
Output Measures in Libraries

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ABSTRACT

AN IMPORTANT TREND in library management over the last two decades has been the increasing use of measurement for management decision-making. The purpose of this article is to trace briefly the history of the use of performance measures in libraries and to discuss some issues in the use of such measures for decision-making and problem solving.

PERFORMANCE AND OUTPUT MEASURES

Performance measures was a key phrase in the 1970s (DeProspero et al., 1973). In the 1980s it was replaced by *output measures* (Zweizig & Rodger, 1982; Van House et al., 1987). Although these terms are often used interchangeably, it is more useful to preserve a distinction between them.

Performance measures refer collectively to several kinds of measures that reflect the performance of the organization. These include: inputs or resources used; processes or measures reflecting internal operations; productivity or the ratio of outputs to inputs; outputs, that is, the extensiveness and effectiveness of services delivered; and outcomes, the most difficult to measure, the effects of the services provided on clients and society. This article is primarily concerned with output measures in libraries.

THE TREND TOWARD MEASUREMENT

The growing use of performance and output measures for libraries is a result of several interrelated developments:

—The appearance of library researchers and, more recently, librarians

- with interest and skills in quantitative methods which they used to address major library issues and management questions, for example, Goldhor (1972).
- The increasing size and complexity of libraries which has caused managers to seek new tools to help with decision-making.
 - The discovery of libraries by nonlibrary researchers, particularly operations researchers and economists who found libraries to be complex organizations with interesting problems that were underutilized as research sites. Examples include Morse (1968), Hamburg et al. (1974), Leimkuhler (1972), Baumol and Marcus (1973), and Getz (1980).
 - Growing demand for accountability in the public sector coupled with increased sophistication among librarians and other managers. As quantitative methods, program evaluation, and evaluation research have spread through the public sector, and accountability requirements have tightened, librarians have adopted these methods to remain competitive with other organizations seeking the same resources.
 - The availability of grant funds from sources like the Library Services and Construction Act. Funders often require that projects include an evaluation component.
 - An emphasis on formal planning. In public libraries, input-oriented standards have been replaced by planning processes: first Palmour et al. (1980) and more recently McClure et al. (1987). In academic libraries, the Association of Research Libraries introduced MRAP, the Management Review and Analysis Program, in the early 1970s. Planning requires setting of goals and objectives and assessing the library's current needs and progress for which objective data are useful.
 - The appearance of a number of publications aimed at helping library managers to use measurement methods and results. These include Kantor (1984), Lancaster (1977), Lancaster (1988), Van House et al. (1987), and Zweizig & Rodger (1982).

Of course, managers have always used data for decision-making. And data do not replace managerial judgment. Managers, both librarians and others, vary in the extent to which they use performance measures in their decision-making. What has distinguished recent developments in libraries has been an increasing sophistication of the measures and methods used, a greater reliance on data in decision-making; and a reliance on output measures in particular.

It is beyond the scope of this article to comprehensively review the use of measurement data of all sorts in libraries. However, a review of some major landmarks in the use of measurement data leading to the present use of output measures will help to show the development.

EARLY APPLICATIONS

An early landmark in the discussion surrounding output measures

in libraries was Orr's (1973) framework. He described the assumed relationships among resources, capability, utilization, and beneficial effects of library services, in which an increase in one is expected to lead to an increase in each of the succeeding measures though not necessarily proportionately. Quality of service is a function of resources, capability, and utilization; value is a function of the library's beneficial effects.

Hamburg et al. (1974) attempted to develop an overall measure of library effectiveness. A group of faculty and students at the University of Pennsylvania's Wharton School set out to develop a system of statistical information for effective management of libraries and for decision-making about libraries. Objective evaluation of library performance requires concrete, measurable objectives. They concluded that the goal of libraries of all kinds is exposure of individuals to documents of recorded human experience. They then proposed a global measure of library outputs based solely on document exposure. Each service transaction was translated into exposure time.

This approach had methodological and conceptual problems (the most serious of which is the assumption that longer is always better), but it was significant in promoting service- and measurement-oriented evaluation and resource allocation. The message was that library evaluation should be based on library goals—i.e., on the services delivered. In relating the exposure hours delivered by a library to its operating costs, they suggested a way to justify library budgets and to compare library services for resource allocation.

Rzasa and Baker (1972) suggested an overall measure of academic library performance based on the number of users, materials used, reference questions, users studying their own materials, and total potential users in the library's population. The weights of each of these factors would be assigned by library management, and the overall results summed to a single figure of library performance.

These two approaches reveal the basic weakness of any attempt to develop a single measure of library output—the library provides a multitude of services to a variety of different types of users. Any attempt to consolidate measures of these individual services into a single index requires an ultimately arbitrary (and/or political) decision about the relative values of different services and types of users.

OUTPUT MEASURES IN PUBLIC LIBRARIES

Public libraries have played an important ongoing role in the development of output measures. DeProspero et al. (1973) developed a set of measures of public library services. Unlike Hamburg, they did not try to translate all services into a common unit of measure. They designed their measures to be do-it-yourself and even published a companion workbook (Altman et al., 1976). Their approach was significant in promoting the idea that managers, not researchers, could carry out the data collection and use the data for decision-making, and for developing

a set of distinct measures covering major library services. The first edition of *Output Measures for Public Libraries* (Zweizig & Rodger, 1982) followed DeProspero in presenting a set of measures covering common library services in an easy-to-follow manual. The second edition (Van House et al., 1987) retained the do-it-yourself approach and added more guidance on collecting data and interpreting the results.

The Public Library Association's sponsorship and promotion of the two editions of *Output Measures for Public Libraries* and their wide use in the public library community indicate, first, the value that public librarians place on output measures, and second, the readiness of the public library community to use measures that are presented simply and clearly.

OUTPUT MEASURES IN ACADEMIC AND RESEARCH LIBRARIES

In academic libraries, measurement has been used more often to study a specific service or resource, especially the collection. Academic libraries have been a favorite site for researchers, many of whom are academic librarians themselves. The pressures on many academic librarians to publish has no doubt added to the number of published evaluations of academic library services.

Kantor's (1984) manual presented a self-study approach to measurement, with forms and detailed directions, for academic and research libraries. It is concerned specifically with availability and accessibility of materials and delays in interlibrary loan delivery.

Several years' investigation into output measures for academic and research libraries by the Association of College and Research Libraries and its Committee on Performance Measures, Ad Hoc, has resulted in a manual that is currently being prepared by Nancy Van House, Beth Weil, and Charles McClure (in press). The manual will present a set of measures reflecting performance on major library services—document provision, information services, and facilities. The expected publication date is summer 1990.

In the United Kingdom, the Standing Conference of National and University Libraries (SCONUL) and the Library Association have collaborated on the development of measures intended to assess the adequacy of university library funding. The first phase of the project was concerned with the development of cost data. The second phase is concerned with measuring outputs to track expenditures. The emphasis is on quantities of services provided and internal processes (Loveday, 1988).

MEASURES OF SPECIFIC SERVICES

In contrast to these approaches to a single measure or set of measures of the full scope (or at least a significant portion) of library activities, numerous measures of specific library services have been developed. A comprehensive review would require a book such as

Lancaster's (1977) (currently being updated). What follows is an overview of some common approaches to the development of output measures for some major library services.

Collections

A major library service is the provision of documents. Evaluation of document provision has three dimensions. Collection evaluation is concerned with adequacy of the collection. Materials availability studies address the extent to which users find what they are looking for. Document delivery studies measure how quickly users obtain materials whether from the collection or elsewhere. The last two approaches often overlap since both are concerned with access to and use of materials.

Collection evaluation is generally considered separately from materials availability and document delivery. In academic and research libraries in particular, collection evaluation depends not only on use (Lancaster, 1982) but on other factors as well since a research collection exists for archival purposes which are not easily captured by output measures. Major approaches to collection evaluation are both quantitative (size, rate of growth) and qualitative (including expert judgment and bibliographies). These are summarized by Lancaster (1988). Both the Association of Research Libraries and the Research Libraries Group have been concerned with the development of methods for describing and evaluating research collections.

Evaluation of collections by their use and accessibility falls within the scope of output measures. The simplest approach is to measure use by counting the number of items circulated, possibly including those used within the library. Other output measures include:

- the proportion of the collection that circulates (e.g., Kent et al., 1979);
- the relative use of each part of the collection (e.g., Kantor, 1978);
- the proportion of user searches that are successful (Buckland, 1975; Kantor, 1984; Van House et al., 1987);
- the proportion of searches that are successful at each step in the search process (which allows a diagnosis of the causes of search failures [Kantor, 1984]);
- potential availability based not on actual user searches but on proxies such as references in user publications (Orr et al., 1968) or samples of published materials (DeProspero, et al., 1973); and
- the time required for users to get materials not immediately available, based on actual patron searches (Buckland, 1975) or proxies (Orr et al., 1968).

Studies of the determinants of collection use (e.g., Goldhor, 1972; Goldhor, 1981) go beyond output measurement to the investigation of the determinants of output measures.

Reference Services

Reference evaluation has assessed both quantity and quality. (Mea-

asures of reference effectiveness have been summarized in reviews by Powell [1984], and Lancaster [1988]). Measures of reference quantity focus on the enumeration and classification of questions answered (e.g., Goldhor, 1987).

Reference quality is much more difficult to assess. Measures that have been used include:

- the proportion of questions answered correctly as judged by the librarian (e.g., Kantor, 1981; Van House et al., 1987);
- the proportion of questions answered correctly in a simulation, as judged by an objective observer, with librarians knowing that they are being tested (Lancaster, 1988);
- the proportion of actual user questions answered correctly, as judged by an expert observer, after the fact, with the librarian not knowing at the time of the transaction about the evaluation (Van House & Childers, 1984);
- the proportion of questions answered correctly in a simulation, with librarians not knowing they are being tested—that is, unobtrusive studies (Hernon & McClure, 1987);
- the speed with which questions are answered;
- patron satisfaction with the answers and services provided (Goldhor, 1979; Weech & Goldhor, 1984); and
- the availability of reference staff.

Another area in which there has been much interest but less activity is the evaluation of literature searching services (Lancaster, 1988).

A major issue in reference evaluation is whether the reference librarian is aware that the evaluation is taking place or not—i.e., whether the study is obtrusive or unobtrusive. Weech and Goldhor (1982) compared the two approaches in five public libraries. Using questions of a comparable degree of difficulty, they found significantly better performance on the obtrusive test, suggesting, not surprisingly, that the obtrusiveness of the test affects the results.

Other aspects of the reference transaction that have been studied, such as the characteristics of users and their frequency and reasons for use, or attempts to explain the causes of differences in levels of reference performance, fall outside the scope of this article. They are, however, reviewed by Lancaster (1988).

Facilities

A library service somewhat neglected in output measurement has been the provision of equipment and facilities. In academic and research libraries in particular, the library is a major provider of study space and copy machines. Libraries also provide other selected facilities and equipment such as computers.

DeProspero et al. (1973) presented a method for measuring the intensity of use of public library facilities. The other major facility of interest

has been the catalog, as libraries switching to online catalogs have had to determine the number of terminals needed (Tolle et al., 1983).

ISSUES

Over the course of the development and use of such a wide array of output measures in libraries of all types and sizes, several key issues have emerged. Several conceptual issues relate to the definition of library effectiveness, to who judges effectiveness, and to the definition of information needs and uses. Methodological issues relate to the data collection methods, sampling, and statistics. Management issues address the appropriate use and interpretation of measurement data.

The Definition of Library Effectiveness

Output measures are intended to reflect the library's effectiveness in providing services. However, to measure effectiveness, one must first define it. For example, Hamburg et al. (1974) identified a single overarching library goal—exposure hour—and defined effectiveness as goal achievement. So their measure of effectiveness was the number of exposure hours produced.

The larger issue of organizational effectiveness has been called “the Holy Grail of management research” (Mohr, 1982) because of its elusiveness. At least four major definitions of organizational effectiveness have been proposed (Childers & Van House, 1989), each of which has different implications for the measurement of effectiveness. Researchers on library effectiveness have, for the most part, bypassed the fundamental question of defining library effectiveness (Childers & Van House, 1989) and have treated effectiveness as synonymous with goal attainment (e.g., McClure et al., 1987) which is only one of the four major approaches. Others stress the importance of measures of internal operations (process model), of relationships with the environment and acquisition of resources (open systems model), and of the satisfaction of key constituencies (multiple constituency model).

The multiplicity of library effectiveness measures that have been used suggests that a single, operational definition of library effectiveness probably does not exist, but rather that effectiveness is a multidimensional construct (Childers & Van House, 1989). However, addressing, if not answering, the fundamental question of the definition of library effectiveness is essential to further developments in this area.

Whose Perspective?

A related question is, from whose perspective is effectiveness measured? Different organizational participants may well have different goals for the library or may use different models of effectiveness. The result may be, at the very least, differences in the values expected on each measure. More fundamentally, different groups may use different mea-

asures to evaluate the library (Childers & Van House, 1989). *Output Measures for Public Libraries* calls its measures user-oriented, but they were chosen by librarians. Measures of reference success most often rely on the judgment of the librarian (Kantor, 1981; Van House et al., 1987) although users, not surprisingly, often judge the same transaction differently (Whitlatch, 1987).

Information Needs and Uses

Another issue relates to the fluid nature of information needs and library use. Many output measures are concerned with the user's success in meeting his/her need, be it for a document or for information. The measure is the proportion of searches that are successful or of needs that are met. But operationalizing this concept requires that the users have a discreet need that can ultimately be classified as being met fully, partially, or not at all. In practice, users' information search behavior is rarely so simple or so linear. Needs may appear, disappear, and change, all within the span of a single library transaction (Dervin & Nilan, 1986).

Measurement, Sampling, and Statistics

Most librarians have little or no training in statistics. Most output measures rely on sampling, but sampling and data analysis must be kept simple for do-it-yourself output measures. This simplification has its price in the precision of the data and sophistication of the analysis.

Library activities are difficult to sample because most vary over time—school and academic libraries follow the cycles of the academic day, week, and year; public libraries see seasonal variations in people's information needs and time allocation. Any short-term sample runs the risk of being representative only of that slice of the year. Longer term, more complex sampling schemes are difficult to design and to manage amidst other demands of operating an active library.

Sampling gives rise to sampling error. The second edition of *Output Measures for Public Libraries* (Van House et al., 1987) added a discussion of sampling error because libraries were concerned about performance differences that amounted to less than the sampling errors for the data being compared. As a practical matter, most libraries are limited to small samples with large sampling errors. Managers are often unfamiliar with the concept of sampling error or unclear of its implications for their decision-making.

User Surveys

Many output measures depend on user reports and/or evaluations—for example, materials availability measures that rely on actual user searches. User surveys are difficult to design and administer. They require not only a high level of effort but an understanding of the methods and pitfalls of survey research. A more insidious problem may

be surveys that try to impose library categories on user behavior inappropriately (Dervin & Nilan, 1986) thereby asking questions that users find difficult to answer or that do not accurately depict the behavior under study.

INTERPRETING AND USING OUTPUT MEASURES

Two key management questions in the use of any output measure are, exactly what is being measured? And what can the library do to improve its performance?

Determinants of Output Measures

Library services are a coproduction of the library and user. The user contributes to the production of his/her library services in at least two ways: (1) much library use is self-service; and (2) when the user asks staff for assistance, the user must communicate his/her need and then understand and use the staff member's response.

D'Elia (1988) has argued that the materials availability measures of the first and second editions of *Output Measures for Public Libraries* (Zweizig & Rodger, 1982; Van House et al., 1987) are invalid as measures of library performance because the user adds an immeasurable component. Materials availability measures reflect instead user success in the library.

More generally, libraries are complex organizations embedded in an even more complex and changeable environment. Output measures are affected by library and user actions and characteristics and by the external environment. The use of output measures to diagnose library performance and assess the outcomes of library actions is complicated by the complexities of the real world. While we may be able to construct abstract models of the relationship between library actions and output measures, in practice the complexity of the library and its environment interferes with attempts to understand and manipulate output measures. So far, researchers and library managers have been unable to identify, let alone control, all the variables that enter into the determination of output measures. This does not mean that output measures should be abandoned, but they should be used with caution and an understanding of their limitations.

These two questions—the validity of output measures as indicators of library performance and the identification of their determinants—require further investigation. In the meantime, managers must understand that knowledge of output measures and especially the factors that influence them is incomplete.

Cross-Library Comparisons

To be useful for decision-making, a measure must yield comparable results with repeated applications. Reliability within a library over time can be ensured by consistency in data collection and analysis. A

major reason for the detailed instructions in the output measures manuals (e.g., Kantor, 1984; Van House et al., 1987) is to ensure accurate and repeatable results. However, no manual can account for all possible circumstances. Many local differences in services and operations result in incommensurable results. Comparisons of output measures data across libraries, therefore, are generally much less credible than comparisons within a library over time. The universal tendency, however, is to compare—how else does a library decide what is an acceptable level of performance?

Output Measures, Funding, and Standards

Output measures have been used or proposed as the basis for standards and for state aid to public libraries. Input-based standards are insensitive to the kinds and quality of resources and the uses to which they are put. Standards based on output measures are intuitively appealing. However, until more is known about output measures and their determinants, such a move is perhaps premature.

- Unless the set of measures used covers all dimensions of library effectiveness, basing standards or funding on output measures may skew library performance in favor of measurable activities. In particular, quantity is much easier to measure than quality.
- Until the determinants of output measures, especially those not under the library's control, are better understood, such uses of output measures run the risk of inappropriately rewarding or penalizing libraries for factors not under their control.
- Until the determinants of output measures are better understood, basing standards or funding on output measures may subject libraries to impossible demands. They may be ordered to improve their performance on certain measures even though no one can tell them how.
- Cross-library comparisons are valid only if the measures are applied uniformly. Absolutely comparable data would require impossibly detailed instructions which still could not ensure complete comparability. And such uniformity would probably not be as useful for internal management as letting people make their own choices about measures and measurement within certain broad parameters.

CONCLUSION

The increasing use of output measures and other kinds of performance measures in libraries has been an exciting and valuable trend. The continued development of measures, and their growing use by library managers, promises to improve the understanding and management of library services.

Much remains to be learned about output measures and their determinants, however, before there is a full understanding of what the measures are saying about library services and, more importantly, what a library can do to improve its performance. Continued methodological

development is also needed to ensure that the measures used are valid, reliable, precise, and practical.

The library field has been notable for its isolation in considering the common problem of organizational effectiveness. It should draw on research in related areas such as research on organizational effectiveness and program and service evaluation in related fields, especially in the management of the public sector and of service organizations (e.g., Cameron & Whetten, 1983). For example, Childers and Van House (1989) have drawn on the work of Cameron in higher education (Cameron, 1978; Cameron, 1981; Cameron, 1986).

In output measures in other areas, continued dialogue between managers and researchers is essential. Managers need the help of researchers in developing reliable, valid, and precise measures. Researchers need the help of managers in defining library effectiveness and mapping the boundaries of the construct.

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