costs of providing specific services is presented here. The method is designed to enable library managers to identify at a detailed level the resources consumed in providing a particular service. This information provides a quantitative basis for and a monitor of library management decisions. To illustrate the use of the methodology, it is applied to the determination of the unit costs of tracking overdue materials at a major university library.

THE RAPID INCREASE in the costs of providing library services over the past several years is well known.[1–3] The causes of this increase are difficult to isolate but hold the key to reducing the rate of growth in library costs. While it is a vast undertaking to identify all of the economic, social, and technological factors that have contributed to cost increases, one cause that can be recognized is the lack of impetus for the development and use of effective cost containment methods.

The provision of library services has been viewed by universities as essential for instructional and research programs and by municipalities as required for constituent cultural opportunity. Library services have been viewed in the same light as medical services. A person who needs medical care asks if it can be provided rather than what it will cost. Universities have thus tended to ask if "adequate" libraries and library services can be provided rather than how they can be provided in a truly cost-effective manner. This approach may have been appropriate in the past as the financial resources for providing library services have generally been available.

Recently universities and municipalities have found that their financial resources are more constrained, that there is greater competition for those resources, and that increasing costs for all programs have resulted in a decline in what can be obtained with their resources. As a result, libraries have found that funds are harder to get, must be accounted for more carefully, and still buy less. Thus libraries have recognized the need to manage their resources more carefully and to attempt to allocate those resources more efficiently.

The key to managing library resources is knowing what the costs of providing library services are. A method that can be used to isolate the costs of providing specific services is discussed here. An example of how this method has been applied to the identification of the cost of pursuing overdue materials in a university library is described. Finally, the potential for application of the methodology to other library service activities is discussed.

Cost Determination

Cost determination can be divided into two categories, macrocosting and microcost-

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ing. Both types of cost analysis have been used extensively in production environments in industry.[4] During the past few years, they have also been applied to many service organizations, most notably in hospitals.[5]

The purpose of macrocosting is to examine a system such as a library in order to determine its present costs and from these costs to estimate trends and make inferences concerning future system costs. For libraries, this could prove to be a very fruitful endeavor and appears to have been attempted on a limited scale within the context of budget preparation. Nevertheless, there is substantial opportunity to pursue macrocosting studies in libraries especially in the areas of long-range planning and of evaluation of proposed program or service changes.

The purpose of microcosting is to obtain measures by which specific management decisions may be judged. Microcosts can be used to evaluate specific changes within a library system. This is because microcosts focus upon fundamental "unit costs" and can be used to determine the cost of providing a specific service or even a single unit of that service.

The microcosting technique is explained here by example. For illustration, the application of the method to the handling of overdue materials is described step by step. The results of this application are described, and the extension of the method to other library services is discussed.

Microcosting

The underlying framework for microcosting is conceptually simple. The first step is the construction of a flowchart describing the specific tasks and events that constitute the provision of a particular service. Figure 1 shows an example of a flowchart for tracking overdue materials using the Virginia Polytechnic Institute and State University (VPI & SU) automated Circulation and Finding System.[6]

The most important attribute of the flowchart is that it represents all of the events that may occur in the tracking of an overdue item. Thus the flowchart schematically describes the order in which the various tasks associated with tracking an overdue item may be performed. The possibility that certain steps may be repeated is represented by a "feedback" or return loop.

Once the flowchart has been constructed, it is used to design a work sampling study to identify the library resources that are used to track overdue materials. This work sampling study is described in detail below. First, the pertinent costs and the resulting motivation for the work sampling study are discussed.

The total cost of providing a service is composed of four components: direct labor, indirect labor, materials and equipment, and overhead.

Personnel time is a limited resource, the consumption of which carries an associated cost. The personnel time expended in the specific tasks that constitute the provision of a service is called the direct labor commitment to that service. The direct labor component of the cost of providing a service is the cost of the pesonnel time allocated to the provision of that service.

The first step in determining the direct labor cost for a service is to use the flowchart to help enumerate the personnel that participate in the provision of the service. In the case of the tracking of overdue materials, the participating personnel are one librarian, one library assistant, two level B clerks, one level C clerk, one level C clerk typist, and three level B clerk typists. All of these persons devote part of their time to tracking overdue materials.

Identification of the cost of tracking overdue materials requires the determination of what portions of the personnel salaries are appropriately allocated to this service. This determination is made using work sampling.

Indirect labor is classified in two distinct activity categories. The first of these is work that is not related specifically to any procedure or responsibility. Activities that fall into this category are answering telephones and cleanup. The second category is nonproductive time. Nonproductive time includes idle time, standby time, lunch breaks, and personal time for coffee and rest room breaks. The costs of indirect labor time must be apportioned among the various procedures or responsibilities of the personnel. The actual method of apportionment can be determined by existing man-

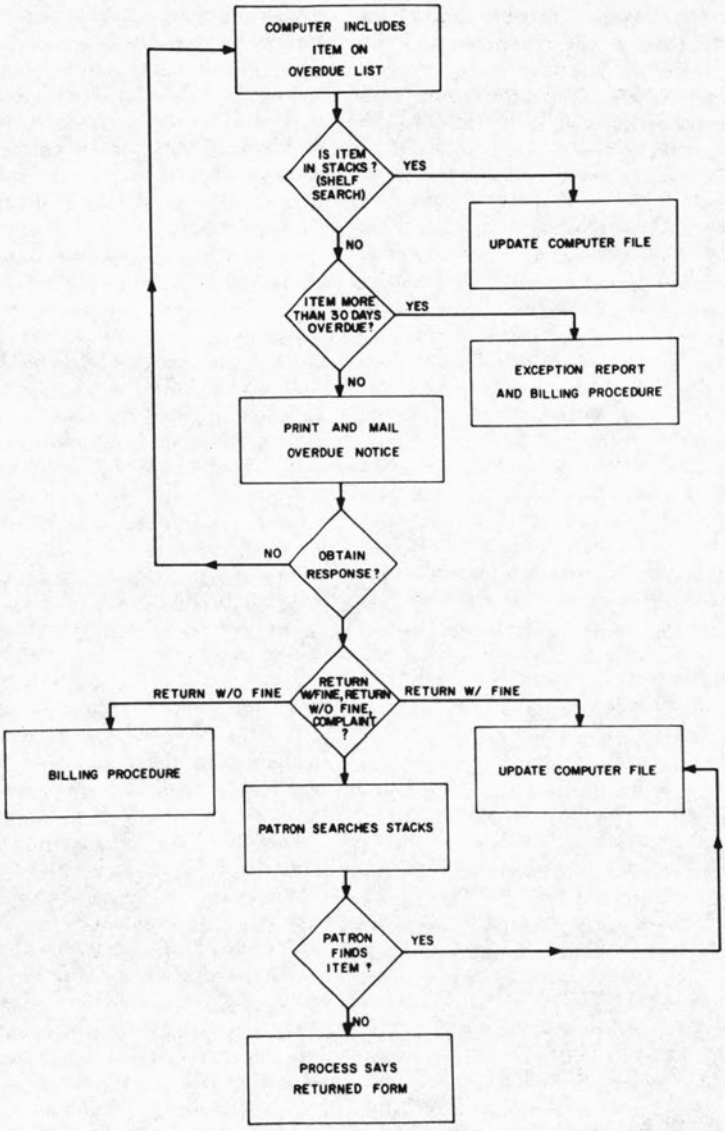

Fig. 1
Flowchart for Overdue Materials Tracking Tasks

agement policy or can be based upon direct labor allocations. In the overdue materials study, indirect labor times were distributed to the task of tracking overdue materials in proportion to the direct labor expended on that activity.

Current materials costs can be obtained from the purchasing agent. In cases where materials costs fluctuate, a moving average can be used to estimate costs of particular items. Equipment depreciation for items used in the performance of a task can be obtained from the accounting department. Care must be taken to allocate the depreciation cost in proportion to its use for the given procedure. In the case of the tracking

of overdue materials, the only significant equipment in use is the computer and the computer terminal. Computer-use charges include depreciation. The depreciation cost for the computer terminal is allocated in the proportion equal to the percentage of direct labor committed to tracking overdue materials.

Overhead costs are real costs and must be included in the calculation of the cost of providing a service. Overhead is divided into two parts, departmental and general.

Departmental overhead includes the cost of providing supervision and support personnel. These costs are specific to the department but not to any given departmental responsibility.

General overhead is the cost allocated to the department by the library and includes housekeeping, building depreciation, and utilities.

Both types of overhead are specified by accounting, and both can be distributed over department responsibilities in proportion to the direct labor allocated to departmental procedures. At the VPI & SU library, the circulation department is responsible for the tracking of overdue materials. However, by university policy, departmental and general overhead rates are aggregated and valued at 63 percent of labor costs (direct and indirect).

All four categories of the costs of providing a service have been linked to the direct labor time expended in providing that service. It therefore remains to determine the direct labor commitment to the service. An effective method for doing this is work sampling.[7–9]

Work Sampling

Work sampling is a technique of randomly observing personnel perform their defined tasks and inferring from those observations a profile of the average labor allocations to the various employee responsibilities. By *random observations* is meant that the times at which observations are made are selected by use of a random device (e.g., a table of random numbers) as opposed to their being scheduled at regular intervals. This randomization of observation times guarantees that representative and unbiased data are obtained.

The key to the accuracy of the inferences is to make the observations without disturbing the work environment. Proper introduction of the study and its objectives to the staff prior to execution of the study contributes significantly to minimizing the disturbance of the work environment. An important aspect of this introduction is the emphasis of the focus of the study upon the cost of the service rather than upon individual worker productivity.

To construct the work sampling study, a set of task categories is defined using the procedure flowchart. In addition, general work categories are defined to represent tasks associated with services other than the one under study. Categories corresponding to indirect labor activities are also defined.

Figure 2 shows the task categories used in the overdue materials study. Note that each task category is defined and has been assigned a code. To execute the work sampling study, observation times are selected randomly and recorded on the data sheet shown in figure 3. Then, at each of the selected observation times, a "snap shot" of the department is taken. By "snap shot" is meant that an observer locates each of the departmental personnel and enters on the data sheet the task code corresponding to the activity in which the person is engaged.

Figure 3 shows an example data sheet in which task code entries have been made. In the overdue materials study, 1,013 such individual data entries were accumulated. These data are then analyzed to determine the quantity of direct labor consumed in the provision of the given service.

To analyze the accumulated data, the fractions of available employee time committed to the various tasks are tabulated. Then, the following variables are defined:

T_j = the total available work time for employee j,

t_j = the direct labor time expended by employee j in the provision of the service under study,

s_j = the total indirect labor time for employee j,

r = the aggregate overhead rate (63% in the present study),

d = the computer terminal depreciation rate,

Task Codes

Overdue Materials Tasks

SS — stack search
M — mailing overdue notices
T — computer terminal
RF — returns and fines
E — exception reporting
SR — says returned reporting
C — complaints
RP — running overdue programs
O — other

Non-Overdue-Related Tasks

CHK — checkouts and check-ins
HR — holds and recalls
Res — reserve
Sup — supervision
UP — user problems
O-II — other-II

Additional Designations

P — personal
L — lunch
I — idle

Task Definition for Overdue Materials

Stack Search. Canvassing the shelves to be sure material listed as overdue has not been returned directly to the shelves by the borrower.

Mailing Overdue Notices. Any activity requiring the handling and/or sorting of overdue notices for the purpose of mailing them. This is for the 8-, 15-, and 30-day notices that are automatically generated by the computer.

Computer Terminal. Entering overdue update information obtained from stack search into the computer via the terminal or running the computer programs to generate the overdue materials list.

Returns and Fines. Processing the returns and collecting fines submitted for overdue items.

Exception Reporting. Typing or processing exception reports for overdue materials. This task is specific to items more than 30 days overdue.

Says Returned Reporting. Preparing entries for the "says returned" file.

Complaints. Dealing with patrons who indicate that an overdue item has been returned.

Running Overdue Programs. Running the computer programs to obtain listing for stack search.

Other. Any other task that does not fit into one of the above categories but does relate to overdue materials. Any such entry should be explained on the back of the data form.

Task Definitions for Responsibilities Other Than Overdue Materials

Checkouts and Check-ins. Working at checkout desk.

Holds and Recalls. Processing or working on holds and recalls.

Reserve. Working on reserve book activities.

Supervision. Directing or supervising student employees.

User Problems. Responding to patron requests for assistance that are not related to overdue materials.

Other-II. Any other task that does not fit any of the above definitions. Should be accompanied by a category of task on reverse side of the data form.

Additional Designations

Personal. Individual is involved in a personal activity such as a coffee break or a visit to the rest room.

Lunch. Individual is on a lunch break.

Idle. Individual is at a work station but is idle.

Fig. 2
Task Categories

e = the equipment and materials cost of providing the service under study (computer costs for the present study), and

c_j = the salary rate for employee j.

Then, with the use of these definitions, the total cost of providing the library service is expressed by equation 1, where N is the number of employees that participate in the provision of the service. In this expression that total cost of providing a service is defined in terms of the direct and indirect labor expenditures that are, in turn, obtained from the work sampling study.

Results

Table 1 shows the percentage of available employee time expended in the various direct labor activities associated with tracking

$$C_T = \sum_{j=1}^{N} \{c_j [t_j + \frac{t_j}{T_j - s_j} s_j] [1+r] + \frac{t_j}{T_j - s_j} d\} + e \quad (1)$$

ANALYST JOE

TIMES / NAMES	7:42	8:12	8:35	8:52	9:16	9:38	9:50	10:11	10:26	10:48
JOHN (Clerk B)	CHK	HR	CHK	HR	HR	HR	HR	P	HR	CHK
MARY (Supervisor)	HR	HR	HR	I	RES	RES	RES	P	RES	RES
BILL (Clerk B)	I	T	SS	SS	SS	SS	P	RES	CHK	I
SUE (Clerk-Typist C)	RF	RF	SUP	I	UP	M	E	E	P	P
ELLEN (Clerk B)	I	T	SS	SS	T	CHK	CHK	P	CHK	CHK
TOM (Library Asst)	RES	HR	RES	RES	C	SUP	HR	RES	CHK	SUP
JILL (Clerk-Typist B)	CHK	CHK	HR	HR	E	E	I	HR	M	M
RICK (Clerk C)	HR	HR	SS	SS	SS	SS	P	CHK	M	M

Fig. 3
Example Data Sheet

overdue materials and the resulting total direct labor fraction commitment to this service at the VPI & SU library. These figures represent the values of the quantities t_j/T_j and are presented as more informative than the actual t_j values. These values are computed using the work sampling data accumulated as are the corresponding fractions of indirect labor times shown in table 2.

The entries in table 2 represent the total indirect labor fraction and the fraction of the available employee time consumed by indirect labor that is allocated to the tracking of overdue materials.

As an example, note that for the supervisor 5.4 percent = [17.7/(100.0 − 23.5)] [23.5]. By adding the allocated personnel times listed in tables 1 and 2, the total fraction of available employee time allocated to the tracking of overdue materials is obtained. These allocations are shown in table 3.

After obtaining computer costs from the computer log, terminal depreciation from accounting, and personnel salary rates from the personnel office, the total cost of tracking overdue materials is computed using the expression defined above, and these costs are distributed to the overdue materials tracked. Using the tabulated data, it is found that the average cost of tracking

TABLE 1

PERCENTAGES OF AVAILABLE EMPLOYEE TIME EXPENDED ON DIRECT LABOR ACTIVITIES FOR OVERDUE MATERIALS TRACKING

Activity Code	Job Class: Supervisor	Library Assistant	Clerk Typist B	Clerk Typist C	Clerk B	Clerk C
SS	3.9	1.0	11.1	10.2	18.9	1.0
M	0.0	3.4	0.3	0.0	0.0	0.0
T	0.0	0.5	1.0	0.0	0.0	0.0
RF	0.0	2.9	2.8	0.0	7.8	0.0
E	0.0	0.0	0.0	0.0	0.0	0.0
SR	2.1	0.4	0.0	0.0	1.9	0.9
C	0.0	1.0	0.3	0.0	0.9	1.0
RP	3.9	9.8	0.3	0.0	0.0	0.0
O	7.8	2.4	1.1	0.0	4.1	0.0
Direct Labor Fraction (t_j/T_j)	17.7	21.4	16.9	10.2	33.6	2.9

TABLE 2

PERCENTAGES OF AVAILABLE EMPLOYEE TIME EXPENDED ON INDIRECT LABOR AND ALLOCATED AS INDIRECT LABOR TO TRACKING OVERDUE MATERIALS

Job Class	Indirect Labor Fraction (Percent)	Indirect Labor Allocation (Percent)
Supervisor	23.5	5.4
Library Assistant	25.7	7.4
Clerk Typist B	30.6	7.4
Clerk Typist C	25.9	3.6
Clerk B	20.6	8.7
Clerk C	23.8	.9

overdue materials at VPI & SU is $.22 per overdue item. At VPI & SU this cost amounts to approximately $18,330 per year.

Upon completion of the study, the stack search activity was examined. It was found that fewer than 3 percent of the items listed as overdue had been returned to the shelves without being discharged. As a result of this finding, the stack search activity has been eliminated from the set of overdue materials tasks routinely undertaken. Examining the study results indicates that the stack search activity is time-consuming. In fact, this task requires an average of approximately .61 person-days per day.

Eliminating the stack search frees this time for allocation to other tasks. Including consideration of job category, this time represents $8,000 of the $18,330 annual cost of tracking overdue materials. Now it should be noted that total library operating costs are not necessarily reduced by this amount. Instead, the work avoided by eliminating the stack search creates additional available employee time that is committed to other activities. A follow-up study is planned to determine how much of this additional time is used to provide user services.

TABLE 3

TOTAL FRACTIONS OF AVAILABLE EMPLOYEE TIME ALLOCATED TO TRACKING OVERDUE MATERIALS

Job Class	Total Labor Fraction (Percent)
Supervisor	23.1
Library Assistant	28.8
Clerk Typist B	24.3
Clerk Typist C	13.8
Clerk D	42.3
Clerk C	3.8

CONCLUSIONS

The use of microcosting has permitted the identification of the unit cost of providing a specific type of library service, the tracking of overdue items. Obvious uses for this information are the formulation of overdue return policies and overdue fine schedules. The unit costs can be combined with incentives for efficient materials use to develop operating policies that recover library costs while promoting more responsible utilization of library collections.

It should be noted that the methods by which the indirect and overhead costs are obtained are specific to the particular library being studied. However, it is quite easy to computerize the data manipulation procedure. This permits easy alteration of cost computation formulas and can also be used as a format for refining the method described. The key point is that unit costs of providing user services can be identified using this method.

The method described for microcosting does not require sophisticated equipment or highly trained personnel. In the overdue materials study, library employees with no previous exposure to the technique collected the data. The actual design of the study and the analysis of the data should be entrusted to an industrial engineer. Nearly all university libraries can find an industrial engineer on campus. Urban-based municipal libraries can locate an industrial engineer at a nearby industrial plant or through the state society of professional engineers. Thus the resources required to undertake a microcosting study are likely to be readily available.

A variety of other library services, both routine and special, are well suited to microcosting analysis. Reference services, interlibrary loans, photocopying services, acquisitions and cataloging, and check-in and return services are all reasonable subjects for microcosting studies. In fact, any library service or activity that requires the use of personnel time can be investigated using the microcosting technique. For any given library, the method will have greatest utility in examining services over which some decision-making control is possible.

In summary, a method has been de-

scribed that will enable library managers to identify the costs of providing specific services. The method was illustrated by application to overdue materials but can be applied to nearly any library activity. In addition, the method can be standardized and loaded on a computer so that it can be applied throughout the library. The value of the method is that it provides a sound approach to determining at a microscopic level how library resources are being consumed.

The information derived can be used to make decisions or formulate library policy. One approach to taking advantage of the power of the method is to use it both before and after a decision or policy is implemented to determine the effect of the change. For example, the impact of a very stringent overdue fine schedule could be determined by executing the overdue materials study again after the institution of such a schedule. Thus microcosting is a tool that library managers, as they face increasing costs and shrinking budgets, can use to learn about "where the money goes" and how to stretch it further.

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